

Catalogue of Measures

Miskolc-Košice-Uzhgorod Trilateral Pilot Area

(Hungary, Slovakia, Ukraine)



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(Hungary, Slovakia, Ukraine)

Part of Output 4.1

TRANSGREEN Project “Integrated Transport and Green Infrastructure Planning in the Danube-Carpathian Region for the Benefit of People and Nature”

Danube Transnational Programme, DTP1-187-3.1

April 2019

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Acknowledgement

This publication was elaborated as part of Output 4.1 Catalogues of measures of the TRANSGREEN “Integrated Transport and Green Infrastructure Planning in the Danube Carpathian Region for the Benefit of People and Nature” project (DTP1-187-3.1, January 2017 – June 2019) funded by the Danube Transnational Programme through the European Regional Development Funds.

The work was kindly supported by Fleisz Bálint (VIKÖTI Kft.) in Hungary; by the Ministry of Transport and Construction of the Slovak Republic and the Slovak Road Administration providing data on road objects and traffic intensity, the Slovak Railways providing data on railway animal mortality and by field mappers who collected data on animal mortality and on animal movements in the field in Slovakia; the Transcarpathian Regional State Administration - Department of Ecology and Natural Resources, Ludvig Potish (Uzhgorod National University), Egor Grynyk (WWF Ukraine), Adalbert Potish (Zakarpattya Regional Forestry and Hunting Administration), and Leonid Pokrytiuk (volunteer) in Ukraine.

Authors gratefully acknowledge the efforts of all the TRANSGREEN project partners and both local and national stakeholders involved within the frame of the Carpathian Convention and have trust in their benefiting from the outcome.

Citation

Immerová, B., Kadlečík, J., Koubek, I., M., Thompson, T., (editors), Argalášová, Z., Balázs, C., Bashta, A.-T., Garayová, J., Hudáková, L., Nagy, G., Ohegyi, E., Olekšák, M., Pavelko, A., Skuban, M., Szirányi, A., Trojčák, R., Weipérth, A., Yamelynets, T. (2019): Catalogue of Measures. Miskolc-Košice-Uzhgorod trilateral pilot area (Hungary, Slovakia, Ukraine). Danube Transnational Programme TRANSGREEN Project, Part of Output 4.1. State Nature Conservancy of the Slovak Republic.

ISBN 978-80-8184-060-9

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About TRANSGREEN

TRANSGREEN means a better connection of the Carpathian region with transport infrastructure that takes nature into account. The project aims to contribute to safer and environmentally-friendly road and rail networks that are being developed in the Czech Republic, Hungary, Romania, Slovakia, and Ukraine. www.interreg-danube.eu/transgreen

Output 4.1 Catalogues of measures available for:

Kysuce-Beskydy cross-border pilot area
(the Czech Republic, Slovakia)

Miskolc-Košice-Uzhgorod trilateral pilot area
(Hungary, Slovakia, Ukraine)

Arad-Deva pilot area
(Romania)

Tîrgu Mureş - Iaşi pilot area
(Romania)

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Introduction

Miskolc-Košice-Uzhgorod area is located on the Hungarian-Slovak-Ukraine border. This area was selected as the pilot area for the project TRANSGREEN due to its importance in safeguarding the landscape connectivity between these three countries. The area biodiversity is rich; there are areas protected at national as well as international level and with many threatened species present. Habitats of these species need to be protected against any disturbance which would lead to their loss.

Today, the area is undergoing transport infrastructure development. Existing roads are to be supplemented by newly built roads, which are still in the state of planning.

Transport infrastructure fragments the landscape and creates a barrier for many species. In this area, there are large carnivores migrating from Slovakia to Hungary, medium-sized mammals but also many wetland species living in wetland areas, which create important habitats for large birds of prey, waterfowl and amphibians, of which a high number is killed each year on the road. The issues of noise pollution, effect of emissions from vehicles and visual disruptions are also to be considered.

Landscape fragmentation is one of the main reasons for biodiversity loss. Long-term habitat fragmentation causes isolation of populations and leads to species extinction. There are many initiatives on board to preserve the treasures of this region, from the highest political level represented by an international convention on the protection of the Carpathian Mountains (Carpathian Convention) to the local activities in the field.

This document is a result of a joint effort of partners of the TRANSGREEN project funded by the INTERREG Danube Transnational Programme. The aim of the project was to contribute to the development of safer and environmentally-friendly road and rail networks in the pilot areas in the Czech Republic, Hungary, Romania, Slovakia and Ukraine. It provides practical information on how to reduce further fragmentation of the area or mitigate its impact on biodiversity while keeping the pace with the necessary development.

This Catalogue and its annex (In-depth Analysis) provide invaluable information on the natural conditions of the area, mapped ecological corridors, animal mortality on the existing roads and proposals of mitigation measures to be taken in order to maintain the ecological connectivity of the area.

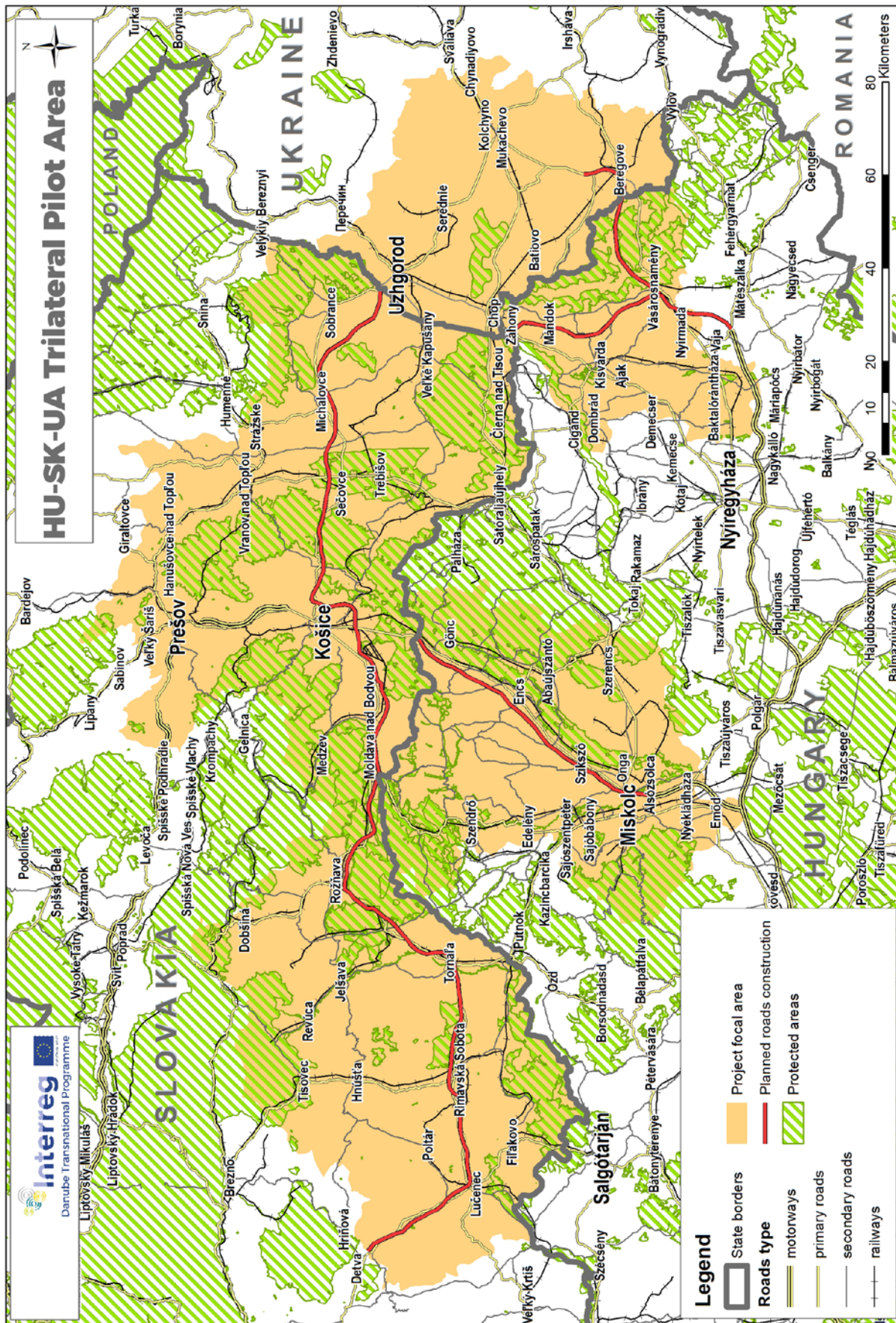


Fig. 1: Map of the pilot area.

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Aim of the Study



The aim of this document is to provide detailed information on the permeability of the pilot area for wildlife and to provide possible solutions for its preservation and/or improvement. For this reason, critical sites were identified, verified in the field, and mitigation measures were proposed.

The main criteria for identification of critical places/sites were:

- » The absence of urbanization on the transition area with a sufficient width within the urbanized landscape, taking into account the needs of large carnivores.
- » Citation of the locality in the literature, or in the documentation on nature conservation, and especially in the documentation of the Regional Territorial Systems of Ecological Stability.
- » Threats to the site according to a possible planned or unplanned (“illegal”) urbanization.

In the pilot area, a construction of Miskolc-Košice-Uzhgorod motorway is under way and it is crucial to secure the permeability of the land for animal migration. The existing road and rail infrastructure is mostly without any mitigation measures for animal migration. An important factor which influences the permeability of the road is the traffic intensity. In many places, this reaches more than 5,000 vehicles per day and thus creates an impermeable barrier for animals. The barrier effect of the road is many times multiplied by the railway and/or rivers. Intensive urbanisation, often tens of kilometres long, also adds to the decreased permeability. Fences and huge fields without any leading vegetation suitable as a hiding place are another type of barrier.

In Slovakia, data on road and railway mortality were collected from relevant institutions. Data on railway animal mortality had to be adjusted as they were collected at longer sections, which only pass through certain critical places/sites. New data have been added from the performed seasonal field monitoring. The monitoring was carried out in the area of competency of the Protected Landscape Area (PLA) Cerová vrchovina, National Park (NP) Slovak Karst, PLA Vihorlat, and in the competency area of the Regional Centre of Nature Protection in Prešov. Photo traps were installed at selected bio-corridors near the roads or in a broader area, where movement of large carnivores or other mammal species had been monitored. Particular sections of the roads were selected for animal mortality monitoring and for mapping of animal crossings and animal presence signs near the road. Information on the average daily traffic intensity for all days of the year (RPDI) is based on data gained from the Slovak Road Administration in the year 2015.

In Hungary, the datasets on road and railway mortality were collected from the relevant institutions. The datasets were used of EIA and Appropriate Assessment (AA) of the main road M30, which was done in 2016. New data have been added from

the seasonal sampled field work. The one-year long monitoring was done in the area of M30, which belongs to the directorate of Bükk National Park, and in the area of M3, which belongs to the directorate of Hortobágy National Park. Photo traps and acoustic recorders were installed at the selected bio-corridors along the supposed location of the planned road. Several aquatic, wetland and terrestrial habitats were measured during the one-year long research program. All sampling methods were used during the national protocol (NBmR - National Biodiversity monitoring system, WFD - Water Framework Directive).

In Ukraine, data on road and railway mortality within the Zakarpattya region were collected as a result of the official request to the National Police of Ukraine, submitted by the project team in 2017. In response to our request, we received information about 223 traffic accidents with animals for the period from 2006 to 2017 in the entire Zakarpattya region. According to the response, animal species cannot be included in the received statistics since no registration by species is being conducted. As we were only interested in traffic accidents cases with wild animals, we crossed out the cases which occurred close or within settlements (possibly the cases with domestic animals or cattle), and those which had no definite anchorage. As a result, we had data about 97 cases of motor vehicle collision with animals beyond the settlements. These data were mapped and checked by our experts within the Project focal area. Also, new data have been added from the seasonal field monitoring which was carried out by the Project experts. The monitoring was performed on the road section Mukachevo - Beregove - the border with Hungary. The most critical places/sites were identified and mapped, and measures were proposed by the Project experts.

Based on the information available, mitigation measures which can help to improve the landscape permeability for animal species were proposed for each critical place/site. The measures differ in type (legal, management) and finances required for their implementation. Some of the measures are low cost; others, many times optimal - (e.g. ecoduct or underpass), are more costly and their realisation would require developing a special project. However, even lower cost measures, e.g. installation of traffic signs, appropriate construction or removal of fences, or planting of naturally guiding vegetation can significantly improve the permeability of the land or decrease the animal mortality.

The document clearly identifies the issue of landscape connectivity in the area and creates a basis for decision-making. It is meant to help the authorities, officers, planners of construction projects and other stakeholders to make a decision which will benefit both people and nature. There is a lot of experience already in Europe on how to minimize the negative environmental impacts of transport infrastructure. We have a unique opportunity to use this experience to avoid the mistakes that have been made and develop the transportation infrastructure in a sustainable way.

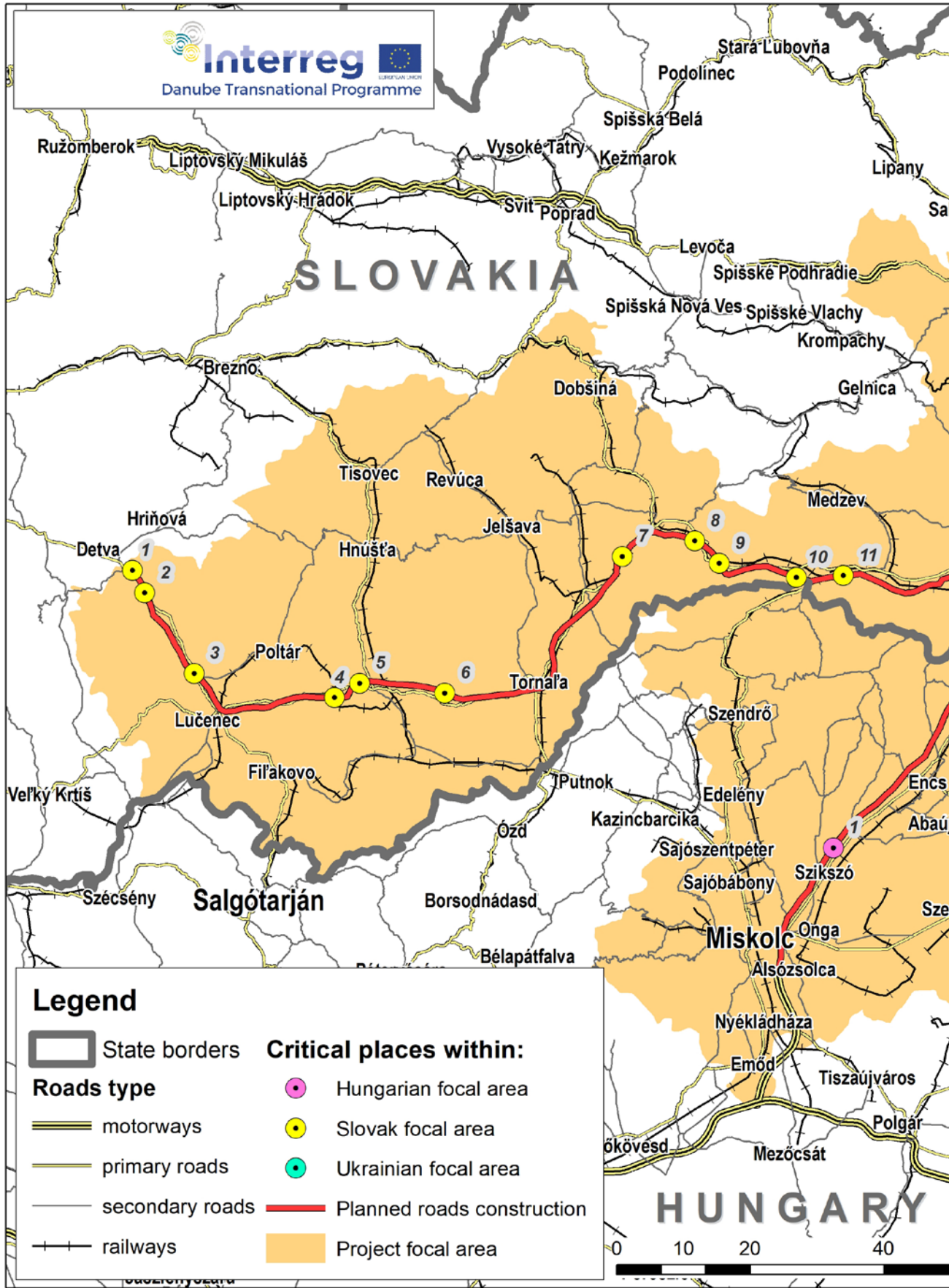


Fig. 2: Map of proposed measures in the pilot area.

3

Identified critical sites and measures proposed



3.1 Hungary

The critical sites of all road section of M3 and M34 were identified during one-year long monitoring program, besides datasets of EIA and AA of M30 that could be used in the analyses.

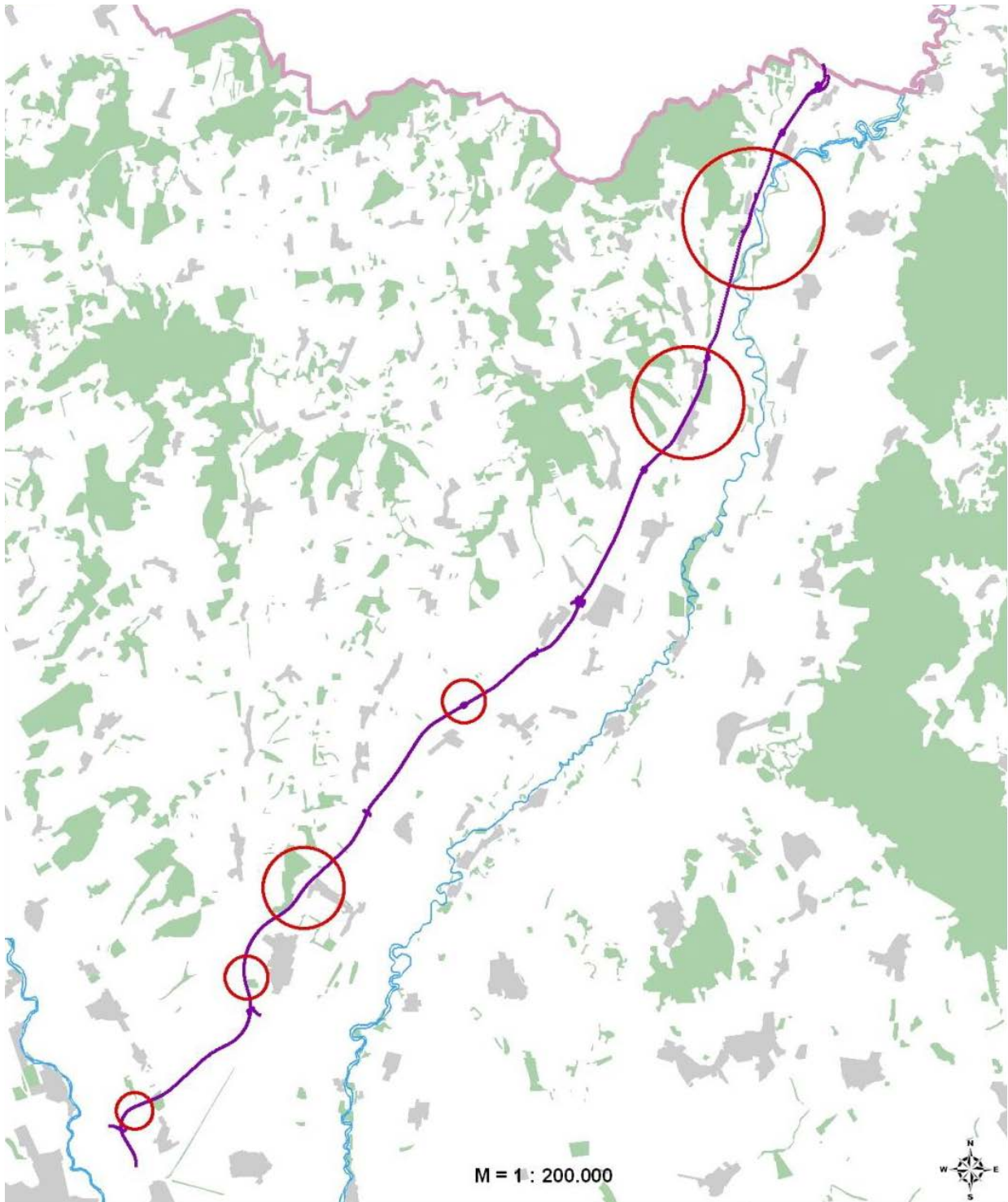


Fig. 3: Map of the proposed measures on the road M30. The red circles mark the conflict zones between the traffic and wildlife.

Critical site No. 1 Szikszó

**Location: M30 - km 43+000 - 46+000
(Near Szikszó: Magyar-hegy, Kerek-hegy)**

Both sides of the new road are different types of grassland, forests, old orchards without maintenance, and for one year maintained agricultural field system. During the last decades the intensive agriculture has decreased in the whole area and semi-natural reforestation is in progress. Several protected species (butterflies, birds, small mammals) live in the mosaic habitat and populations of large mammals use it as a bio-corridor between the Hernád River valley and the huge forest habitats.

The site needs further research to clarify that the species have suffered from road infrastructure and the future traffic. There is currently no quantitative data on potential species to cross the road in this section.

Proposed measures:
Management measures:

1. Plan and design overpasses for large mammals in the section between 45+000-46+000 (Figure 5).

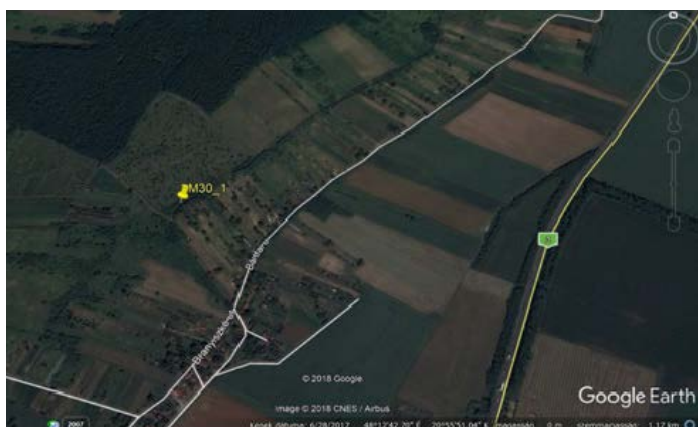


Fig. 4: Monitored area near Szikszó.



Fig. 5: View of the road and lands around. Author of the EIA in TURA-TERV Kft., RODEN Kft., ÚT-TESTZ Kft., (2015): KÖRNYEZETI HATÁSVIZSGÁLATI DOKUMENTÁCIÓ, 05. 2015, pp: 351.

2. Plan and design underpasses in the road-crossed area of the Vadász-stream, because large mammals and birds, and aquatic species use the verges and aquatic habitats of this stream as bio-corridor.
3. Minimum 2.5 m high fencing parallel to the road from Miskolc to the Slovakian border.



Fig. 6: Location of the planned wildlife mitigation measure (vadátjáró). Author of the EIA, in TURA-TERV Kft., RODEN Kft., ÚT-TESTZ Kft., (2015): KÖRNYEZETI HATÁSVIZSGÁLATI DOKUMENTÁCIÓ, 05. 2015, pp: 351.

Critical site No. 2

**Location: M30 - km 77+000 - 80+000
(Near Hernádszurdok: Hernád River valley, Bársonyos stream)**

Description: Parallel to the valley of the River Hernád, a new road section of M30 will be running between the Miskolc-Košice railway line and Road No. 3 (Figure 6). The new road will cross the Bársonyos-stream in 78+900. The wild boars have a huge population and the roe deer and red deer have dense populations in this area.

Floodplain forests are distributed along the River Hernád and several side arms and temporal ponds and wetlands insure important habitats for terrestrial (insects, birds, and mammals), semi-aquatic (amphibians, reptiles) and aquatic species (noble crayfish, fishes).

The site needs further research to clarify the species suffering from road infrastructure and traffic.

There is currently no data on potential species to cross the railway line and the road No. 3 in the regulated section of the Bársonyos stream. The site needs further study to clarify the species which use this section of the road for migration, because during the survey the experts only concentrated on the bio-corridors of large mammals.

Proposed measures:
Management measures:

1. Plan and design at least 40 m wide and 5 m high underpasses in the road-crossed area of the Vadász-stream in 78+900 (Figure 7).

- Near the new road, the wildlife mitigation measures on the road No. 3 and the railway line have to be redesigned and rebuilt.



Fig. 7: Monitored area south of Hernádszurdok.



Fig. 8: Location of the planned wildlife mitigation measure (vadátjáró) in the Barsonyos stream. Author of the EIA in TURA-TERV Kft, RODEN Kft, ÚT-TESTZ Kft., (2015): KÖRNYEZETI HATÁSVIZSGÁLATI DOKUMENTÁCIÓ, 05. 2015, pp: 351.

The whole area from the Garadna to the Slovak border needs further research to clarify the species suffering from road infrastructure and traffic. In this case, all species need to be taken into consideration, from large carnivores to small aquatic species. There is currently no data on potential species to be crossing cross the different types of linear infrastructure elements (railway, roads). The site needs further study to clarify the species which use this section of the road for migration, because during the survey the expert concentrated only on the bio-corridors of large ungulates and we have no exact data on large carnivores.

Proposed measures:

Management measures:

- Two ecoducts or large overpasses between the road section from 80+000 km up to the Hungarian-Slovakian border.
- 2.5 m high fencing parallel to the whole section of the M30.
- To build underpasses at places where the road cuts through the stream.

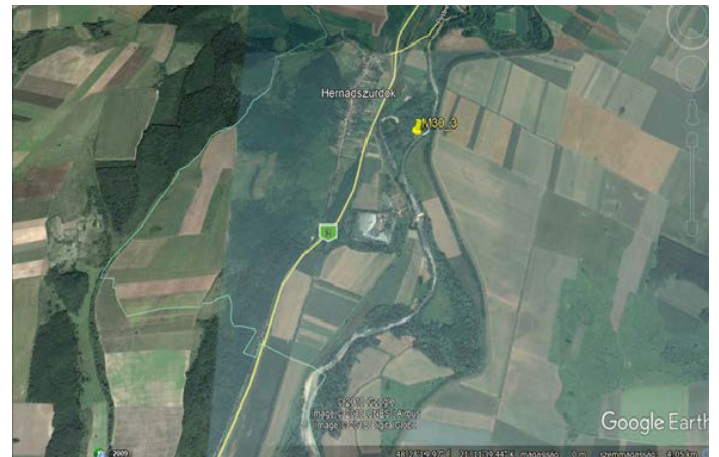


Fig. 9: Monitored area near Hernádszurdok.



Fig. 10: Location of the planned wildlife mitigation measure (vadátjáró) towards the south of Hernádszurdok. Author of the EIA, in TURA-TERV Kft, RODEN Kft, ÚT-TESTZ Kft., (2015): KÖRNYEZETI HATÁSVIZSGÁLATI DOKUMENTÁCIÓ, 05. 2015, pp: 351.

Critical site No. 3

Location: M30 - km 80+000 - 83+000 (Near Hernádszurdok: Hernád River valley, Bársonyos stream)

Description: Several different types of terrestrial and aquatic habitats are found within the 1 km area of the River Hernád. Moreover, the floodplain forests of the river have a direct connection with forests of the Cserhát Mountains. As a result, a very intensive wandering of large mammals (the wild boar, the roe deer, and the red deer) was detected in this area in the east-west direction. During the research program of EIA in 2016 only one case, but in 2017-2018 several acoustic observations of the wolf (*Canis lupus*) were detected in the area of Hernádszurdok.

3.2 Slovakia

In Slovakia, 17 critical sites were identified and are described below with suggested mitigation measures:

PLA Cerová vrchovina Administration competency area

1. Píla-Mýtňa
2. Fafáky
3. Halier
4. Čierna lúka
5. Ťahan
6. Ožďany

NP Slovenský kras Administration competency area

7. Brzotín
8. Krásnohorské Podhradie

9. Soroška
10. Zemné hradisko
11. Drienovec

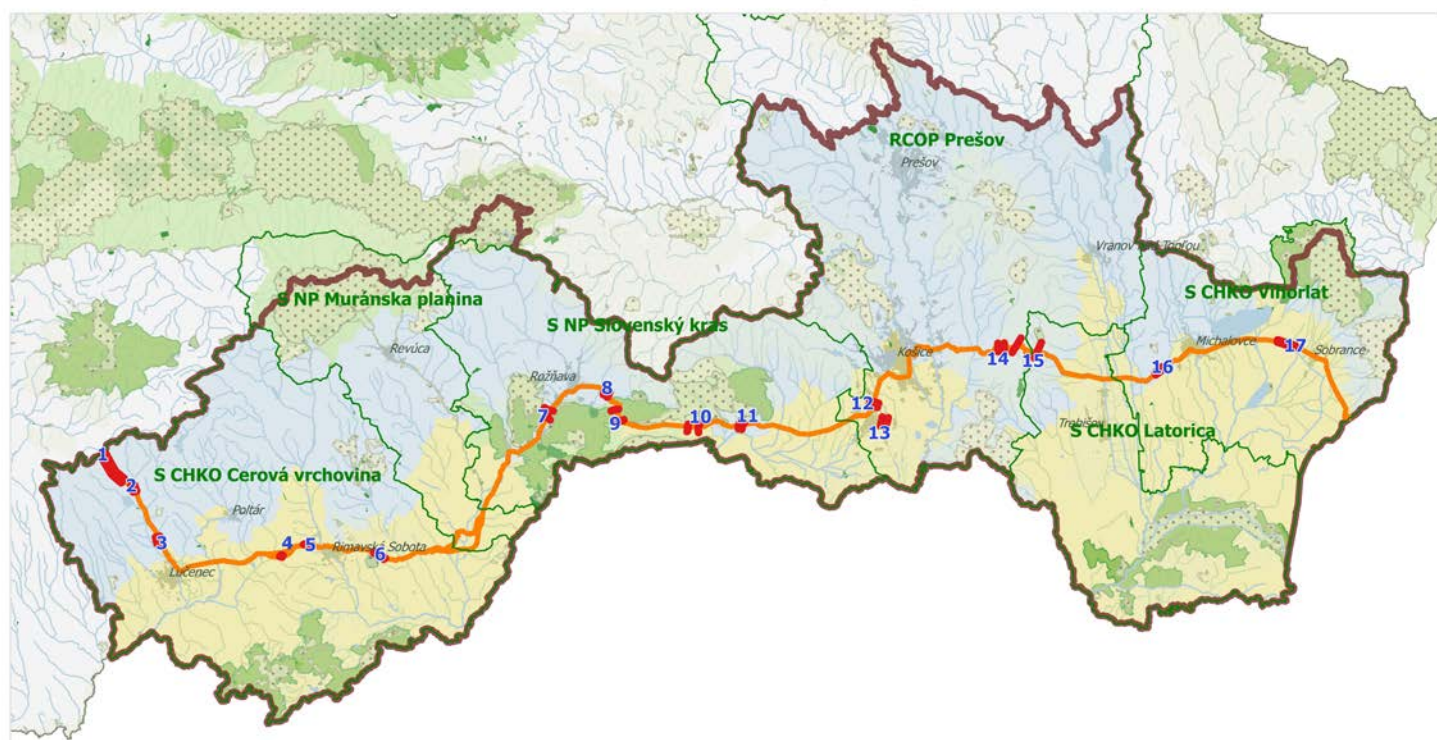
Regional Centre of Nature Protection in Prešov competency area

12. Šaca
13. Haniska
14. Svinica
15. Košický Klečenov

PLA Vihorlat Administration competency area

16. Gajdoš
17. Pozdišovce

Critical sites in Slovak part of pilot area



Legend

Critical sites	Competency area of SNC SR	Large-scale protected areas (NP/LPA)
Pilot area	Protected areas	Protection zone of NP/LPA
Main road barrier	Natura 2000 - SCI sites	Biogeographic region
Watercourses	Natura 2000 - SPA sites	Alpine
State border	Small-scale protected areas	Pannonian



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Fig. 11: Critical sites identified in Slovakia.

3.2.1 PLA Cerová vrchovina Administration competency area

Critical site No. 1

Name of the corridor: Píla-Mýtňa

Location: Píla pri Mýtnej, Mýtňa cadasters

Linking the geographic units of Ostrôžky – Veporské vrchy – Revúcka vrchovina

Transport infrastructure: road no. I/16, the rail line (Slovak Railways 160, rail line Zvolen – Košice)

Average daily traffic intensity (SSC 2015): 8,780 vehicles per 24 hours

The section is situated at the border of 2 mountain ranges, Slovenské rudohorie and Slovenské stredohorie. It is situated in the valley covered by the forest and its width is approximately 5 km. Besides the traffic-related mortality of small mammals and birds, we observed activity signs of the following species: the European roe deer (*Capreolus capreolus*), the red deer (*Cervus elaphus*), and the wild boar (*Sus scrofa*). Moreover, on April 9, 2018, one grey wolf (*Canis lupus*) was killed by traffic in that area. It is worth mentioning that also hunters occasionally observed the movement of brown bears (*Ursus arctos*) across the road in selected places.

Measures proposed:

1. Grow no maize on this agricultural land and leave narrow stripes without any crops next to the road.
2. Build permanent barriers and underpasses for amphibians and install anti-crash walls in order to force the birds and bats to fly higher above the passing vehicles near the Píla water reservoir.
3. Remove bushes within the distance of 15 m on both sides of the road in order to avoid unexpected occurrence of animals on the road.
4. Designate the area of bio-corridor as a silent zone according to § 24 of the Act no. 274/2009 Coll. on Hunting without hunting of the game.
5. Keep the part of the corridor permeable and unfenced between the Píla water reservoir and the border of Detva district.
6. Use road signs to alert the drivers of the danger of unexpected wildlife intrusion on the road.

Animal road mortality during the monitoring period (June 2017 – November 2018)

Species	Number
<i>Anas platyrhynchos</i>	1
<i>Canis lupus</i>	1
<i>Cervus elaphus</i>	1
<i>Erinaceus europaeus</i>	3
<i>Lepus europaeus</i>	1
<i>Lutra lutra</i>	2
<i>Martes martes</i>	5
<i>Sciurus vulgaris</i>	1
<i>Strix aluco</i>	1
<i>Ursus arctos</i>	1
<i>Vulpes vulpes</i>	7

List of species registered by photo traps (December 2017 – June 2018)

Species	Number
<i>Capreolus capreolus</i>	3
<i>Cervus elaphus</i>	8
<i>Sus scrofa</i>	9
<i>Vulpes vulpes</i>	1

Animals and their presence signs observed during the monitoring period (June 2017 – March 2018)

Species	Number
<i>Capreolus capreolus</i>	2
<i>Cervus elaphus</i>	2
<i>Sus scrofa</i>	1
<i>Vulpes vulpes</i>	1



Fig. 12: Critical site in the corridor Píla - Mýtna.



Fig.13: Forest stands located on both sides of the I/16 road. Such places are preferred by wildlife animals with the purpose of their moving and/or migrating.

Critical site No. 2

Name of the corridor: "Fafáky"

Location: Lovinobaňa, Mýtna cadastres

Linking the geographic units of Revúcka vrchovina – Stolické vrchy mountain ranges

Transport infrastructure: road no. I/16

Average daily traffic intensity (SSC 2015): 9,007 vehicles per 24 hours

The corridor is located near the border of 2 mountain ranges, Slovenské rudohorie and Slovenské stredohorie. It is represented by agricultural land which joins together 2 forest complexes. It is approximately 1 km wide. We observed the European roe deer (*Capreolus capreolus*), the red deer (*Cervus elaphus*) and the red fox (*Vulpes vulpes*) in the area. No signs of large carnivores were found.

List of species registered by photo traps (December 2017 – May 2018)

Species	Number
<i>Capreolus capreolus</i>	4
<i>Cervus elaphus</i>	313
<i>Vulpes vulpes</i>	4

Animal road mortality during the monitoring period (June 2017 – June 2018)

Species	Number
<i>Bufo bufo</i>	2
<i>Capreolus capreolus</i>	1
<i>Cervus elaphus</i>	1
<i>Martes martes</i>	1
<i>Meles meles</i>	1
<i>Sus scrofa</i>	1
<i>Vulpes vulpes</i>	5

Animals and their presence signs observed during the monitoring period (July 2017 – May 2018)

Species	Number
<i>Capreolus capreolus</i>	8
<i>Cervus elaphus</i>	32

Measures proposed:

1. Grow no maize on this agricultural land and leave narrow stripes without any crops next to the road. Road verges management by mowing is recommended.
2. Remove bushes within the distance of 15 m on both sides of the road in order to avoid unexpected occurrence of animals on the road near the crossroads to the Dolné Fafáky settlement.
3. To restore the guiding vegetation made of bushes up to the forest complex.
4. Keep the land within the corridor permeable, unfenced and unbuilt.
5. Use road signs to alert the drivers of the danger of unexpected wildlife intrusion on the road.

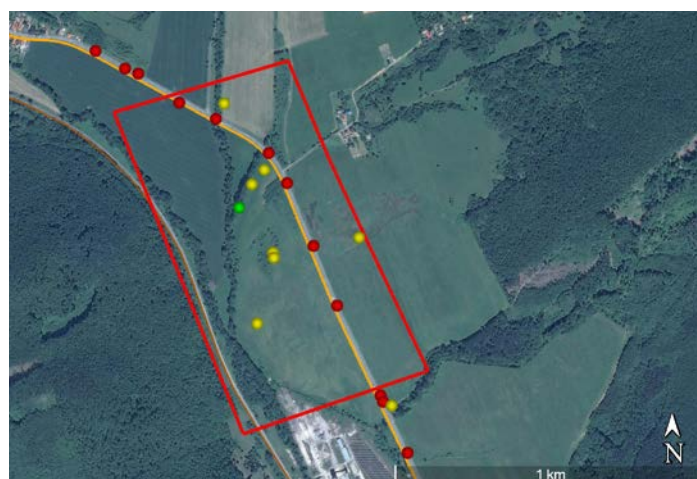


Fig. 14: Map of critical site in the bio-corridor Fafáky in the Slovak part of the pilot site. The forest complexes of both sides are connected with small forest stripes.

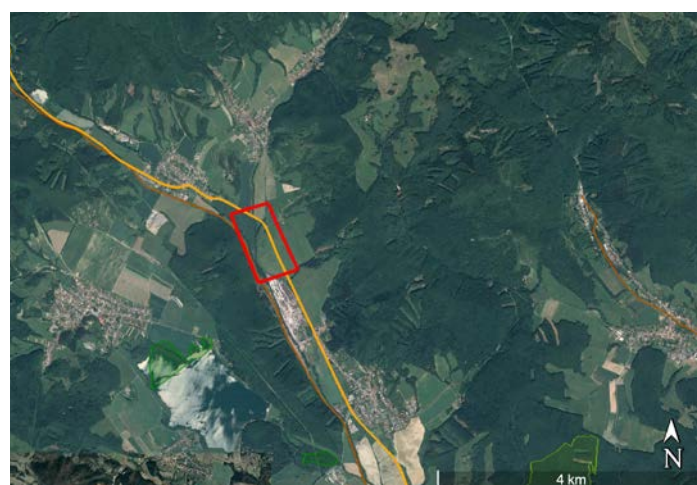


Fig. 15: Map of the critical site in the bio-corridor Fafáky from a broader perspective.



Fig. 16: Critical site in the bio-corridor Fafáky and the road I/16 in the Slovak part of the pilot site.

Critical site No. 3

Name of the corridor: "Halier"

Location: Tomášovce, Točnica cadastres

Linking the geographic units of Juhoslovenská kotlina – Revúcka vrchovina

Transport infrastructure: road no. I/16

Average daily traffic intensity (SSC 2015): 9,998 vehicles per 24 hours

This corridor connects Slovenské rudohorie and Lučenecko-košická zníženina depression. It is the connection between 2 forest complexes and there is arable land in between them. It is approximately 1,100 m wide. We observed roe deer with the help of photo traps. No signs of large carnivores were found. However, hunters and other studies confirmed the importance of the place due to frequent movement of large mammal species. Through this place, wildlife can move to the southern parts of this region, even up to the Hungarian border.

List of species registered by photo traps
(January 2018 – June 2018)

Species	Number
<i>Capreolus capreolus</i>	4
<i>Dama dama</i>	64
<i>Sus scrofa</i>	2

Animal road mortality during the monitoring period
(July 2017 – May 2018)

Species	Number
<i>Capreolus capreolus</i>	1
<i>Felis silvestris</i>	1
<i>Martes martes</i>	1
<i>Meles meles</i>	1
<i>Strix aluco</i>	1
<i>Sus scrofa</i>	1
<i>Vulpes vulpes</i>	3



Fig. 17: Map of critical site in bio-corridor Halier in the Slovak part of the pilot area.

Animals and their presence signs observed during the monitoring period (June 2017 – May 2018)

Species	Number
<i>Capreolus capreolus</i>	15

Measures proposed:

1. Grow no maize on this agricultural land and leave narrow stripes without any crops next to the road. Road verges management by mowing is recommended.
2. Remove bushes within the distance of 15 m on both sides of the road in order to avoid unexpected occurrence of animals on the road.
3. To restore the guiding vegetation made up of bushes up to the forest complex in the agricultural land on the left side of the corridor.
4. Keep the land within the corridor permeable, unfenced and unbuilt.
5. Use road signs to alert the drivers of the danger of unexpected wildlife intrusion on the road.



Fig. 18: Map of the critical site in the bio-corridor Halier in the Slovak part of the pilot area.



Fig. 19: View of the critical site in the bio-corridor Halier and the 1st class road I/16 in the Slovak part of the pilot area.

Critical site No. 4

Name of the corridor: Čierna lúka

Location: Ožďany, Rimavská Sobota cadastres

Linking the orographic units of Juhoslovenská kotlina - Cerová vrchovina - Revúcka vrchovina

Transport infrastructure: road no. I/16

Average daily traffic intensity (SSC 2015): 6,577 vehicles per 24 hours

The corridor is situated in Lučenecko-košická zníženina lowland. The corridor is covered by the forest and partially arable land. It is 1,200 m wide. We observed the European roe deer (*Capreolus capreolus*), the wild boars (*Sus scrofa*), the red deer (*Cervus elaphus*), and The Red fox (*Vulpes vulpes*). No signs of large carnivores were found.

List of species registered by photo traps
(January 2018 - June 2018)

Species	Number
<i>Capreolus capreolus</i>	56
<i>Cervus elaphus</i>	58
<i>Meles meles</i>	1
<i>Parus caeruleus</i>	1
<i>Sus scrofa</i>	104
<i>Vulpes vulpes</i>	1
Unknown	1

Animal road mortality during the monitoring period
(June 2017 - August 2017)

Species	Number
<i>Lepus europaeus</i>	1
<i>Martes foina</i>	1
<i>Vulpes vulpes</i>	2

Live animals and presence signs observed during the monitoring period
(February 2018 - March 2018)

Species	Number
<i>Capreolus capreolus</i>	1
<i>Cervus elaphus</i>	9
<i>Lepus europaeus</i>	1
<i>Sus scrofa</i>	17
Unknown	1
Canidae	3

Measures proposed:

1. Keep the land within the corridor permeable, unfenced and unbuilt.
2. Grow no maize on this agricultural land and leave narrow stripes without any crops next to the road. Road verges management by mowing is recommended.
3. Remove all the bushes within the distance of 15 m on both sides of the road in order to avoid unexpected occurrence of animals on the road.
4. Use road signs to alert the drivers of the danger of unexpected wildlife intrusion on the road.
5. Place light-reflective artificial deterrents along the road which would reflect the light from the car towards the forest and thus stop the animal from entering the road.
6. Place active light sensors along the road, which would start flashing once there is an animal near the road (e.g. 20 m from the road) to inform the drivers about its presence.



Fig. 20: Map of the critical site in the bio-corridor Čierna lúka connecting two forest complexes in the Slovak part of the pilot area.



Fig. 21: Map of the critical site in the bio-corridor Čierna lúka from a broader perspective.



Fig.22: View of the forested critical site in the bio-corridor and the 1st class road I/16 in the Slovak part of the pilot area.

Critical site No. 5

Name of the corridor: Ťahan

Location: Bakta, Tomášovce pri Bátke, Bátka cadastres

Linking the geographic units of: Juhoslovenská kotlina – Revúcka vrchovina

Transport infrastructure: road no. I/16

Average daily traffic intensity (SSC 2015): 5,277 vehicles per 24 hours

This potential wildlife passage is a part of the Lučenecko-košická zníženina lowland approximately 2 km wide. It is situated in the forest complex. The roe deer (*Capreolus capreolus*), the fallow deer (*Dama dama*), the wild boar (*Sus scrofa*), the red deer (*Cervus elaphus*), and the red fox (*Vulpes vulpes*) were observed or recorded by photo traps and by presence signs. Also, The badger (*Meles meles*) was recorded in the area.

List of species registered by photo traps (January 2018 – June 2018)

Species	Number
<i>Capreolus capreolus</i>	9
<i>Cervus elaphus</i>	17
<i>Dama dama</i>	63
<i>Sus scrofa</i>	8

Animals and their residence signs observed during monitoring period (July 2017 – February 2018)

Species	Number
<i>Capreolus capreolus</i>	8
<i>Dama dama</i>	6
<i>Meles meles</i>	1
<i>Sus scrofa</i>	17
Unknown	1

Measures proposed:

1. Keep the land within the corridor permeable, unfenced and unbuilt.
2. Grow no maize on this agricultural land and leave narrow stripes without any crops next to the road. Road verges management by mowing is recommended.
3. Remove all the bushes within the distance of 15 m on both sides of the road in order to avoid unexpected occurrence of animals on the road.
4. Use road signs to alert the drivers of the danger of unexpected wildlife intrusion on the road.
5. Place light-reflective artificial deterrents along the road which would reflect the light from the car towards the forest and thus stop the animal from entering the road.
6. Place active light sensors along the road, which would start flashing once there is an animal near the road (e.g. 20 m from the road) to inform the drivers about its presence.

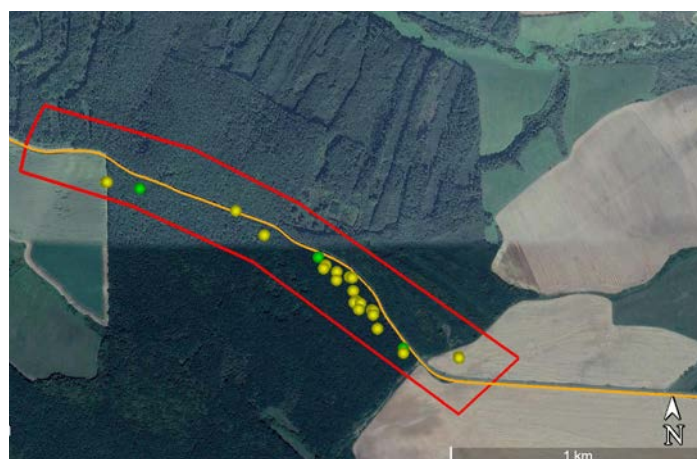


Fig. 23: Map of the critical site in the bio-corridor Ťahan.



Fig. 24: Map of the critical site in the bio-corridor Ťahan from a broader perspective.



Fig. 25: View of the forested critical site in the bio-corridor Ťahan and the 1st class road I/16 in the Slovak part of the pilot area.

Critical site No. 6

Name of the corridor: Oždany

Location: Oždany cadastre

Linking the geographic units of Juhoslovenská kotlina – Cerová vrchovina – Revúcka vrchovina

Transport infrastructure: road no. I/16 and highway no. R2

Average daily traffic intensity (SSC 2015): 5,162 (R2) and 6,577 (I/16) vehicles per 24 hours

The corridor is located in Lučenecko-košická zníženina lowland. It is approximately 1,600 m wide. This passage is transected by the R2 expressway near the Oždany village. A long viaduct was built on R2 which enables frequent wildlife movement under the busy roadway.

List of species registered by photo traps
(January 2018 – May 2018)

Species	Number
<i>Capreolus capreolus</i>	5
<i>Sus scrofa</i>	1

Animal road mortality during the monitoring period
(June 2017 – November 2017)

Species	Number
<i>Buteo buteo</i>	1
<i>Vulpes vulpes</i>	5

Animals and their presence signs observed during the monitoring period
(June 2017 – July 2017)

Species	Number
<i>Capreolus capreolus</i>	4

Measures proposed:

1. Keep the land within the corridor permeable, unfenced and unbuilt.
2. To restore the guiding vegetation made up of bushes up to the forest complex in the agricultural land on the left side of the corridor.
3. Designate the area of corridor as a silent zone according to § 24 of the Act no. 274/2009 Coll. on Hunting without hunting of the game.



Fig. 26: Map of the critical site in the bio-corridor Oždany.



Fig. 27: Map of the critical site in the bio-corridor Oždany from a broader perspective.



Fig. 28: The construction of a long viaduct near the village Oždany allows for frequent wildlife movement, including large mammal species.

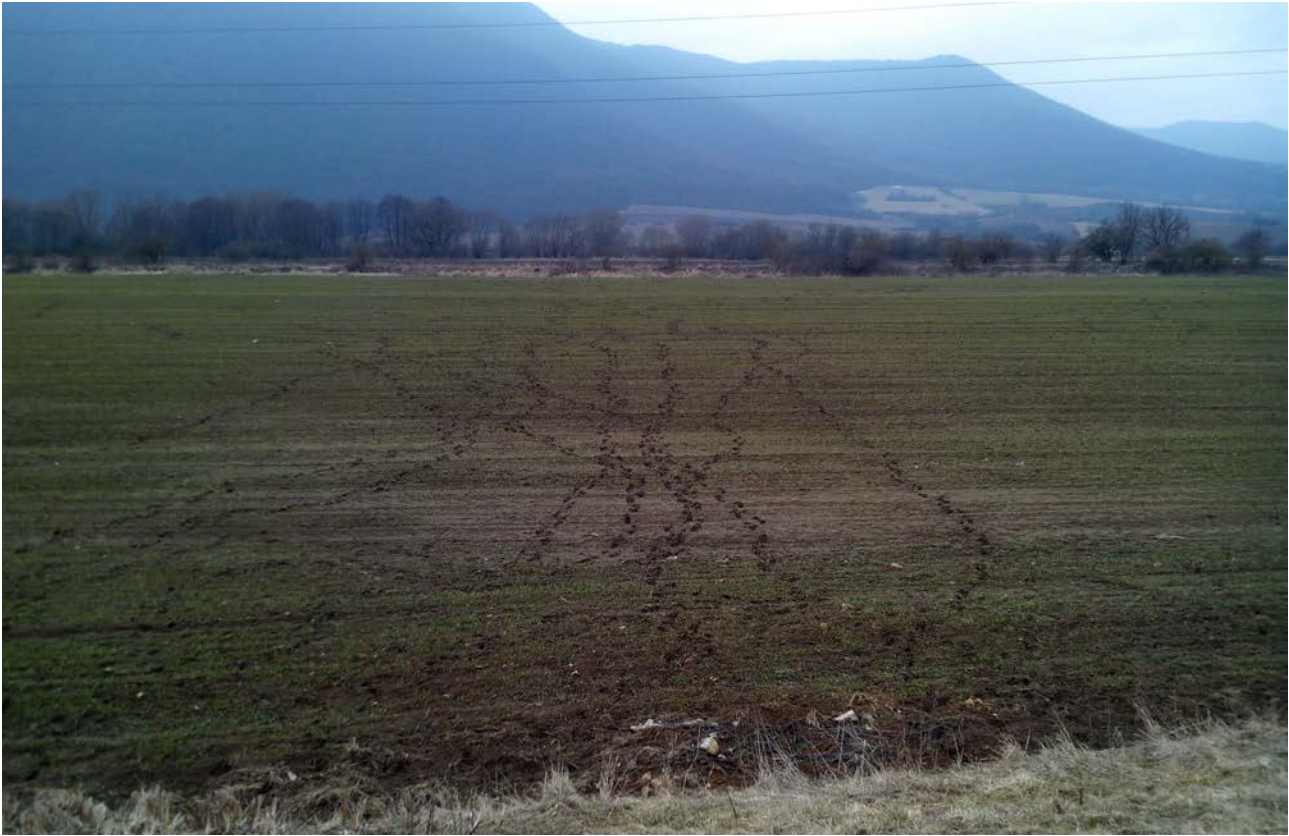


Fig. 30: The bio-corridors Brzotín – tracks of the red deer (*Cervus elaphus*) herd from Silická planina towards the road I/50 and Plešivská planina, March 2018.



Fig. 31: The bio-corridors Brzotín – a wildcat killed by traffic in January 2018.

Critical site No. 8

Name of the corridor: Krásnohorské Podhradie

Location: Rožňavská kotlina, Krásnohorské Podhradie cadastre

Internal name: Krásnohorské Podhradie / Mauzóleum / Motorest

Linking the geographic units of: Volovské vrchy – Rožňavská kotlina – Slovenský kras

Transport infrastructure: road no. I/16; planned highway no. R2, railway no. 160

Average daily traffic intensity (SSC 2015): 7,064 vehicles per 24 hours

The overall width of the corridor is 1 km. However, there were no photo traps installed in this area because it is generally well-known place for traffic collisions with wildlife which even indicates a special traffic sign. Especially the red deer and the wild boar are observed frequently. Even during the day, herds of ungulates in dozens of numbers can be observed. Two sections in this place are mostly selected for crossing to the other side of the road: one at the eastern edge of the village between a former fast food restaurant and a mausoleum used during the night; and the other one at a slight undulated depression alongside the hedgerows from where wildlife has a good and safe overview of the road (used during day and night).

Frequent crossing and movement activity of the red deer indicates a high habitat suitability of this place.

The red deer gathering together and waiting for a suitable moment for crossing the road on the other side can often be observed during the day.

Railway mortality – according to data collected by the Slovak Railways, 1 roe deer was killed in 2014 and another one in 2017.

Measures proposed:

1. Keep the area between Krásnohorské Podhradie village and the monument site (mausoleum) permeable and unfenced.
2. Remove all the bushes situated on both sides of the road close to the road between the villages of Krásnohorské Podhradie and Lipovník.
3. Grow no maize on the agricultural land.
4. Keep the agricultural land within the corridor permeable and unfenced.
5. Restore guiding vegetation situated in the eastern part of the corridor southwards.

List of species killed on the road during the monitoring period (April 2014 – July 2018)

Species	Number
<i>Erinaceus concolor</i>	3
<i>Erinaceus europaeus</i>	2
<i>Martes foina</i>	1
<i>Vulpes vulpes</i>	5



Fig. 32: Map of the critical site in the bio-corridor Krásnohorské Podhradie (red line); yellow lines account for movement paths. QGIS 2.18.0.



Fig. 33: Map of the critical site in the bio-corridor Krásnohorské Podhradie from a broader perspective.



Fig. 34: Critical site in the bio-corridor Krásnohorské Podhradie (former restaurant/ mausoleum) – many tracks alongside the muddy edge of the road and on the road itself indicating an intensive movement of the red deer in March 2018.



Fig. 35: Bio-corridor Krásnohorské Podhradie – a red deer herd prepared to cross the road I/50 in January 2018.

Critical site No. 9

Name of the corridor/source: Soroška/Gemerská pahorkatina – Domic – Silická planina – Horný vrch – Zádielska dolina / Regional TSES (R – ÚSES) of Rožňava District (1993)

Location: Slovenský kras National Park / Soroška

Linking the geographic units of planina Horný vrch plain – Silická planina

Transport infrastructure: road no. I/16; planned highway no. R2, railway no. 160

Average daily traffic intensity (SSC 2015): 5,792 vehicles per 24 hours

This site connects Alpine and Pannonian biogeographic regions. Soroška represents a border between Silická planina plain and Horný vrch plain. It is a large forest complex which offers safe opportunities for everyday movement and migration of wildlife. This site is an important route for large carnivores as they prefer the narrow-forested place on the ridge for their crossing activities. Altogether, 5-8 photo traps were installed. The grey wolf (*Canis lupus*) was recorded twice by different photo traps, and one radio-collared brown bear (*Ursus arctos*) was observed once when he crossed this site – all records were made during the night. Soroška is 2 km wide. This is a typical passage for large carnivores, which prefer a dense forest. According to data collected by the Slovak Railways, 5 red deer and 1 roe deer were killed in 2016-2017 on the broader rail line crossing the area. Mortality on the road is mentioned below.

List of species registered by photo traps (December 2017 – July 2018)

Species	Number
<i>Canis aureus</i>	2
<i>Canis lupus</i>	1
<i>Capreolus capreolus</i>	125
<i>Cervus elaphus</i>	463
<i>Felis silvestris</i>	4
<i>Lepus europaeus</i>	6
<i>Meles meles</i>	49
<i>Sus scrofa</i>	85
<i>Vulpes vulpes</i>	213
Dog	9
Unknown	53

Measures proposed:

1. It is important to prevent this place from human activities which would disturb these animals (construction, industrial activities, permanent sport activities, etc.). At the moment, there is one restaurant. Occasionally, the cattle are grazing here.
2. Coming from the Lipovník village the road leads through the meadows. No fencing of these meadows in the case of grazing is recommended.
3. Further, the road continues through the forest complex. Proposal: cut the trees to make the verge more open in order to avoid unexpected wildlife intrusion on the road in this part of the corridor.
4. Use road signs to alert the drivers of danger of unexpected wildlife intrusion on the road.
5. Build the overpass.
6. Place light-reflective artificial deterrents along the road which would reflect the light from the car towards the forest and thus stop the animal entering the road.
7. Place active light sensors along the road, which would start flashing once there is an animal near the road (e.g. 20 m from the road) to inform the drivers about its presence.

Animal road mortality during the monitoring period (November 2014 – April 2018)

Species	Soroška	Soroška - surroundings
<i>Erinaceus concolor</i>	1	
<i>Martes martes</i>	1	1
<i>Meles meles</i>	2	
<i>Mustela nivalis</i>		1
<i>Sciurus vulgaris</i>		2
<i>Vulpes vulpes</i>	4	2

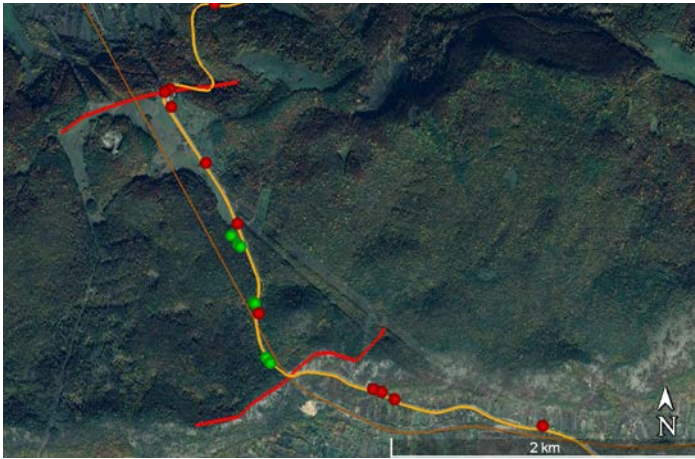


Fig. 36: Map of the critical site in the bio-corridor of Soroška.



Fig. 37: Map of the critical site in the bio-corridor of Soroška from a broader perspective.



Fig. 38: The bio-corridor of Soroška – view of the southern part of the corridor in September 2016. Forest stands on both sides of the road, ideal conditions for wildlife crossing.

Critical site No. 10

Name of the corridor/source: Zemné hradisko / Gemerská pahorkatina – Dómica – Silická planina – Horný vrch – Zádielska dolina / Regional TSES (R-ÚSES) Košice – surroundings – update (2006)

Location: National Nature Reserve Zemné hradisko, Turnianska kotlina basin

Linking the geographic units of planina Horný vrch plain – planina Dolný vrch plain

Transport infrastructure: road no. I/16, railway no. 160

Average daily traffic intensity (SSC 2015): 5,587 - 5,809 vehicles per 24 hours on I50

Zemné hradisko is a national nature reserve. It is defined as a potential passageway for large mammals. The overall width is 1,700 m. 6 photo traps were installed at this site (2 on each point). The observed sightings are shown in the table below. One traffic collision with a brown bear was recorded in the past. The currently recorded collisions are mentioned below. According to the data collected by the Slovak Railways, 18 animals (ungulates) were killed during the years 2014 – 2017 on the railway line crossing the area.

List of species registered by photo traps (April 2017 – July 2018)

Species	Number
<i>Buteo buteo</i>	31
<i>Capreolus capreolus</i>	171
<i>Cervus elaphus</i>	3784
<i>Felis catus</i>	2
<i>Felis silvestris</i>	7
<i>Lepus europaeus</i>	59
<i>Meles meles</i>	38
<i>Mustela putorius</i>	10
<i>Passer montanus</i>	1
<i>Phasianus colchicus</i>	1
<i>Pica pica</i>	1
<i>Sus scrofa</i>	18
<i>Vanellus vanellus</i>	22
<i>Vulpes vulpes</i>	199
Unknown	100

Measures proposed:

1. Build permanent barriers and underpass for amphibians and install anti-crash walls in order to force the birds to fly higher above the passing vehicles near Hrhovské rybníky fishponds.
2. There is agricultural land on both sides of the road between Hrhov and Dvorníky - Včeláre villages. It is recommended that no maize be grown on this agricultural land and that narrow stripes without any crops be left next to the road.
3. Create the guiding vegetation made of bushes on the agricultural land between Hrhov village and Zemné hradisko reserve.
4. Build the underpass for mammals up to the size of foxes and badgers.
5. Use road signs to alert the drivers of danger of unexpected wildlife intrusion on the road.

Animal road mortality during the monitoring period (June 2014 – January 2018)

Species	Zemné Hradisko	Zemné Hradisko - surroundings
<i>Capreolus capreolus</i>	1	
<i>Lutra lutra</i>		1
<i>Martes foina</i>	1	
<i>Meles meles</i>		1
<i>Vulpes vulpes</i>	4	4



Fig. 39: Map of the critical site in the bio-corridors of Zemné Hradisko.



Fig. 40: Map of the critical site in the bio-corridors of Zemné Hradisko from a broader perspective.



Fig. 41: The bio-corridor of Zemné Hradisko – view from the south, March 2018

Critical site No. 11

Name of the corridor: Drienovec

Location: Košická kotlina

Linking the geographic units of Slovenský kras (Jasovská planina – Košická kotlina – Bodvianska pahorkatina) – Hungary

Transport infrastructure: road no. I/16

Average daily traffic intensity (SSC 2015): 8,826 vehicles per 24 hours

The site is located on an open agricultural land, where the red deer and the roe deer frequently occur. The site directly connects the Slovenský kras National Park with Hungary (Euclidian distance to the state border SK/HU: 6 km). There were no photo traps installed. The overall width of the potential passageway is 600 m. A large part of the corridor was fenced by the land owner in 2017.

Animal road mortality during the monitoring period (March 2015 – September 2017)

Species	Number
<i>Felis silvestris</i>	1
<i>Lepus europaeus</i>	1
<i>Martes sp.</i>	1
<i>Vulpes vulpes</i>	1

Railway mortality – according to the data collected by the Slovak Railways, 2 ungulates (1 roe deer and 2 red deer) were killed during the year 2015 on the line crossing the area.

Measures proposed:

1. Keep the corridor permeable and the area unfenced. Start negotiations with the local stakeholder who fenced his property with the purpose to build a passage for migrating animals.
2. Use road signs to alert the drivers of danger of unexpected wildlife intrusion on the road.
3. Improve the culvert permeability for animals.
4. Restore the guiding vegetation made up of bushes.

Moreover, a green bridge in case the expressway R2 is built in this place is recommended.



Fig. 42: Map of the critical site in the bio-corridor of Drienovec.

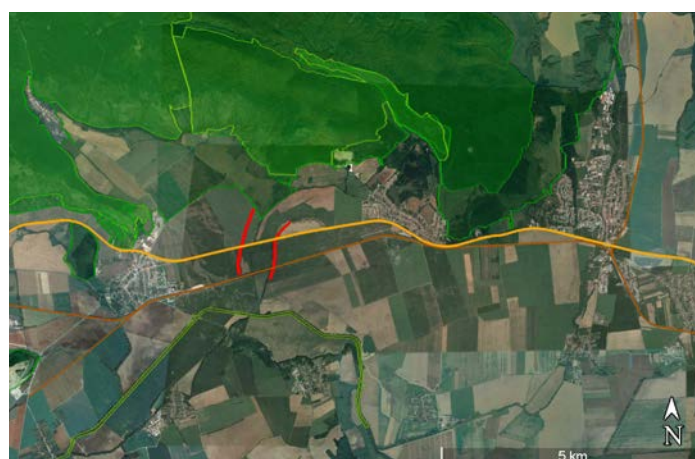


Fig. 43: Map of the critical site in the bio-corridor of Drienovec from a broader perspective.



Fig. 44: The bio-corridor of Drienovec – there are two places where the red deer pushed through the fencing and opened up the passage in February 2018.

3.2.3 Regional Centre of Nature Protection in Prešov competency area

Critical site No. 12

Name of the corridor: Šaca

Location: Šaca cadastre

Transport infrastructure: road no. I/16 Šaca – Pereš, planned highway no. R2 Šaca - Košické Oľšany (R2 – status – Process of documentation for building permission)

Average daily traffic intensity (SSC 2015): 21,235 vehicles per 24 hours

The corridor is connecting the forest complex of Kodydom with the bio-centre Jakobov dvor and SCI Haništiansky les. During the monitoring period, we did not confirm any wildlife movement across the road. The main reason for this could be that the area is substantially urbanised, and hence does not offer any cover condition for wildlife, and additional habitats are fragmented by many roads.

On two of the installed photo traps we recorded frequent presence of the roe deer (*Capreolus capreolus*), the red deer (*Cervus elaphus*), the red fox (*Vulpes vulpes*), the wild boar (*Sus scrofa*), the European hare (*Lepus europaeus*), and the European badger (*Meles meles*). Such high traffic volumes are known to seriously impede wildlife movement since the barrier effect already starts at the traffic volume of 6,000 vehicles per 24 hours. Additionally, local hunting clubs have a duty to remove killed game species immediately. Therefore, some carcasses were removed without our knowledge.

List of species registered by photo traps (July 2017 – July 2018)

Species	Number
<i>Capreolus capreolus</i>	241
<i>Cervus elaphus</i>	4
<i>Felis silvestris</i>	5
<i>Garrulus glandarius</i>	1
<i>Lepus europaeus</i>	10
<i>Meles meles</i>	18
<i>Parus major</i>	1
<i>Sciurus vulgaris</i>	1
<i>Sus scrofa</i>	120
<i>Vulpes vulpes</i>	51

Animal road mortality during the monitoring period (July 2016)

Species	Count
<i>Martes sp.</i>	1

Railway mortality – according to the data collected by the Slovak Railways, 4 ungulates (2 roe deer and 2 red deer) were killed on rail lines crossing the area.

Measures proposed:

1. Keep the corridor permeable and the area unfenced.
2. Beware of housing development.
3. Use road signs to alert the drivers of the danger of unexpected wildlife intrusion on the road.



Fig. 45: Map of critical site in potential corridor "Šaca", actually represented by only a small forest stripe in urban landscape.



Fig. 46: Map of the critical site in the potential corridor of "Šaca" from a broader perspective.

Critical site No. 13

Name of the corridor: Haniska

Location: Haniska cadastre

Transport infrastructure: road no. III/3401
L'udvíkov Dvor – Haniska, planned highway no. R2
Šaca – Košické Olšany

Average daily traffic intensity (SSC 2015): 3,715 – 4,178 vehicles per 24 hours

This place is potentially connecting the bio-centre of Jakobov dvor and SCI Haništiansky les with a further continuation to Hungary. During the monitoring process, no animal movement across the roadway was recorded. Three photo traps documented the occurrence of the roe deer (*Capreolus capreolus*), the red fox (*Vulpes vulpes*), the wild boar (*Sus scrofa*), the European hare (*Lepus europaeus*), the European badger (*Meles meles*), along with the wildcat (*Felis silvestris*). As shown in Fig. 46, the landscape has been urbanised and properly suitable for small mammal species which got used to human disturbance.



Fig. 47: Map of the critical site in an already dysfunctional corridor near “Haniska”.

List of species registered by photo traps (July 2017 – July 2018)

Species	Number
<i>Capreolus capreolus</i>	270
<i>Cervus elaphus</i>	14
<i>Felis silvestris</i>	3
<i>Lepus europaeus</i>	21
<i>Meles meles</i>	10
<i>Sus scrofa</i>	36
<i>Vulpes vulpes</i>	39

Measures proposed:

1. Keep the corridor permeable and the area unfenced.
2. Beware of housing and transport infrastructure development.

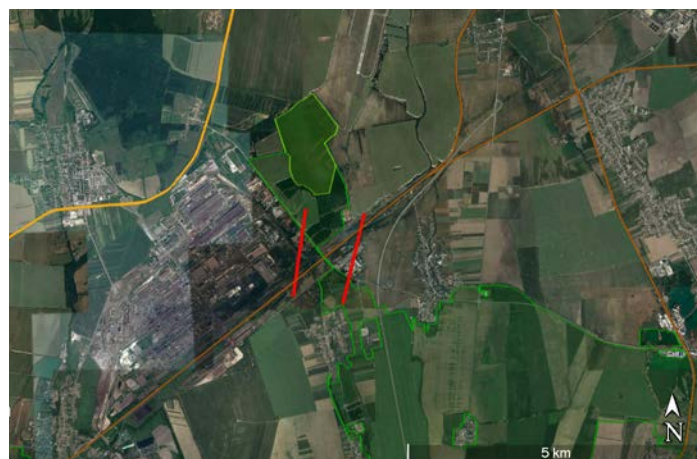


Fig. 48: Map of the critical site of an already dysfunctional corridor near “Haniska” from a broader perspective.

Critical site No. 14

Name of the corridor: Svinica

Location: Svinica cadastre

Transport infrastructure: road no. I/19 Svinica - Košický Klečenov, planned D1 Bidovce - Dargov

Average daily traffic intensity (SSC 2015): 9,802 vehicles per 24 hours

This section connects the bio-centre of Venešové with the bio-centre of Rákocziho les. Three photo traps were installed, and these recorded the occurrence of the roe deer (*Capreolus capreolus*), the red fox (*Vulpes vulpes*), the wild boar (*Sus scrofa*), the European hare (*Lepus europaeus*) and the European badger (*Meles meles*). Few small mammals were killed during the monitoring period.

Measures proposed:

1. Clean and make the culvert between Svinica and Košický Klečov villages permeable.
2. Cut the bushes off the guiding stripe of vegetation in the distance of 15 m from the road in order to avoid unexpected wildlife intrusion on the road.

Animal road mortality during the monitoring period (June 2017 - February 2018)

Species	Number
<i>Felis catus</i>	1
<i>Martes foina</i>	2
<i>Vulpes vulpes</i>	1



Fig. 49: Map of the critical site in the potential bio-corridor at "Svinica".

List of species registered by photo traps (July 2017 - June 2018)

Species	Number
<i>Aegithalos caudatus</i>	2
<i>Ardea cinerea</i>	2
<i>Buteo buteo</i>	1
<i>Canis lupus</i>	2
<i>Capreolus capreolus</i>	113
<i>Cervus elaphus</i>	8
<i>Ciconia nigra</i>	7
<i>Felis silvestris</i>	1
<i>Garrulus glandarius</i>	1
<i>Glis glis</i>	33
<i>Lepus europaeus</i>	32
Cat	2
<i>Martes foina</i>	4
<i>Martes sp.</i>	6
<i>Meles meles</i>	3
Mouse	27
<i>Nyctereutes procyonoides</i>	1
<i>Parus major</i>	2
<i>Phasianus colchicus</i>	1
<i>Sciurus vulgaris</i>	4
<i>Strix aluco</i>	1
<i>Sus scrofa</i>	12
<i>Turdus merula</i>	1
<i>Turdus pilaris</i>	2
<i>Vulpes vulpes</i>	66

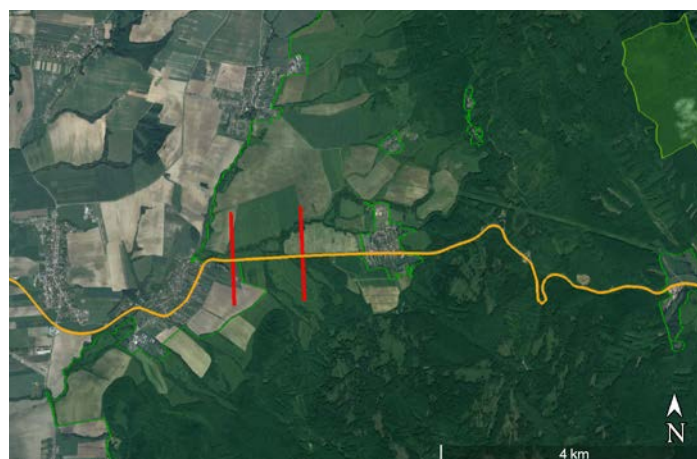


Fig. 50: Map of the critical site in the potential bio-corridor at "Svinica" from a broader perspective.

Critical site No. 15

Name of the corridor: Košický Klečenov

Location: Slanské vrchy, Košický Klečenov cadastre

Transport infrastructure: road no. I/19 - Dargov, planned motorway no. D1 Bidovce – Dargov

Average daily traffic intensity (SSC 2015):
9,802 - 9,503 vehicles per 24 hours

The corridor is situated at the section Šimonka – Krčmárka – Veľký Milič and is approximately 2 km wide. We recorded crossing activities of both the red deer and the grey wolf. In 2016, one wildcat was killed by traffic. Two phototraps recorded the occurrence of the red deer (*Cervus elaphus*), the roe deer (*Capreolus capreolus*), the red fox (*Vulpes vulpes*), the wild boar (*Sus scrofa*), the European hare (*Lepus europaeus*), and the European badger (*Meles meles*). Moreover, the wild cat (*Felis silvestris*) and the grey wolf (*Canis lupus*) were registered here as well.

Mapping has confirmed that the Slanské vrchy mountain range system represents an important wildlife corridor between Slovakia and Hungary. Unfortunately, some parts are fenced which could otherwise be reconsidered. Fortunately, in this place, the so far planned highway D1 Bidovce – Dargov should run through a tunnel.

List of species registered by photo traps
(September 2017 – June 2018)

Species	Number
<i>Canis lupus</i>	2
<i>Capreolus capreolus</i>	84
<i>Cervus elaphus</i>	81
<i>Felis silvestris</i>	5
<i>Fringilla coelebs</i>	1
<i>Lepus europaeus</i>	21
<i>Martes sp.</i>	1
<i>Meles meles</i>	16
<i>Sus scrofa</i>	31
<i>Turdus merula</i>	6
<i>Turdus philomelos</i>	4
<i>Turdus pilaris</i>	2
<i>Vulpes vulpes</i>	89

Animal road mortality during the monitoring
(August 2017 – February 2018)

Species	Number
<i>Lepus europaeus</i>	2
<i>Sciurus vulgaris</i>	1

Measures proposed:

1. The road leads through the forest complex. Therefore: cut the trees to make the verge more open in order to avoid unexpected wildlife intrusion on the road in this part of the corridor.
2. Use road signs to alert the drivers of danger of unexpected wildlife intrusion on the road.
3. Place light-reflective artificial deterrents along the road which would reflect the light from the approaching car towards the forest and thus stop the animal entering the road.
4. Place active light sensors along the road, which would start flashing once there is an animal near the road (e.g. 20 m from the road) to inform the drivers about its presence.

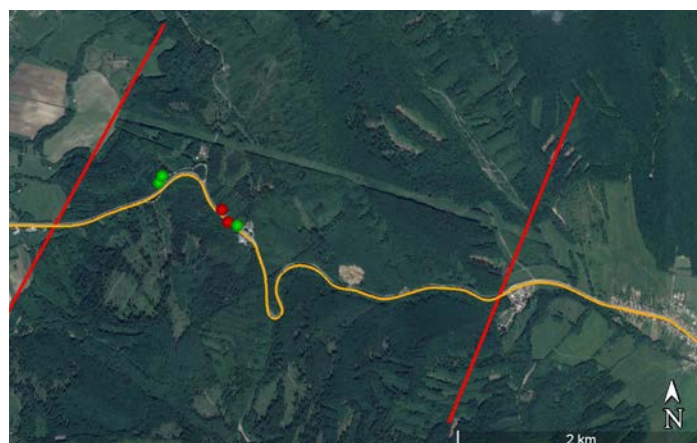


Fig. 51: Map of the critical site in the bio-corridor of "Košický Klečenov" in a contiguous forest complex.



Fig. 52: Map of the critical site in the bio-corridor of "Košický Klečenov" from a broader perspective.



Fig. 53: Wolf crossing the road at the corridor of Košický Klečenov indicating high importance of this place.

3.2.4 PLA Vihorlat Administration competency area

Critical site No. 16

Name of the corridor: Fekišovce – Gajdoš – Nižná Rybnica

Location: Veľké Revištia, Úbrež, Nižná Rybnica cadastres

Orographic unit: Východoslovenská nížina lowland

Transport infrastructure: road no. I/19, planned motorway no. D1

Average daily traffic intensity (SSC 2015): 4,033 vehicles per 24 hours

Corridor description: The corridor runs along the road E50, which is an important road leading to a border crossing to Ukraine (Vyšné Nemecké – Uzhhorod). A motorway D1 Pozdišovce – SK state border with Ukraine is planned to be built here. The area is mostly agricultural (arable land, meadows). The corridor is also an important waterfowl migration route within central Europe. The roadkills recorded here during the monitoring period include the European roe deer (*Capreolus capreolus*), the wild boar (*Sus scrofa*), the red fox (*Vulpes vulpes*), the wildcat (*Felis silvestris*), the long-eared owl (*Asio otus*), the common buzzard (*Buteo buteo*), and the tawny owl (*Strix aluco*).

Traces of 7 vertebrate species were recorded during monitoring: the European roe deer, the red deer (*Cervus elaphus*), the wild boar, the red fox, the European hare (*Lepus europaeus*), the wildcat, and the European pine marten (*Martes martes*). No signs of large carnivores were found.

List of species registered by photo traps (September 2017 – June 2018)

Species	Number
<i>Capreolus capreolus</i>	299
<i>Cervus elaphus</i>	3
<i>Felis silvestris</i>	1
<i>Lepus europaeus</i>	32
<i>Sus scrofa</i>	45
<i>Vulpes vulpes</i>	25

Animal road mortality during the monitoring (May 2017 – May 2018)

Species	Number
<i>Asio otus</i>	1
<i>Buteo buteo</i>	1
<i>Capreolus capreolus</i>	3
<i>Felis silvestris</i>	3
<i>Lepus europaeus</i>	1
<i>Martes foina</i>	1
<i>Meles meles</i>	2
<i>Strix aluco</i>	2
<i>Sus scrofa</i>	1
<i>Vulpes vulpes</i>	8

Measures proposed:

1. There is a complex of agricultural land on both sides of the road. It is recommended that no maize be grown on this agricultural land and the narrow stripes without any crops be left next to the road.
2. Remove all trees and bushes within the distance of 15 m on both sides of the road in the narrow stripes of vegetation near the Gajdoš settlement. Plant bushes/trees to cover the migration route in open areas.
3. Clean and make the underpass near to the Gajdoš village passable.



Fig. 54: Map of the critical site in bio-corridor Fekišovce – Gajdoš – Nižná Rybnica.



Fig. 55: Map of critical site in the bio-corridor of Fekišovce – Gajdoš – Nižná Rybnica from a broader perspective.



Fig. 56: Installation of the phototrap in the biocorridor.



Fig. 57: Roe deer recorded by the phototrap in the biocorridor.

Critical site No. 17

Name of the corridor: Trhovište – Pozdišovce

Location: Pozdišovce cadastre, Michalovce District

Linking the geographic units: Východoslovenská nížina lowland

Transport infrastructure: road no. I/19, planned motorway no. D1

Average daily traffic intensity (SSC 2015): 8,525 vehicles per 24 hours

Corridor description: The corridor runs along the road E50, which is an important road leading to a border crossing to Ukraine (Vyšné Nemecké – Uzhgorod). A motorway D1 Pozdišovce – state border – Ukraine is planned to be built here. The corridor is placed between the built-up area of the village Trhovište and Pozdišovce. A rail line crosses the corridor in the village of Laškovce. Pozdišovský les, an important forest habitat, is located within close vicinity of the corridor.

The roadkills recorded here during the monitoring period include the European roe deer (*Capreolus capreolus*), the red fox (*Vulpes vulpes*), and the long-eared owl (*Asio otus*).

Traces of 3 vertebrate species were recorded during the monitoring: the European roe deer, the red fox, and the European hare (*Lepus europaeus*).

List of species registered by phototraps (September 2017 – June 2018)

Species	Number
<i>Capreolus capreolus</i>	50
<i>Lepus europaeus</i>	7
<i>Sus scrofa</i>	14
<i>Vulpes vulpes</i>	9

Animal road mortality during the monitoring (December 2017 – March 2018)

Species	Number
<i>Asio otus</i>	1
<i>Lepus europaeus</i>	2
<i>Vulpes vulpes</i>	3

Measures proposed:

1. There is a complex of agricultural land on both sides of the road. It is recommended that no maize be grown on this agricultural land and the narrow stripes of vegetation which end at Laškovce village. Due to the fact that the bio-corridor is quite wide it is reasonable to plant some more guiding vegetation in agricultural land on both sides of the road in order to cover the migration route in open areas.
2. Remove all trees and bushes within the distance of 15 m on both sides of the road in the narrow stripes of vegetation near the Cajdoš settlement. Plant bushes/trees to cover the migration route in open areas.
3. Clean and make the underpass between Trhovište and Pozdišovce villages passable.



Fig. 58: Map of the critical site in the bio-corridor of Trhovište – Pozdišovce.



Fig. 59: Map of the critical site in the bio-corridor of Trhovište – Pozdišovce from a broader perspective.

3.3 Ukraine

Critical site No. 1

Location: M06 – km 740 – 743 (Near Svalyava)

Description: According to the data received from the National Police, there is a critical point on the road M06, km 740 – 742 near the town of Svalyava. Traffic intensity at this point is 22,000 cars per day. The road goes through the Latorytsya River, beginning right at the river. The valley is 200 – 300 m wide and surrounded by low mountains (elevation under river valley is 50 – 100 m). There are pasturelands on the left side of the road and some patches of arable land. A narrow strip of abandoned pasture on the right side of the road is a location of several springs of water. The road is constructed on the embankment (elevation of 1 – 1.5 m), it has 2 lanes (one lane in each direction) partly fenced with roadside guard rails (please see the photos below). There is a culvert (1 m in diameter) on this section of the road, which aimed to transfer water of springs (right side of the road) to the river Latorytsya (left side of the road). Nowadays it is not functioning (dry), because of change in streams that form shallow puddles suitable for amphibians on the abandoned agricultural land.

The site needs further research to clarify the species suffering from road infrastructure and traffic.

Currently, there are no data on species that cross the road in this section. There were 2 wild animal trails discovered in this section (see photos below). The site needs further study to clarify which species use this section of the road for migration.

The area partly overlaps with the ecological corridor of “Latorytsya Valley”.



Fig. 60: View of the road and lands around, 2018

Measures proposed:

Management measures:

1. Lower the maximum speed of traffic on this section of the road, subject responsible: National Police, Zakarpattya Regional Road Administration (to 70 km / hour maximum).
2. Put the road sign 1.36 “Wild animals” combined with the table 7.2.1 “Zone of action” 3 km in both directions (2 km of critical point + 0.5 km from each side as a safety measure).
3. Monitor the species passing the road and elaborate the corresponding management plan.



Fig. 61: The monitored area of Mukachevo - Nyzhni Vorota (north of Svalyava).

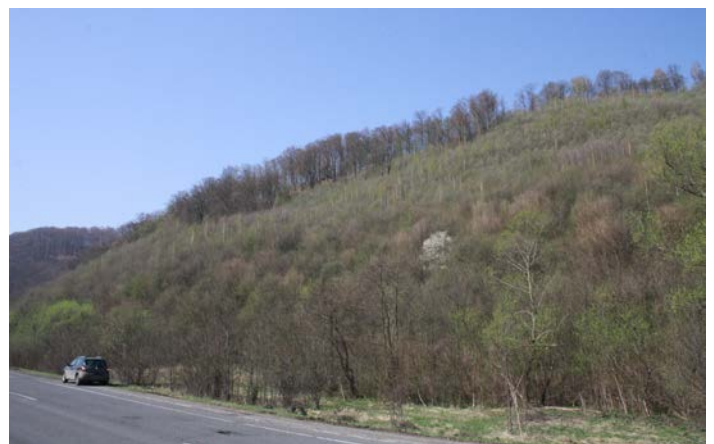


Fig. 62: View of the road and lands around, 2018



Fig. 63: The animal trail close to the road Mukachevo - Nyzhni Vorota. 2018.



Fig. 64: The culvert under the road Mukachevo - Nyzhni Vorota., 2018.

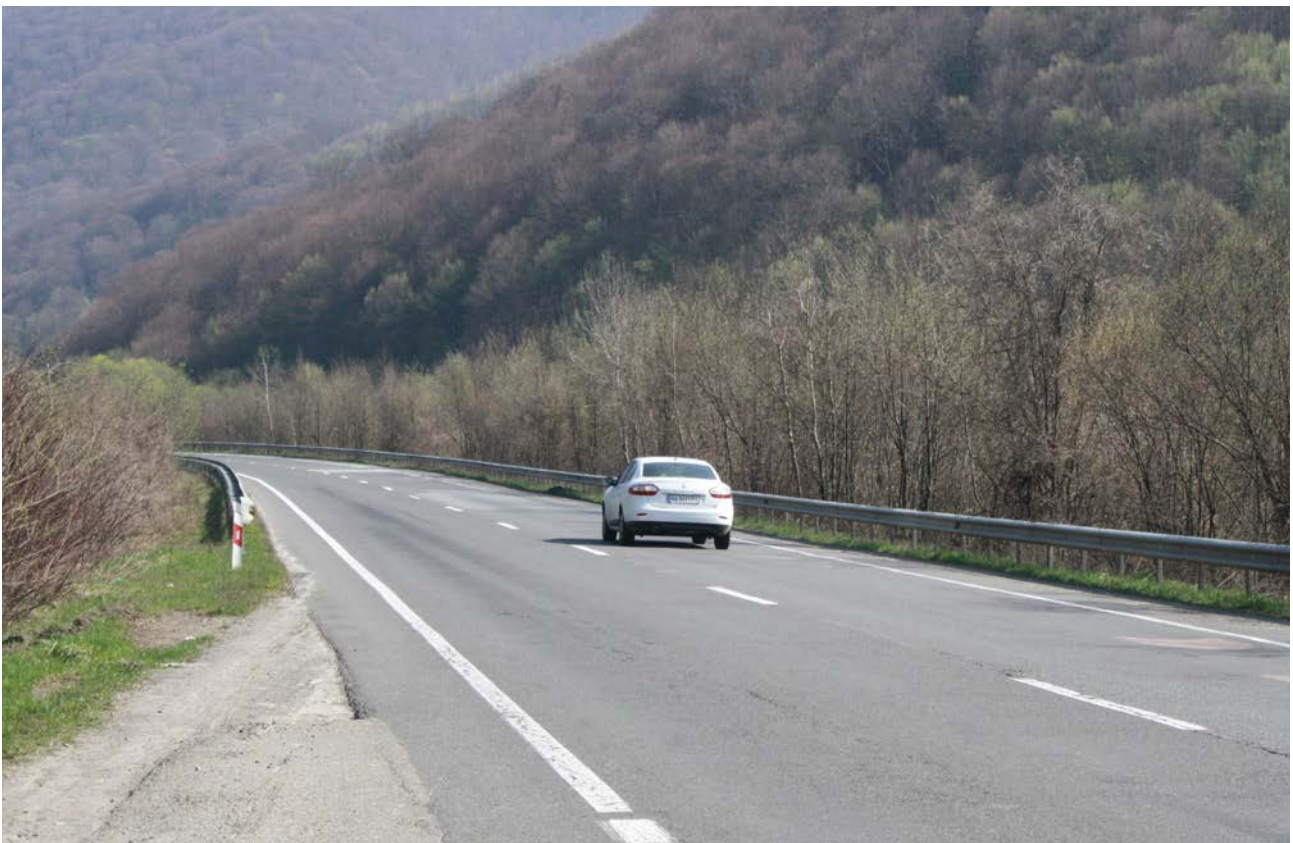


Fig. 65: Road fencing (Mukachevo - Nyzhni Vorota), 2018.

Critical site No. 2

Location: M06 – km 825 – 827 (Latorytsya River valley)

Description: According to the data received from the National Police, there is a critical point on the road M06, km 825 – 827 km between the village of Syurte (Szürte) and the town of Chop. Traffic intensity in this point is approximately 5,500 cars per 24 hours. The road goes over the floodplain of Latorytsya River. The floodplain is 200 – 300 m wide, surrounded by arable land, pastures and some industrial complexes of the Tisza plain. The road is built on the embankment (elevation of 1 – 4 m), it has 2 lanes (one lane in each direction), partly fenced with roadside guard rails (see the photos below). The speed limit at this part of the road is 90 km per hour. There is a bridge on Latorytsya (approx. 60 m long), which provides a good option for animals to migrate under (underpass), except the time of seasonal and flash floods.

Currently, there are no data on possible species that cross the road in this section. The site needs further research to clarify which species suffer from road infrastructure and traffic.

The area fully overlaps with the ecological corridor of “Latorytsya Valley”, according to the map prepared by the Department of Ecology and Natural Resources of Zakarpattya Regional Administration.

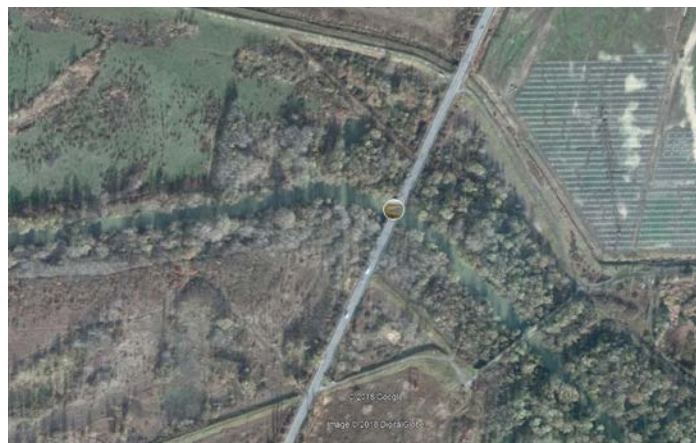


Fig. 66: The monitored area on the road section of Syurte-Chop.



Fig. 67: View of the road and bridge on the road section of Syurte-Chop, 2018.



Fig. 68: View of the Latorytsya floodplain close to the road section of Syurte-Chop, 2018.



Fig. 69: The Latorytsya floodplain near the road section of Syurte-Chop is an important migration corridor in Zakarpattia region. High water in spring, 2018.

Measures proposed:

- 1.** Lower the maximum speed of the traffic on this section of the road, subject responsible: National Police, Zakarpattia Regional Road Administration (to 70 km per hour maximum)
- 2.** Put the road sign 1.36 “Wild animals” with the table 7.2.1 “Zone of action” 1 km in both directions.
- 3.** Monitor the animals which use this section of the road for migration and elaborate the corresponding management plan.

Critical site No. 3

Location: Beregove

Description: There are potential critical points on the planned road between the border with Hungary and Beregove. Arable land is located on both sides of the road (mainly the maize and crops) and has a net of old ameliorative channels. The part near the state border is managed by the State Border Guard Service of Ukraine.

Currently, there are no existing barriers, except for the road itself. Since there are different cultivated plants at the area, it is an important feeding area of local wildlife populations, which move to different parts of fields crossing the road. This was proven by the field mapping in the areas in different seasons of 2017-2018. The traces of the wild boar (*Sus scrofa*), the roe deer (*Capreolus capreolus*), the red fox (*Vulpes vulpes*) and the badger (*Meles meles*) have been recorded crossing the road. The traces of the European hare (*Lepus europaeus*) were recorded within the vicinity of the road. In case the area is ever used for crop cultivation, it may be an important critical factor for safe animal movements.

Description of development intentions:

A new road with high traffic intensity is planned as a part of road to Mukacheve and connected the highway in Hungary and a road in direction to Kyiv. In the case of high traffic intensity, the road may have a certain negative impact on the local large and middle mammal species populations.

Animals and their signs observed during the monitoring period (June 2017 – April 2018)

Species	Number
<i>Capreolus capreolus</i>	8
<i>Meles meles</i>	8
<i>Sus scrofa</i>	28
<i>Vulpes vulpes</i>	9
<i>Lepus europaeus</i>	2

Measures proposed:

1. Lower the maximum speed of traffic in this section of the road (to 70 km/hour). Subject responsible: National Police, Zakarpattia Regional Road Administration.
2. Put the road sign 1.36 "Wild animals" with the Table 7.2.1 "Zone of action" (covering the whole section between Beregove and the state border).



Fig. 70: The monitored area close to the Beregove (a planned bypass construction).



Fig. 71: View of arable land near the planned road section from the border with Hungary to north of Beregove, 2017.



Fig. 72: View of arable land near the planned road section from the border with Hungary to north of Beregove, 2017.



Fig. 73: View of an arable land near the planned road section from the border with Hungary to north Beregove, 2017.



Fig. 74: Traces of a badger crossing the road section from the border with Hungary to north Beregove, 2017.



Fig. 75: Traces of the wild boar crossing the road; the section from the border with Hungary to north Beregove. 2017.

Critical site No. 4

Location: Mukacheve

Description: There are critical points on the road E58 between Beregove and Mukacheve.

The traffic on the road Mukacheve – Beregove gets very busy around the clock. Traffic intensity is about 3,000 cars per 24 hours. The number of cars depends on the days of the week. The average speed (measured at the section surrounded by the forest, outside of villages) is 80-100 km per hour in the day and 60-90 km per hour during the night.

There is a deciduous forest (mainly oak and hornbeam) on the left side of the road and arable land with lines of trees and bushes on the right. A bush surrounds the road in some sections. The forest is managed by the State Forestry Administration of Zakarpattya region. Arable lands belong to the local farmers.

The traces of the wild boar (*Sus scrofa*), the red deer (*Cervus elaphus*), the red fox (*Vulpes vulpes*), and the European pine marten (*Martes martes*) have been recorded crossing the road. However, a lot of traces of

other species were recorded within the vicinity of the road: the European hare (*Lepus europaeus*), the roe deer (*Capreolus capreolus*), and small carnivores like the pine marten (*Martes martes*).

Traffic collisions with wild animals were not recorded here, possibly because of low density of these animals.

Some crosses of different animals have been noted on the base field traces in snow and mud and mapped during the survey in 2017-2018. There are no barriers like fences for animal movement, except for the road itself.

Animals and their signs observed during the monitoring period (June 2017 – April 2018)

Species	Number
<i>Sus scrofa</i>	4
<i>Cervus elaphus</i>	1
<i>Vulpes vulpes</i>	6
<i>Lepus europaeus</i>	4
<i>Martes martes</i>	1



Fig. 76: The monitored area on the road section Beregove – Mukachevo.



Fig. 77: View of the forests along the road; the section of Beregove – Mukachevo, 2017.



Fig. 78: View of the forests along the road; the section of Beregove – Mukachevo, 2017.



Fig. 79: View of the forests along the road; the section of Beregove – Mukachevo, 2017.



Fig. 80: View of the forests along the road; the section of Beregove – Mukachevo, 2017.

Measures proposed

1. Lower the maximum speed of the traffic in this section of the road, subject responsible: National Police, Zakarpattya Regional Road Administration (to 70 km per hour maximum). The exact locations of the sections where limitation of speed is needed can be identified after additional research.
2. Put the road sign 1.36 “Wild animals” with the table 7.2.1 “Zone of action” 3 km in both directions. The exact locations of the necessary road signs can be identified after additional research.
3. Further monitoring of the section is needed.

Critical site No. 5

Location: Yanoshi

Description: There are critical points on the road E58 between Beregove and Mukacheve.

The traffic on the road Mukacheve – Beregove gets very busy around the clock. Traffic intensity is about 3,000 cars per 24 hours. The number of cars depends on the days of the week. The average speed (measured at the section surrounded by the forest, outside of villages) is 80-100 km per hour in the day and 60-90 km per hour during the night.

There is a deciduous forest (mainly oak and hornbeam) on the left side of the road and arable land with lines of trees and bushes on the right. A bush surrounds the road in some sections. The forest is managed by the State Forestry Administration of Zakarpattya region. Arable lands belong to the local farmers.

Some crosses of different animal species have been registered on the base field traces in snow and mud and mapped during the survey in 2017-2018. The traces of the wild boar (*Sus scrofa*), the roe deer (*Capreolus capreolus*), the red fox (*Vulpes vulpes*), the wild cat (*Felis silvestris*) and the European hare (*Lepus europaeus*) have been recorded. There are no barriers like fences for animal's migrations except for the road itself.

Traffic collisions with wild animals possibly occur because of low density of the mentioned animals. We only recorded remains of the wild cat at the road close to Yanoshi village (point 3).

The area is not included into the officially delineated ecological corridor.

Animals and their signs observed during the monitoring period (June 2017 – April 2018)

Species	Number
<i>Sus scrofa</i>	10
<i>Capreolus capreolus</i>	2
<i>Vulpes vulpes</i>	9
<i>Lepus europaeus</i>	5
<i>Felis silvestris</i>	1

Animal road mortality during the monitoring period (June 2017 – April 2018)

Species	Number
<i>Felis silvestris</i>	1



Fig. 81: The monitored area, section of Beregove – Mukachevo.



Fig. 82: The Road Mukacheve – Beregove, 2018.



Fig. 83: The Road Mukacheve – Beregove, 2018.



Fig. 84: A tail of a wild cat found on the side of the road section Mukacheve – Beregove, 2018.

Measures proposed

1. Lower the maximum traffic speed in this section of the road, subject responsible: National Police, Zakarpattya Regional Road Administration (to 70 km per hour maximum). The exact locations of sections where limitation of speed is needed can be identified after additional research.
2. Put the road sign 1.36 “Wild animals” with the table 7.2.1 “Zone of action” 3 km in both directions. The exact locations of the necessary road signs can be identified after additional research.
3. Further monitoring of the section is needed.



4. Conclusions

From the results of field monitoring presented in this document it can be seen that this area is home to many important species, large carnivores including, and that these animals are many times killed due to intensity of traffic or weak implementation of mitigation measures. Many sites are currently hardly permeable for migration of large mammals, and many corridors have been already destroyed in the past.

Safeguarding the landscape connectivity is therefore essential to keep their population balanced and healthy. Connectivity is radically decreasing with the uncontrolled development. There is, however, still a chance to reduce the trend of landscape fragmentation and save the few remaining places open and permeable for wildlife.

The change can come not only through corrective measures requiring more finances, such as building a green bridge over the road or a railway, but also through a simple measure, such as installing a warning sign to attract driver's attention and cause him/her to slow down. Through land use plan decisions to leave particular spots of the landscape open, undeveloped and undisturbed in order to keep the area free for animal migration are crucial, especially in critical places/sites.

The Catalogue of measures is designated for all stakeholders, participating on landscape planning and preparation of land-use plans as well as those, who assess new buildings plans, including new transport infrastructure. Their appropriate decision is crucial to preserve or improve permeability of the land for animal migration. And this is unnecessary, if we want to secure survival of large carnivores as well as many other species in this area.



Annex:

In-depth Analysis

Miskolc-Košice-Uzhgorod Trilateral Pilot Area (Hungary, Slovakia, Ukraine)



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1. Introduction

Several large transport infrastructure projects are under construction or being planned along the Carpathian Mountains. The Carpathian region is the largest mountain region in Europe and is shared by seven Central and Eastern European countries, namely the Czech Republic, the Slovak Republic, Hungary, Poland, Ukraine, Romania and the Republic of Serbia. The TRANSGREEN project aims to contribute to safer and environmentally friendly road and rail network development. This In-depth Analysis focuses on transboundary Slovak-Hungary-Ukraine region, where the construction of Miskolc-Košice-Uzhgorod motorway is under way (Figure 1: Map of the pilot area). It is located at the border of two biogeographical regions, the Alpine and the Pannonian biogeographical region (Figure 2).

This document provides an overview of policies influencing the construction of transport infrastructure in the area along with an overview of stakeholders involved in this process. Furthermore, a detailed description of the current status of ecological corridors in the area is provided.

Major issues with new infrastructure in biodiversity rich areas are those of habitat fragmentation, biodiversity loss, disruption of migration routes and mortality caused by collisions. Other issues include noise pollution, emissions from vehicles and visual disruptions.

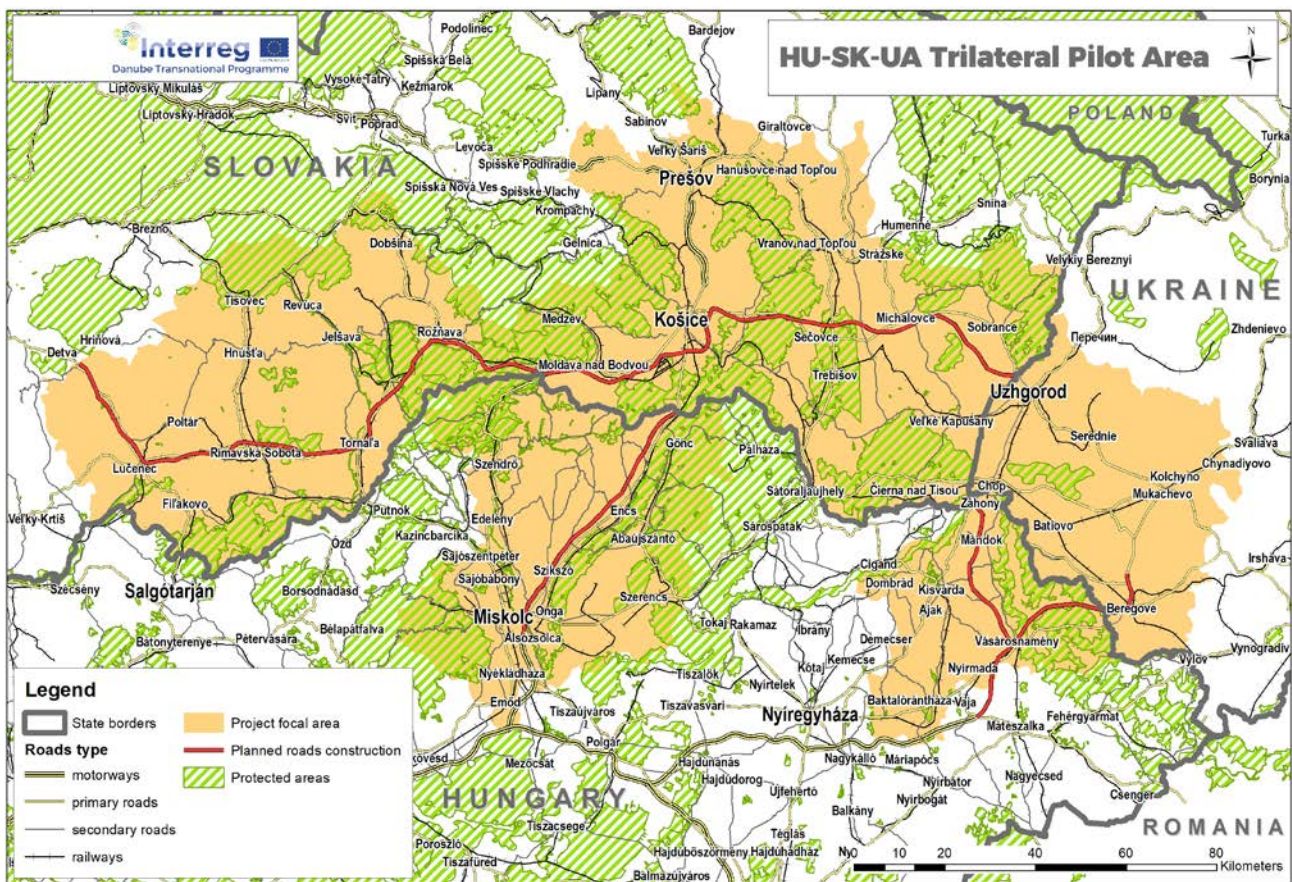


Fig. 1: TRANSGREEN project; HU-SK-UA pilot area.

2

Aim of the Study



The aim of the document is to clearly identify the issue of landscape connectivity in the area and to create a basis for decision-making. The document should help the authorities, officers, planners of construction projects and other stakeholders to make decisions which will benefit

both people and nature. There is a lot of experience already in Europe on how to minimize the negative environmental impacts of transport infrastructure. We have a unique opportunity to use this experience to avoid the mistakes that have been made and develop the transportation infrastructure in a sustainable way.

2.1 Selection of the pilot area

The pilot area selection was made based on the location of ecological corridors, protected sites or Natura 2000 sites along the areas that are either in the planning or construction phase of the TEN-T network (Trans-European Transport Network). The road network discussed in this study is the Miskolc-Kosice-Uzhgorod motorway network, connecting Hungary, Slovakia and Ukraine. In Hungary, there is a new motorway planned from Vásárosnamény to Beregsurány, which is a part of the 'core network'

(a sub-group in the TEN-T network projects) to be upgraded whereas the Miskolc to Tornyosnémeti is a part of the 'comprehensive network to be upgraded' category (a sub-group in the TEN-T network) projects in the TEN-T network. In Slovakia, there is an ongoing construction of the R2 expressway from Trenčín to Košice in process, the D1 motorway from Košice to Vyšné Nemecké (SK - UA state border) and the R4 expressway from Haniska - Kechnec (SK - HU state border, direction to Miskolc).

2.2 Geographical identification of the pilot area

The road connecting Miskolc to Tornyosnémeti within the Borsod-Abaúj Zemplén County is part of the Hungarian side of the pilot area. The Borsod-Abaúj Zemplén County connects to Slovakia in its northern and north-western part. The Borsod-Abaúj Zemplén County is mostly hilly with riverine lowlands created by the rivers Sajó, Bodrog and Hernád flowing from Slovakia into the Tisza River. The vegetation in this region is a mixture of sub-Carpathian and the Great Aföld (Great Hungarian Plain). The area comprises part of the Bükk National Park (Bükk Nemzeti Park).

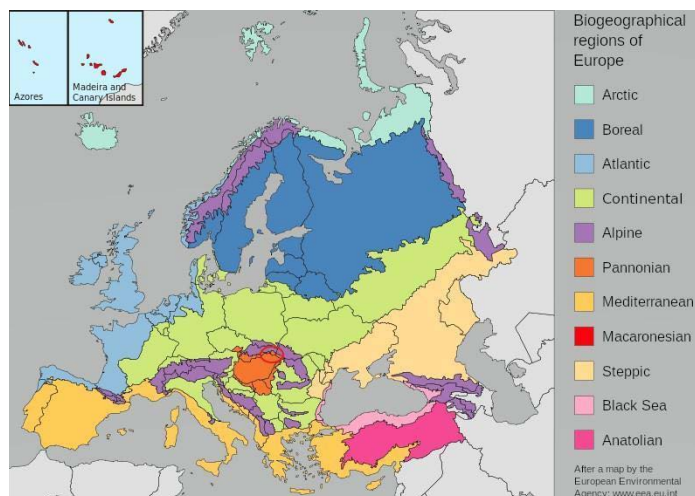


Fig. 2: Meeting point of the Alpine and Pannonian biogeographical area in the pilot area.

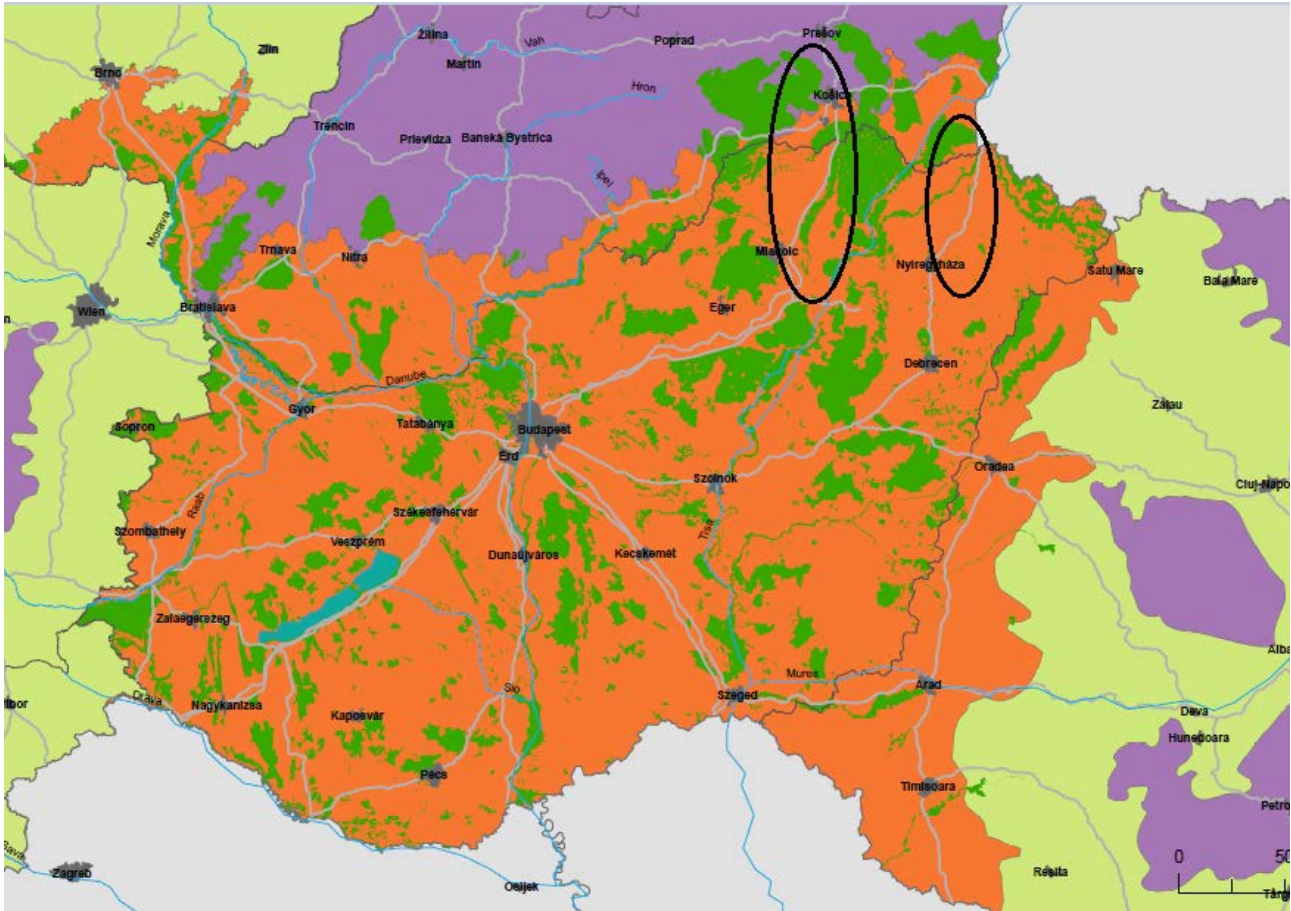


Figure 3. Map showing the Pannonian region and the area marking the new motorway: green area showing the Natura 2000 sites in the Pannonian; and the orange showing the Pannonian region in Hungary¹.

The roadway from Vásárosnamény to Beregsurány is located within the Szabolcs-Szatmár-Bereg County in Hungary, which shares a short border with Slovakia in the north and with Ukraine in the north and the northeast. It lies in the Great Aföld. The main river for this county is the Tisza along with its tributaries Batár, Túr, Szamos, and Kraszna rivers. Most part of this county is under the Szatmár-Bereg Landscape Protection Area which covers a total of 37 settlements. These are almost equally distributed between the Szatmár plain and the Bereg plain, both of which belong to the Hortobágy National Park Directorate. The Kaszonyi-hegy Nature Conservation Area of around 156.6 ha located in the Bereg part Barabas located on the outskirts of the Hungarian-Ukrainian border also falls under the Hortobágy National Park Directorate. The roadway within this county also passes through the Upper Tisza (Felső-Tisza) region which is a Ramsar site mainly supporting a number of globally threatened species, and which also serves as a migration path for several fish species which are endemic to the Danube River.

The Slovak part of the pilot area is situated in the southeast part of the country and covers 1,077,039 ha, which represents 22% of the area. It is rich

in biological diversity and valuable due to its morphology, climate and soils. In accordance to the geomorphological division of Slovakia, it belongs to the Province of West Carpathians and the Eastern Pannonian Basin. The Slovenské stredohorie Mountain range in the north and the Lučensko – Košická depression and enclaves of Matra – Slánska oblasť area in the south are parts of the Western Carpathians. The Východoslovenská nížina Lowland in the southeast corner of the pilot area belongs to the Eastern Pannonian Basin.

Beginning from the west, the pilot area in Slovakia has a hilly landscape made of sandstone ridges and scattered basalt formations, the remains of volcanic activity, reaching up to 400 – 600 m ASL. The highest peak of this area is Karanč (725 m ASL) and the lowest part is a water reservoir Janická vodná nádrž (167 m ASL). The border of Danube and Tisza watersheds intersects the area. The River Ipeľ watershed is located in the north-west of this border. Further to the east, the landscape changes from volcanic to karstic. This is the largest plateau karst area of Central Europe (including Plešivecká plateau, Silická plateau, Zádielska plateau and Jasovská plateau) and is designated

¹Source: From interactive EU Natura 2000 Map.

as a national park (NP Slovenský kras). Towards the east, there is the Košická kotlina Basin typical for its geomorphological structures – the trench faults. The terrain is undulating, with plains and alluvial flatlands until it reaches Slánske vrchy Mountains, which run in the north-south direction and reach over 1,000 m ASL (Šimonka, 1,092 m ASL). This area is highly geodynamical. The most important rivers are Bodva, Hornád and Bodrog. The eastern-most part is represented by Východoslovenská nížina Lowland, which is a flat area with the lowest point of Slovakia (94 m ASL, near the village Streda nad Bodrogom). The watersheds of the river Ondava, Laborec and Latorica create conditions for the presence of alluvial forest. Due to low altitude and local climate, the conditions here are ideal for agriculture, and fruit and wine production.

The Zakarpattya region forms the Ukrainian part of the pilot area. It covers a territory of 12,777 km² (1,277,700 ha), with approximate population of 1,250,000 inhabitants. The population is dispersed unevenly, with the highest concentration in the Tisza lowland. The territory comprises the Carpathian Mountains (80% of the territory) and the Tisza lowland (20% of the territory). 54% of the area is covered by forests (with only 15% of forests which cover the Tisza lowland). Protected areas occupy 13.9 % of the territory.

The main rivers in the territory are the Tisza, Uzh, Latoritsa, Teresva, Rika, Borzhava, Tereblya (Danube

basin). The highest point of the Ukrainian part of pilot area is the Coverla Mountain (2,061m AS), the lowest point is 101 m ASL (Tisza plain).

The main habitats of the Ukrainian part of the pilot area are represented by the forests (54% of the area), rich in species such as oak, hornbeam, beech, fir, spruce and alder. There are swamps on the Tisza plain and small bogs in the mountains.

The main aquatic ecosystems are represented by rivers and lakes. There are 9,429 rivers and streams in Zakarpattya. The biggest river is the Tisza (240 km within the region). Its main tributaries are the rivers Borzhava, Rika, Tereblya, Teresva, Latorytsya and Uzh. The rivers have a montane and sub-montane character. There are 637 lakes, ponds and reservoirs within the region. Natural lakes are mainly small and are located in the mountains (glacial origin) and in the Tisza floodplain (oxbows).

The agricultural land covers 451,600 ha which form 35% of the territory of the Ukrainian region, including 199,800 ha of arable land. The rest includes perennial plantations, pastures and hay-fields.

There are 11 cities, 19 towns and 579 villages, which form the urban habitats. The cities are quite small. Uzhgorod is the largest city with 120,000 inhabitants, the rest including Mukacheve, Beregove, Khust, Prechyn, Svalyava, Rakhiv and others have populations below 100,000 inhabitants.

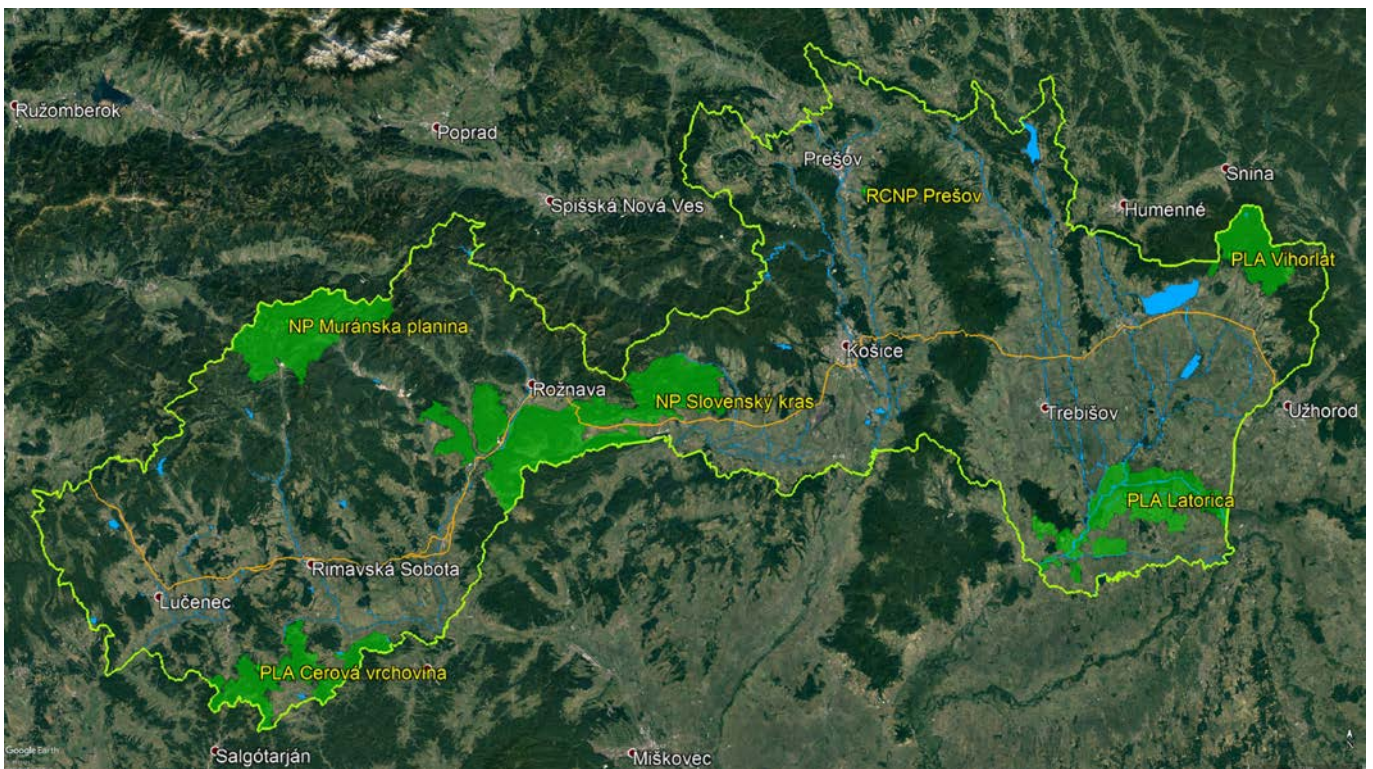


Fig. 4: Pilot area (in Slovakia) with National Parks, Landscape Protected Areas and main watercourses.

3

Policy Setting



3.1

The following legislative frameworks are relevant to the pilot area.

Legislation on nature conservation (acts and decrees)

3.1.1. Hungary

The Ministry of Agriculture, Department for Nature Conservation and Environment is responsible for ensuring the implementation of the EU environmental regulations.

- » **Act No. LIII. of 1996 on Nature Conservation** – This act relates to natural values and landscape. It also applies to duties arising from international agreements and cooperation. It aims to protect and to promote sustainable use of natural resources, protected areas, and landscapes.
- » **National Environmental Program (NEP) 2015-2020** – represents a comprehensive strategic plan for environmental issues in Hungary. It is used as a framework for every environmental plan, strategy or program. The program is updated every six years and has been in effect since 1995. It has the following general objectives:
 - » to improve the quality of life and environmental conditions for human health,
 - » to protect natural resources and values and promote their sustainable use,
 - » to improve the efficiency of resource use and to take steps towards green economy.
- » **National Nature Conservation Master Plan 2015-2020** – This is part of the National Environmental Program. The Master Plan states the importance of biodiversity along with ecosystem services and imposes a multi-sector approach in order to prevent further loss of biodiversity.
- » **KÖM-MARD Joint Ministerial Decree of 2/2002 (I.23.)** – Joint ministerial decree on regulation of environmentally sensitive areas. This decree includes rules regarding environmentally sensitive areas (ESA), legal basis for their designation including.
- » **National Biodiversity Strategy for the period 2015-2020** – The National Biodiversity Strategy was adopted by the Hungarian Government in 2014. The main aim of the strategy is to halt the loss of biological diversity, to prevent the decline of ecosystem services in Hungary by 2020 and to improve their status.
- » **Government Decree 275/2004 (X.8) on Sites of Community Importance** – The decree forms the legal framework for Natura 2000 sites designation and conservation.

- » **Ministerial Decree No. 12/2005 (VI.17.)** – The decree details the limitations that apply in natural habitats of protected species.
- » **Decree No. 46 of 1999** – The decree details the use and exploitation of flood areas, riverside strips, wetlands and periodically inundated areas.

3.1.2. Slovakia

- » **Act No. 543/2002 Coll. on Nature and Landscape Protection** of June 25, 2002 as amended by later regulations: This Act regulates competencies of state administration bodies and municipalities, the rights and obligations of legal persons and natural persons in nature and landscape protection with the aim to secure preservation of natural balance and conservation of diverse living conditions and life forms on the Earth, nature values and beauties to create conditions for long-term sustainable use of natural resources and for providing ecosystem services, taking into account economic, social and cultural needs, as well as regional and local conditions.
- » **Decree of the Ministry of Environment of the SR No 24/2003 Coll. implementing the Nature Conservation Act**
- » **Act. No. 326/2005 Coll. on Forests** of June 23, 2005 as amended by later regulations and Decree of the Ministry of Agriculture of the SR No. 12/2009 Coll. on forest land protection in the spatial planning
- » **Act No. 274/2009 Coll. on Hunting** of July 10, 2009 as amended by later regulations and Decree of the Ministry of Agriculture and Rural Development of the SR No. 489/2013 Coll. implementing the Act on Hunting.
- » **Act No. 364/2004 Coll. on Waters as amended by later regulations**
- » **Act No. 330/1991 Coll. on Land Reform**
- » **Act No. 24/2006 Col. on Environmental Impact Assessment**
- » **National Biodiversity Strategy in Slovakia until 2020** (approved by the Decree of the Slovak Government no. 12/2014 of January 8, 2014): The

main reason for this strategy is to stop the loss of biodiversity and degradation of the ecosystems and their services in Slovakia until 2020 and to safeguard the restoration of biodiversity and ecosystems and increase Slovakia's contribution to stopping the loss of biodiversity in the world.

- » **Action Plan for the implementation of the Updated National Biodiversity Strategy until 2020** approved by the Decree of the Slovak Government no. 442/2014 of September 10, 2014.
- » **Strategy, Principles and Priorities of the State Environmental Policy** approved by the Decree of the Slovak Government no. 619/1993 of September 7, 1993 and Decree of National Council of the Slovak Republic no 339/1993.
- » **National Strategy for Sustainable Development** approved by the Decree of the Slovak Government no. 978/2001 of October 10, 2001.
- » **Updated Slovak Water Management Plan** approved by the Decree of the Slovak Government no. 6/2016 of January 13, 2016.

3.1.3. Ukraine

- » **Act on the Protection of Natural Environment** of June 25, 1991: The act establishes main principles of environmental protection and use of natural resources, competence of authorities, monitoring and control systems, categories of protected areas, economic tools to be used to protect the environment etc.
- » **Act on Natural Protected Areas of Ukraine** of June 16, 1992 – The act defines categories and regime of natural protected areas in Ukraine, management of protected areas, process
- of establishment of new protected areas, protection measures, types of violation of law on protected areas.
- » **Act on Ecological Network of Ukraine** of June 24, 2004 – The act includes terminology related to ecological network, principles of its development, protection and use, elements of ecological network, management, funding, monitoring and control.
- » **Act on Red Book of Ukraine** of February 7, 2002 – The act establishes a regime of protection of rare and endangered species of fauna and flora in Ukraine, proprietary rights, management bodies, categories of species and process of identification and approval of exemptions related to use of flora and fauna included in the Red Book of Ukraine.
- » **Land Code of Ukraine** of October 25, 2001 – Main legal act, which regulates the use and protection of land in Ukraine.
- » **Water Code of Ukraine**, of June 6, 1995 – Main legal act, which regulates the use and protection of water, including management and protection of all types of natural wetlands in Ukraine.
- » **Forest Code of Ukraine** of January 21, 1994 – Main legal act on forests in Ukraine, which establishes the principles of forest policy, forest management and protection, categories of forest, proprietary rights, regime of general and specific use of forest, forest monitoring and certification, control, etc.
- » **Act on Air Protection** of October 16, 1992 – The act establishes main principles of air protection in Ukraine.
- » **Act on Fauna** of December 13, 2001 – The act establishes main principles of use and protection of fauna in Ukraine, protection of habitats, reproduction sites and migration routes, and the need to respect these issues in the EIA processes.

3.2 Legislation on transport infrastructure

3.2.1. Hungary

Hungary does not have specific national project appraisal in relation to linear infrastructure but rather follow the EU frameworks and directives. In the past five years, the Hungarian government has amended the regulation on preparation of building linear infrastructure. Basic laws related to infrastructure development, which are, among others, taken into account during infrastructure development are **the 314/2005 Government Regulation, which is equal to the EIA Directive as well as the 275/2004 Government Regulation which is equal to the Birds and Habitat Directive**. The Hungarian EIA is very strict in terms of that of what is to be investigated and what is to be included in the documentation that is to be submitted. **Another one is the Government Regulation no. 221/2004 on river basin management which implements the Water Framework Directive**. Besides these regulations, many others are taken into account as well, but these are the regulations which are fundamental for the impact assessment. The other regulations regulate the requirements in detail. **284/2007 Government Regulation and 27/2008 KvVm-EüM Joint Ministerial Decision** deals with the details of noise related restrictions; and 306/2010 Government Regulation deals with air pollution. In Hungary, the project appraisals are based on several national as well as on international laws. In EU funded projects, a more detailed study than that of national funded projects is used and the approval of any National Park concerned is compulsory.

The latest regulations related to infrastructure development in Hungary are two Government Resolutions from 2016 describing the future short- and medium-term road developments in Hungary and their implementation until 2022. These form the basis of the future developments in Hungary.

The above-mentioned regulations apply to the pilot area with respect to the implementation of the M30 motorway between Tornyosnémeti and the Slovak state border and M30 motorway between Miskolc and Tornyosnémeti along with the preparation of M34 motorway section between Vásárosnamény and Záhony and the M3 motorway section between Vásárosnamény and Beregdaróc (Ukraine state border) extension to a 2x1 lane motorway.

3.2.2. Slovakia

- » **Act No. 135/1961 Coll., on Road Network** - The Act regulates the construction, use and protection of roads, the rights and obligations of owners and administrators of roads and their users, as well as the competence of the state administration bodies and the state professional supervision authorities in the field of road communications.
- » **Regulation No. 35/1984 Implementing the Act No. 135/1961 Coll. on Road Network**
- » **Act No.8/2009 Coll. on Transit on Land Routes as amended by the most recent legislation** - The law regulates road traffic regulations, rights and obligations of persons regarding to road traffic, the competence of public authorities in the field of road traffic management, vehicle management etc.
- » **Regulation No 9/2009 Coll. Implementing the Act on Road Transit** and on the amendment and supplementation of certain laws, as amended.
- » **Act No. 534/2003 Coll. on the Organization of the State Administration**
- » **Act. No. 513/2009 Coll. on Railroads** and on amendments of some acts: This act establishes for example a type of railroads and rules of their construction and operation; the operation of designated technical devices and permission to perform defined activities; the operation of railway infrastructure and the allocation of its capacity; the scope of the State Administration Authorities in the railroad matters.
- » **Act No. 725/2004 Coll. on Railways and on Operating Conditions for Vehicles in Road Traffic** and on Amendment of Certain Laws, as amended.
- » **Act No. 56/2012 Coll. on Road Transport**, as amended.
- » **Act No. 461/2007 Coll. on the Use of Recording Equipment in Road Transport**

Relevant strategic documents:

- » Strategic Transport Development Plan of the Slovak Republic up to 2030 - Phase II /SEA
- » Strategic Development Plan for Transport Infrastructure in the Slovak Republic to 2020 (Phase I) SEA Strategic plan for Development and Maintenance of second and third-class roads/SEA

Strategic Transport Development Plan: It is a long-term strategic document that guides effective development of the transport sector and determines the implementation of its development vision. Funding of development activities from EU funds depends on these documents.

3.2.3. Ukraine

- » **Act on Regulation of Urban Planning** of February 17, 2011 – The act includes terminology, principles of spatial planning, management, area development planning at different levels, public participation, monitoring and recording, permitting and documentation, obligatory conditions and limits, categories of buildings, expertise procedure, control and liability.
- » **Act on Transport** of November 10, 1994 – The act regulates the management of transport in Ukraine, including regime of lands of transport, safety measures and control system.
- » **Act on Road Traffic** of June 30, 1993 – The act establishes the system road traffic management, requirements and conditions applied to different types of roads, basic traffic rules, environmental protection measures and control.
- » **Act on Motor Roads** of September 8, 2005 – The act contains terminology, classification of roads and their regime, competence of authorities, management and funding of road infrastructure, obligatory measures of environmental protection.
- » **Act on Rail Transport** of July 4, 1997 – The act includes railway terminology, management system of railways in Ukraine, regulation on regime of lands of rail transport, principles of operation of railways in emergency situations.

3.3 Legislation on spatial planning

3.3.1. Hungary

There are 7 levels of competency related to spatial planning in Hungary: European level, national level (Hungary), regional level, priority areas, districts, and settlements. The Parliament, the Government, the National Forum of Regional Development, the Minister and other Ministers, the County Government, the Regional Development Consultation Forum, the County Development Consultation Forum, the Regional Development Agency, the regional administrative bodies, and the local residents are involved in developing the spatial plans. Land use plans have to be reviewed every 10 years. Public comments are allowed in the planning processes. The main aim of spatial planning is to ensure that the content is modified in a way that the plans ensure the feasibility of green infrastructure development with an emphasis on ecological corridors through the additional supervision of national spatial planning strategies (OTRT, Országos Területrendezési Terv).

- » **Act LXXVIII of 1997 on the Development and Protection of the Built-up Environment** – The main aim of this act is to ensure the rational use of built-up areas in order to safeguard the protection of natural environment.
- » **Act of 1996. XXI. on Regional Development and Land use Planning** – The main purpose of this act is to establish fundamental objectives and rules for land use planning and regional development. The aim of regional development is to ensure the promotion of social market in all regions of the country to enable conditions for sustainable development.
- » **Act of 2003. XXVI. on National Spatial Management Plan** – The act determines the processes of land use planning and defines land use categories.
- » **Governmental decree 77/2010. (III. 25.) – Decree on Spatial Planning Permissions and the Appointment of Inspectoral Authorities over Spatial Management Activities**
- » **37/2010. (II. 26.) Decree on Spatial Monitoring System**

3.3.2. Slovakia

- » **Act No. 50/76 Coll. Law on Territorial Planning and Building Code** – The law defines principles, procedures, documentation and other issues dealing with land-use. This is the basic land-use act. Basic land-use documentation includes the Spatial Development Perspective of the Slovak Republic, the Land-use Plan of the Region and the Land-use Plan of Municipality.
- » **Act No. 539/2008 on Regional Development Support** – The act sets a framework for spatial development focused on social and economic development and its planning. The act defines the following documentation on regional development at all levels:
 - » National regional development strategy,
 - » Program of social and economic development of the region,
 - » Program of social and economic development of a group of municipalities,
 - » Program of social and economic development of a municipality.
- » **Act No. 369/90 Coll. on Municipalities** – The act defines responsibilities for planning and land and environment management. It does not define responsibilities for sustainable land-use.
- » **Act No. 221/96 Coll. on Territorial and Administrative Division of the SR and Act No. 222/96 Coll.**
- » **Act on Organisation of Local Self-Government** - Division of responsibilities for land-use and environment, regeneration processes including.
- » **Act No. 330/91 Coll. on Land Consolidation** – The act defines readjustment and rearrangement of land and its ownership.
- » **Act No. 220/04 Coll. on Protection and Use of Agricultural Land.** The act sets the principles of agricultural land use. **Directive of the Ministry of Agriculture of the SR on Implementation of the Decree No. 12/09 on Forest Land Protection in the Territorial Planning and its amendment by the Act 219/2008 Coll.** The directive defines procedure and precondition for a change in forest land use.

Legally binding documents (overall binding or binding for public sector):

- » **Spatial Development Perspective of the Slovak Republic** – The document setting conceptual framework for spatial development at national level by defining basic principles for urban development.

- » **Regional Land-use Plan** - Mid-term up to long-term comprehensive spatial planning document at regional level focused on functional spatial organisation.
- » **Municipal Land-use Plan** – Mid-term up to long-term comprehensive planning document focused on optimisation of functional and structural elements' and systems' organisation at municipality level.
- » **Program of Social and Economic Development of the Region** – Short term up to mid-term planning and programming document of comprehensive social, economic and environmental development of the region.
- » **National Regional Development Strategy** – The document on comprehensive social, economic and environmental development at national level.
- » **Program of Social and Economic Development of Group of Municipalities** – Short term up to mid-term planning and programming document of comprehensive social, economic and environmental development of the group of communes based on their agreement to procure the program jointly.
- » **Program of Social and Economic Development of Municipality** – Short term up to mid-term planning and programming document of comprehensive social, economic and environmental development of municipality.
- » **Landscape – Ecological Plan within the Regional and Municipal Plan** – Landscape Ecological Plan is the document elaborated as part of the procurement of land-use plans at regional and municipal level with the focus on landscape ecologic analyses, assessment and optimisation of functional use in the harmony with landscape ecologic potentials and limits for the development. Landscape ecologic plan is a legal although not binding instrument legally embedded into the spatial planning system as integrative instrument across all aspects of landscape protection and development from the viewpoint of landscape ecology. Landscape ecologic plans are obligatory documents elaborated at the local, regional and state level as a background documents for the elaboration of municipal master plans, regional development plans or national spatial development perspective.

Informal, supporting documents:

- » **Cadastre/Land and Property Register/Land Registry – Cadastre/Land and Property Register:** Land Registry is a public list, which contains a set of data on real property matters containing their list, description, legal

functional use, their geometric and positional determination and registration rights to such property.

- » **Act. No. 275/2006 Coll. on Information Systems of Public Administration as amended** contains information on unutilised plots.
- » **USES** – The documentation on territorial systems of ecologic stability are the documents mapping and proposing functional territorial systems of ecologic stability including the bio-centres, bio-corridors, buffer zones and other elements across different levels of territorial development plans (local, regional, national level) with the aim to protect and support important services of the ecosystems. Territorial systems of ecologic stability identified in their specific documentation are reflected in the territorial development plans – master plans, regional development plans and national spatial development perspective.

3.3.3. Ukraine

- » **Act on Regulation of Urban Planning** of February 17, 2011: The law includes terminology, principles of planning of sites development, management, planning of development of areas at different levels, public participation, monitoring and recording, permitting and documentation, obligatory conditions and limits, categories of buildings, expertise procedure, control and liability.
- » **Act on General Scheme of Planning of Territory of Ukraine** of February 7, 2002: The law establishes main principles of spatial planning in Ukraine, classification of territories, development priorities on certain areas, requirements to development of infrastructure, including establishment of ecological network.
- » **Act on Local Self-Governance in Ukraine** of May 21, 1997: The law defines competence of local self-governance bodies in the sphere of spatial planning.
- » **Act on Local State Administrations** of April 9, 1999: The law defines competence of local self-governance bodies in the sphere of spatial planning.
- » **Act on Protection of Natural Environment** of June 25, 1991: The law establishes main principles of environmental protection and use of natural resources, competence of authorities, monitoring and control systems, categories of protected areas, economic tools to be used to protect the environment etc.
- » **Act on Natural Protected Areas of Ukraine** of June 16, 1992: The law defines categories and regime of natural protected areas in Ukraine, management of protected areas, order of establishment of new protected areas, protection measures, types of violation of law on protected areas.
- » **Act on Ecological Network of Ukraine** of June 24, 2004: The law includes terminology related to ecological network, principles of its formation, protection and use, elements of ecological network, management, funding, monitoring and control.

3.4 EU Directives

3.4.1. EU Directives on Nature Conservation

- » **Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora:** This directive is to ensure the maintenance of biodiversity and forms the cornerstone for the Habitat and Birds directives ensuring the protection of Natura 2000 sites.
- » **Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on**

the conservation of wild birds: This is the more commonly known Birds Directive adopted by European Union in 2009. The main aim of this directive is to ensure the protection of all the European wild birds and their habitats especially through the formation of the Special Protected Areas (SPA).

- » **EU Biodiversity Strategy 2020:** In May 2011, the EU adopted an ambitious new strategy setting out 6 targets and 20 actions to halt the loss of biodiversity and ecosystem services in the EU by 2020 and to restore them as far as possible and to step up EU's contribution to the prevention of global biodiversity loss.

3.4.2 EU Directives related to transport

- » **Decision No 1692/96/EC of the European Parliament and of the Council on Community guidelines for the development of the trans-European transport network.**
- » **Decision No 884/2004/EC of the European Parliament and of the Council amending.**
- » **Decision No 1692/96/EC**, revised in April 2004 - This brought a fundamental change to TEN-T policies, intended to accommodate EU enlargement and consequent changes in traffic flows. In 2017, it was decided that the Trans-European Transport Networks would be extended into Eastern Europe and would include Eastern Partnership member states.

European strategic documents

There are few European documents related to transport. They include:

- » **Transport White Paper 2011** – Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system, COM (2011) 144 final – The European Commission adopted a roadmap of 40 specific initiatives for the next decade to build a competitive transport system that will increase mobility, remove major barriers in key areas and fuel growth and employment.
- » **European Agreement on main international traffic arteries (AGR)** – Slovakia adopts the proposed international road network “E”. There are 11 routes, which are part of this network in Slovakia: E50, E58, E65, E71, E75, E77, E371, E442, E571, E572, and E575.
- » **Regulation (EU) No 1315/2013: This regulation of the European Parliament and of the Council** of 11 December 2013 on Union guidelines for the development of the trans-European transport network (TEN-T) and repealing Decision No 661/2010/ - Slovakia committed to fulfil obligations arising from this regulation, what means to establish a core network by 2030 and comprehensive network by 2050 at the latest. TEN-T (Trans-European Network of Transport) include road, rail, air and water transport networks and are projected to cover Europe, with the aim to connect national networks, to connect regions with centres and to improve quality and efficiency of transport networks. From the core TEN-T corridors, only the Rhine-Danube corridor crosses the pilot area. It provides the main east-west link across Continental Europe. Tracing its route along the Danube River, it connects Strasbourg and Southern Germany with the Central European cities of Vienna, Bratislava and Budapest, before passing through Bucharest to culminate at the Black Sea port of Constanta. The second branch of the corridor tracks a path from Frankfurt to the Slovakian/Ukrainian border, linking Munich, Prague, Žilina and Košice and this one crosses the pilot area.

4

Stakeholder Analysis



Stakeholders play an important role in the process of transport infrastructure development. This chapter provides an overview of organisa-

tions, institutions and state administration bodies involved in nature conservation, transport infrastructure development and spatial planning.

4.1 Organizations, institutions and state administration bodies involved in nature conservation and their competencies in the pilot area

4.1.1. Hungary

- » **Ministry of Agriculture** – One of the main goals of this ministry is sustainability and management of natural resources. Department of environment and nature conservation is part of this Ministry and is responsible for the preparation of the National Environment Report and National Landscape Strategy.
- » **Hortobágy National Park, Aggtelek National Park and Bükk National Park** – There are three national parks involved in the Hungarian part of the pilot area. The Hortobágy National Park is concerned with the M3 motorway and the Aggtelek National Park and Bükk National Park with the M30 motorway. The National Parks in Hungary are supervised by the Ministry of Agriculture.
- » **Szabolcs-Szatmár-Bereg Natural and Environmental Cultural Value - Management Public Benefit Foundation** – a sector agency responsible for maintaining the natural and cultural values of the Szabolcs-Szatmár-Bereg landscape.
- » **Szabolcs-Szatmár-Bereg County Government Office** (regional)
- » **Borsod-Abaúj-Zemplén County Government Office** (regional)
- » **Kaszonyi-Mountain Nature Reserve** (administrated by Hortobágyi NP)

4.1.2. Slovakia

- » **The Ministry of Environment of the Slovak Republic (MoE SR)** – MoE SR is responsible for providing comments to the Concept of Terrestrial Development of Slovakia and the National Plan of Regional Development of the Slovak Republic in accordance with §9 Section (1) a) and p) of Act No. 543/2002 Coll. on Nature and Landscape Protection as amended by later regulations. MoE SR grants exceptions in the case of territorial protection, e.g. entering with or parking of motor vehicles at a territory with fourth or fifth level of protection (zones A and B of zoned protected areas) in accordance with the §§ 15, 16 of Act No. 543/2002 Coll. on Nature and Landscape Protection as amended by later regulations. MoE SR grants exceptions in case of animal species protection, e. g. for disturbance and damage of habitats of protected animals, especially their dwellings, nests or sites for breeding, acquiring food, resting, moulting or wintering in accordance with § 35 Section (1) c) of the Act No. 543/2002 Coll. on Nature and Landscape Protection as amended by later regulations.
- » **The Slovak Environmental Inspection (SEI)** – SEI is a state supervisory body by which the Ministry of Environment of the Slovak Republic executes the state supervision. It imposes penalties on natural persons, entrepreneurs and other legal persons and informs the MoE SR about it in accordance with the Act no. 543/2002 Coll. on Nature and Landscape

Protection as amended by later regulations. It orders necessary remedial measures in order to eliminate the noted shortcomings.

- » **The State Nature Conservancy of the Slovak Republic (SNC SR)** – SNC SR is an expert organization established by the Ministry of Environment of the Slovak Republic as the statutory organization which covers tasks in the field of nature and landscape protection according to the § 65 a) of Act No. 543/2002 Coll. on Nature and Landscape Protection as amended by later regulations. It prepares expert statements for decision making of the state administration bodies. It consists of headquarters and units, which are the administrations of National Parks (NP) and Protected Landscape Areas (PLA). There are four SNC SR Units involved in this area:
 - » NP Slovak Karst Administration
 - » PLA Cerová vrchovina Administration
 - » PLA Vihorlat Administration
 - » Regional Centre of Nature Protection in Prešov
- » **District Office with regional competences (DORC)** – DORC provides comments during the process of issuing the land use decision and building permit for construction, modification of the construction and maintenance works in areas with fourth and fifth level of protection (zones A and B of zoned protected areas) in accordance with § 9 Section (1) b) and c) of Act No. 543/2002 Coll. on Nature and Landscape Protection as amended by later regulations. In case the construction is planned to be built in an area which belongs to Natura 2000 network, it issues the expert statement related to the importance of impact of plan or project on Natura 2000 site (§ 28 of Act No. 543/2002 Coll. on Nature and Landscape Protection as amended by later regulations).
- » **District Office (DO)** – DO provides comments during the process of issuing the land use decision and of a building permit for construction, modification of the construction and maintenance works in areas with first and second level of protection (zones C and D of zoned protected areas) in accordance with § 9 Section (1) b) and c) of Act No. 543/2002 Coll. on Nature and Landscape Protection as amended by later regulations; DO issues agreements on interventions to natural habitat of European interest or natural habitat of national interest and specifies details of revitalisation measures or financial compensation in accordance with § 6 Section (2) of Act No. 543/2002 Coll. on Nature and Landscape Protection as amended by later regulations.
- » **Municipality** – Municipality gives an approval for tree cutting on non-forest land and defines execution of adequate replacement planting, subsequent care or financial compensation in accordance with § 47 Section (3) of Act No. 543/2002 Coll. on Nature and Landscape Protection as amended by later regulations.

4.1.3. Ukraine

- » **Ministry of Environmental Protection of Ukraine** – It is the central body responsible for environmental protection in Ukraine, including nature conservation, approval of establishment of protected areas, preparation of Red Book of Ukraine (Lists of protected species), management of protected areas (natural reserves, biosphere reserves, national natural parks), EIA and SEA etc.
- » **State Ecologic Inspection of Ukraine** – It is a central control body in the field of environmental protection and use of natural resources in Ukraine. It has its division in every region. It controls all types of activities which affect the environment concerning compliance with environmental legislation. Authorities to fine physical and legal persons for violation of environmental legislation (administrative cases) and file cases of violation of environmental law subject to criminal responsibility to competent authorities.
- » **Department of Ecology and Natural Resources of Zakarpattya region** – It is the regional body responsible for environmental protection, management of protected areas (regional landscape parks), establishment of regional environmental network, EIA.
- » **State Forestry Agency of Ukraine** – Responsible for nature conservation in the forests, which are within its management competencies. Management of protected areas (National Natural Park “Zacharovaniy Kray”) and protected areas of lower level (protected landscapes etc.).
- » **Zakarpattya Regional State Administration** – Responsible for the approval of establishment of protected areas on the lands, which are within its management competencies.
- » **Local self-governance bodies** – Responsible for the approval of establishment of protected areas on the lands, which are within their management competencies.

4.2 Organizations, institutions and state administration bodies involved in transport infrastructure development, management and their competencies in the pilot area

4.2.1. Hungary

- » **National Infrastructure Developing Private Company Limited (NIF)** – It is responsible for the expressways and roads under the Policy of the Ministry of Transport since 2007. It is also the largest Hungarian developer in the core railway network.
- » **Governmental Office of Pest County, Department of Environmental and Nature Protection** (national) – One of the major stakeholders in the area involved in transport infrastructure development, the main permitting authority in the pilot area.
- » **Magyar Közút Nonprofit Zrt** – The organisation is responsible for maintenance as well as operation of national road networks.
- » **Municipal Councils** – Regional roads are managed by local authorities. The municipal councils which concern the pilot area are Gyüre Municipal Council, Vámosatya municipal council, Tiszaszalka municipal council, Gelénes municipal council, Beregdaróc municipal council, and Barabás municipal council.
- » **Hungarian Road Authority Szabolcs-Szatmár-Bereg County and the Hungarian Road Authority Borsod-Abaúj-Zemplén County Directorate**. Within the counties, the main responsible road authorities are the Hungarian Road Authority Borsod-Abaúj-Zemplén County Directorate and Hungarian Road Authority Szabolcs-Szatmár-Bereg County Directorate. The two directorates are responsible for operation and maintenance of road network within their respective area of competency.

4.2.2. Slovakia

- » **Ministry of Transport and Construction of the Slovak Republic - Department of traffic infrastructure (MoTC SR)** – The Ministry is a public

institution, which harbours transport, construction, regional development, post office and telecommunications, public works and tourism agenda. In the area of transport, the Ministry is responsible for transport infrastructure policies related to motorways, expressways and main roads (also called 1st class roads or national roads), railways, airways and waterborne transport infrastructure.

- » **National Motorway Company (NDS)** – NDS is the proprietor and manager of motorways, expressways and roads, and it develops transport infrastructure objectives following the motorway and expressway development plan.
- » **Slovak Road Administration (SSC)** – SSC is an independent organization established by the Ministry of Transport and Construction of the Slovak Republic. Professional activities of SSC include investment preparation and construction of the 1st class roads, administration and maintenance of the 1st class roads, central technical register of roads, determination of routes for abnormal transport, bridge management, traffic engineering, traffic census, road traffic-safety etc. SSC has its regional representation through units deployed under a single name Investment Construction and Management of Roads. One regional representation is also situated in Košice.
- » **Railway Administration of the Slovak Republic (ŽSR)** – The Railway Administration provides transport and transport services that correspond with the interests of the state transport policy. The main-scope activities follow the management and operation of infrastructure, provision of services related to the operation of infrastructure, establishment and operation of railway telecommunication and radio networks etc.
- » **Transport Research Institute (VUD)** – The institute is focused on research in the area of transport. It also works as an advisory institute and offers certification services. The institute also provides an independent expert and service support for the ministries.

- » **Self-Governing Region (SGR) - Department of Transport** - Within its transport competency, the SGR is responsible for administration of 2nd and 3rd class roads. It issues a statement regarding the construction activities on roads owned by SGR. SGR elaborates informative proposals of solutions on how to decrease the number of accidents on roads in SGR's ownership, participates in consultations or public hearings concerning new development plans related to traffic.
- » **Municipal Office - Department of Transport** - The municipality in the area of transport is responsible for planning, preparation and construction as well as for administration of local roads owned by the municipality.
- » **District office with regional competences - Department of Transport** - As the road administration, it executes state administration on the 1st class roads.
- » **District offices - Department of Transport** - As the road administration, it executes state administration on the 2nd and 3rd class roads.

- » **Police - Regional offices - Department of Transport** - In the area of transport, the police organise, coordinate and control the measures focused on safety and traffic flow in the territory of the region. They deal with accidents and collect the information about safety and traffic fluency. They issue statements on building projects, on proposals to use traffic signs, on matters relating to the construction, reconstruction, closure of communications, etc. and allow exceptions to traffic rules. Regional offices in the following cities are relevant to the project area: Banská Bystrica, Prešov, Košice.
- » **Police - District office - Department of Transport** - District office deals with road accidents on all roads except motorways. It watches over safety and traffic fluency on roads (except for motorways), it approves the placement of traffic signs and use of traffic equipment, it issues statements in relation to the construction, reconstruction, closure, obstruction and diversion of roads; monitors and evaluates the traffic safety situation, causes of accidents and participates in the organization of preventive and educational activities focused on road users.

Road administration in the pilot area is summarized according SSC, 2017 in the following table:

County	Motorway and motorway feeder	Expressway and expressway feeder	1 st class road	2 nd class road	3 rd class road
Bansko-bystrický	-	NDS, a.s.: SSÚR NOVÁ BAŇA, SSÚR ZVOLEN	NDS, a.s.: SSÚR ZVOLEN	Self-Government Region (SGR) BANSKÁ BYSTRICA: R-SSC BANSKÁ BYSTRICA, R-SSC LUČENEC, R-SSC RIMAVSKÁ SOBOTA, R-SSC ŽIAR NAD HRONOM	SGR BANSKÁ BYSTRICA: R-SSC BANSKÁ BYSTRICA, R-SSC LUČENEC, R-SSC RIMAVSKÁ SOBOTA, R-SSC ŽIAR NAD HRONOM
		Granvia Operation, a.s.:SSÚR SELENEC	SSC: IVSC BANSKÁ BYSTRICA	Customs office	
Košický	NDS, a.s.: SSÚD PREŠOV	NDS, a.s.: SSÚR KOŠICE	NDS, a.s.: SSÚR KOŠICE	SGR Košice: SC KE SK - SÚ MICHALOVCE, SC KE SK - ROŽŇAVA, SC KE SK - SÚ SPIŠSKÁ NOVÁ VES, SC KE SK - SÚ TREBIŠOV, SC KE SK - SÚ MOLDAVA NAD BODVOU	Magistrate of the city KOŠICE
			SSC: IVSC KOŠICE	Magistrate of the city KOŠICE	SGR Košice: SC KE SK - SÚ MICHALOVCE, SC KE SK - MOLDAVA NAD BODVOU, SC KE SK - ROŽŇAVA,
			Customs office	Customs office	SC KE SK - SÚ SPIŠSKÁ NOVÁ VES, SC KE SK - SÚ TREBIŠOV
			Customs office	Customs office	Customs office

Table 1: Road administration in the pilot area is summarized according SSC, 2012².

²Slovenská správa ciest: Prehľad údajov o sieti cestných komunikácií na území Slovenskej republiky. So stavom siete cestných komunikácií ku dňu 01.01.2017. Slovenská Správa Ciest, Odbor 2100 – Cestná databanka, Bratislava, 94 pp. Online 5.4.2018 – IS MCS © Slovenská správa ciest, www.cdb.sk, 1.12017, Link: http://www.cdb.sk/files/documents/cestna-databanka/vystupy-cdb/2017/kniha_ck_kraj_okres_2017-01-01.pdf

4.2.3. Ukraine

- » **Ministry of Infrastructure of Ukraine** – Central executive body in the field of motor and rail transport and all types transport infrastructure. The Ministry develops policies and legislation, carries out state management of road infrastructure and allocates funds for road infrastructure. It is responsible for road safety at the state level.
- » **State Motor Road Agency of Ukraine** – The Agency is responsible for development and maintenance of motor roads and road infrastructure in Ukraine, road policy implementation, road safety, traffic arrangements, investments in road infrastructure, environmental protection by the roads.

- » **“Ukrazaliznytsya”** – State operator of railways in Ukraine – Responsible for development and maintenance of railroad infrastructure in Ukraine, railroad policy implementation, environmental protection and safety of railways and rail transport, investments.
- » **Motor Road Service in Zakarpattia region** – The Service is responsible for maintenance and development of road infrastructure, traffic safety and environmental impact of roads in Zakarpattia region.
- » **“Zakarpattia Oblavtodor”** – Operator of roads in Zakarpattia region (maintenance, construction works etc.).

4.3 Organizations, institutions and state administration bodies involved in spatial planning and their competencies in the pilot area

4.3.1. Hungary

- » **Secretary of State for Planning Coordination**
- » **State Secretariat for Architectural and Construction Affairs**
- » **Governmental Office of Pest County, Department of Environmental and Nature Protection**
- » **Szabolcs-Szatmar-Bereg County Government Office**
- » **Regional and Rural Development Committee**
- » **Hungarian Road Authority Szabolcs-Szatmár-Bereg County**
- » **Adjacent settlement’s municipal councils**
- » **Lechner Nonprofit Kft. or the Lechner Knowledge Center.** The organization is the representative of electronic construction, urban services and regional planning in Hungary.

4.3.2. Slovakia

- » **Ministry of Transport and Construction of the Slovak Republic** – The Ministry is a public institution, which covers transport, construction, regional development, post office and telecommunications, public works and tourism agendas. In the area of spatial planning, it is responsible for construction and regional development.
- » **Self-Governing Region (SGR) – Department of Spatial Planning** – SGR issues statements on territorial plans of cities and municipalities. In the area of landscape planning, it negotiates, discusses and approves the territorial planning documents of self-governing region and the territorial plans of the regions, and also provides for the issuing of opinions on EIA and SEA. It is also responsible for selected tasks of the middle level of state government Cadastral offices (8 regional offices).
- » **District office – Department of Spatial Planning** – It arranges and approves the planning documentation.

- » **Municipal Offices - Department of Spatial Planning** – Municipalities are self-governmental units and subjects of territorial sovereignty and are responsible for the lowest level of state government (e.g. building offices). A municipality also arranges and approves the planning documentation (territorial plan for municipality and territorial plan for zone).
- » **Regional Development Agency (RDA)** – RDAs are non-governmental agencies supporting spatial development at local and micro-regional level.

4.3.3. Ukraine

- » **Ministry of Infrastructure of Ukraine** – Central executive body in the sphere of motor and rail transport and all types of transport infrastructure. It is responsible for development of all types of transport infrastructure in Ukraine and corresponding spatial planning and development.
- » **Ministry of Regional Development, Construction, Housing and Public Utilities** – The

main executive body that develops and implements the policy related to spatial development and planning, construction, urban planning and development, and construction control.

- » **Ministry of Environmental Protection of Ukraine** – The main executive body responsible for environmental protection in Ukraine, including nature conservation, protected areas, EIA and SEA implementation etc.
- » **Regional State Administration of Zakarpattya** – Responsible for spatial development of the region and managed areas.
- » **State Forestry Agency of Ukraine** – The Agency is responsible for spatial development and planning on the forested lands.
- » **State Agency of Water Resources of Ukraine** – The Agency is responsible for spatial development and planning on lands of waters reservoirs and watercourses.
- » **Local self-governance authorities** – Responsible for spatial planning and development within their administrative boundaries.

4.4 Other stakeholders

4.4.1. Hungary

- » **The Association of Hungarian Conservatives** – It is a community of about 100 environmental organisations, the aim of which is to protect nature and promote sustainable development.
- » **Hungarian Birds and Nature Conservation** – The main aim of this organisation is to contribute to the protection of birds in order to preserve the biodiversity and quality of human life. This is achieved through nature conservation and social partnership.
- » **WWF Hungary** – WWF Hungary is involved in the “EUROLARGE CARNIVORES” project aimed to promote communications between the interest groups dealing with large carnivores including nature conservation, hunters etc.
- » **Gyöngybagoly Protection Foundation** – The

organisation is involved in the conservation of owl species in Hungary.

- » **Bereg Tisza Hunting Association** – The Hunting association deals with hunting issues.
- » **Fishing associations in Budapest and Pest County** (<http://partfal.hu/node/11>)
- » **Hungarian National Hunting Chamber** – The Hungarian Hunting Chamber is responsible for the hunting exams and the hunting licenses. The organisation is based on the XLVI Act of 1997. It represents an interest of both professional and sport hunters. They also contribute to wildlife protection along with management of wildlife and exploitation of hunting rights.
- » **Hungarian Chamber of Engineers**
- » **National Toll Services**
- » **Institute for Transport Sciences Non-profit Ltd.**

4.4.2. Slovakia

- » **Hunters Association in Regions** – Hunters are responsible for the management and monitoring of game population. They are notified by the police in cases of traffic accidents caused by game species. In the pilot area, various hunting associations and NGOs (associated with Slovak Hunting Associations and Slovak Forestry Chamber) operate.
- » **National Forest Centre (NLC)** – NLC is a forestry agency established by the Slovak Ministry of Agriculture and it is responsible for research of forest ecosystems and biodiversity, remote sensing & GIS, forest monitoring.
- » **Owners & land users - Farmers and Entrepreneurs** – Owners and users give permission to activities realized on their land. Farmers can also influence the type of crops cultivated in the fields. Owners and users can play a role by implementing the mitigation measures. Removal or installation of fences, changing cultivated crop etc. can influence the permeability of migration corridors. They also give permission to installing photo traps on their land.

4.4.3. Ukraine

- » **Zakarpattia Regional Department of Forestry and Hunt** – The Department is responsible for protection, reproduction and use of game fauna in the region.
- » **Local and regional NGOs active in the sphere of environmental protection and spatial development** (Ekosfera, FORZA, Karpatski stezhky etc.) – The NGOs are active in environmental protection, development of local, regional and national environmental policy, planning of road infrastructure (especially for purposes of tourism development), and finally cooperation with local communities.
- » **Uzhgorod National University** – The University is a leading educational and research institution in the region. It deals with environmental protection (biology and geography), carries out research on the conditions and perspective development of road infrastructure, ecologic corridors, etc.
- » **Institute of Ecology of the Carpathians** – Located in Lviv, the Institute conducts ecological research in the whole region of the Ukrainian Carpathians, in particular that related to flora, fauna and animals' migration.
- » **Regional associations of hunters and fisheries** – Deal with raising public awareness on conflicting topics related to game, including the need for maintenance of migration corridors and feeding areas.

Status of the road and railway network development in the pilot area



5.1 Existing transport infrastructure

5.1.1. Hungary

The first motorway in Hungary was built in 1964. Since then, there has been an increase in the length of the motorways in Hungary and as of 2000, more than 900 km of motorways had been built. Today, total length of motorways is 1,400 km and total length of roads 32,000 km. Approximately 8,000 km cut through the inhabited areas. There has also been an increase in the number of vehicles in Hungary from around 3 million in 2002 to 3.5 million in 2008. Hungary's central location within Europe and its dense network of roads offer the country a competitive advantage. Hungary has a radial network of roads starting from Budapest and radiating towards the country's boundaries. There are three Core Network Corridors of the TEN-T network. Roads (I.-III. class) will be mentioned only marginally, because the focus of the project is on TEN-T corridors.

The M30 is already under construction. The M3 is in the planning stage (EIA was being prepared in 2018). The current status of the motorways is as follows:

Implementation of:

- » M30 road between Tornyosnémeti and the Slovak state border
- » M30 motorway between Miskolc and Tornyosnémeti

Preparation of:

- » M34 motorway section between Vásárosnamény and Záhony
- » M3 motorway section between Vásárosnamény and Beregdaróc (Ukraine state border) extension to a 2x1 lane motorway

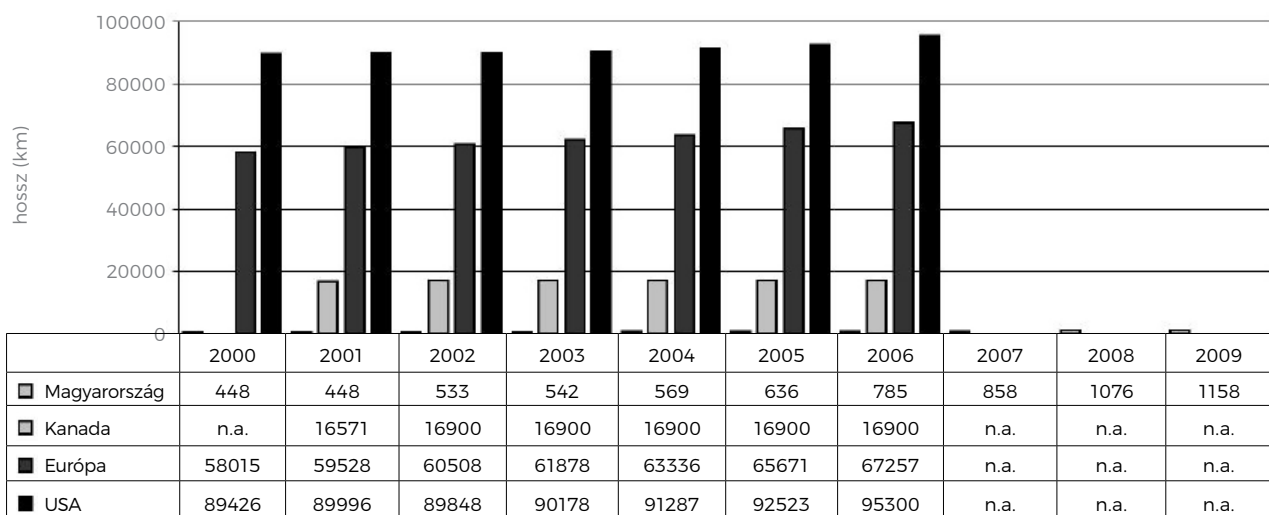


Fig. 5: Length of motorways in Hungary (Magyarország) and Europe (Európa) in kilometers from 2000-2009 (Source: Hungarian Statistical Institution).

81 projects concerning road development (motorways, ways, bridges, environmental impact assessments, road permits, etc.) will be carried out in Hungary by 2022.

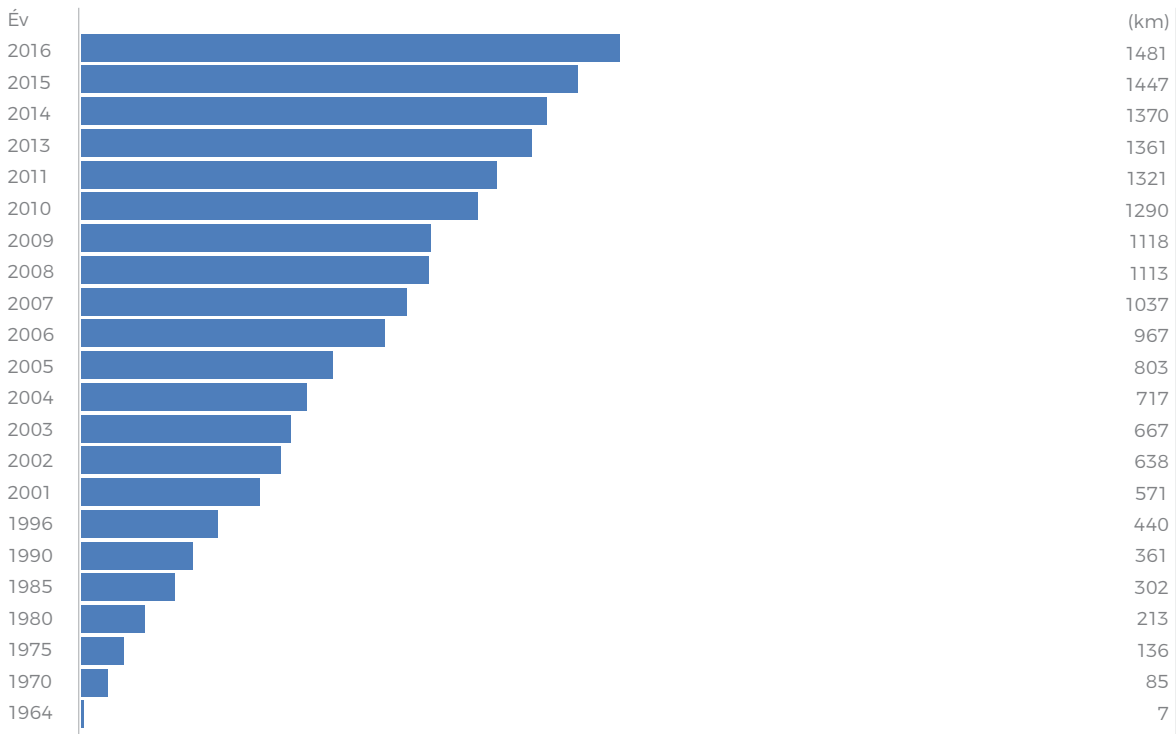


Fig. 6: The length of motorways in Hungary. (Source: Wikipedia).

Railways

Major advancement in railway infrastructure is carried out. Railways are modernised to adapt to higher speed. Railways do cause animal mortality; however, this is not as publicised as in the case of roads and motorways. Overpasses, fences and amphibian passes would be necessary at the railway infrastructure as well. Some mitigation measures have already been implemented, e.g.

power poles are designed in a way that prevents the birds' wings from touching the wire. The newly electrified railway lines contain bird protection measures, usually bird rest places. The only planned construction within the pilot area is an upgrade of the rail from Budapest-Miskolc to the Ukrainian border. This project is supposed to be funded by the "Connecting Europe Facility" (CEF). No construction is anticipated before 2020.

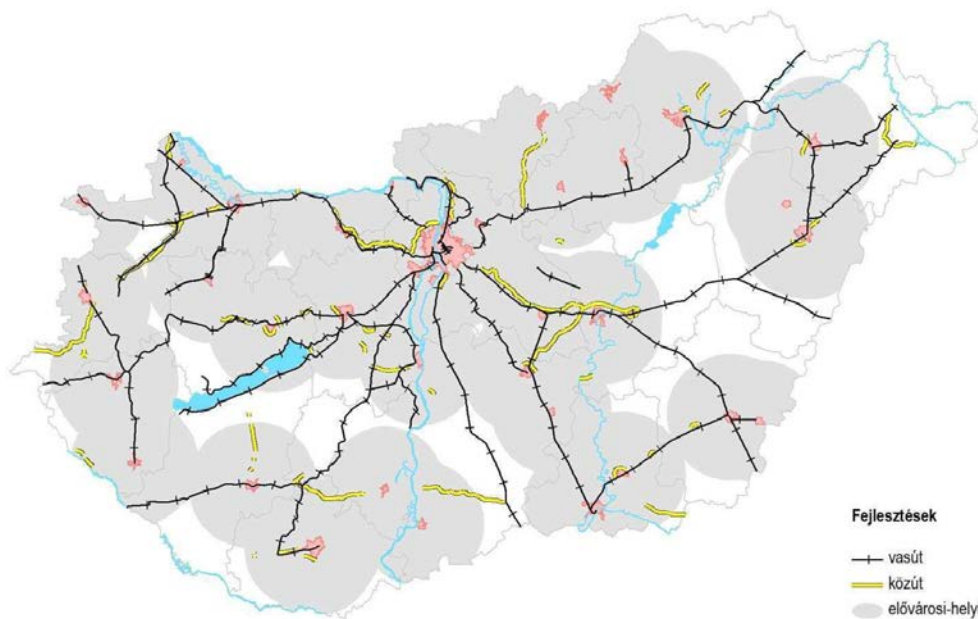


Fig. 7: Railway network in Hungary. Source: NID Ltd.

TEN-T Network in Hungary

There are three Core Network Corridors which cut through Hungary – the Mediterranean Corridor, the Orient/East-Med Corridor and the Rhine-Danube Corridor³.

The Mediterranean Corridor (V. corridor) runs through the Miskolc area in the direction towards Slovakia and Ukraine. The following transport

infrastructure is part of this corridor:

- » Miskolc (highway, railway)
- » Záhonyi (highway, railway, inland waters - Tisza)

There has been a growth in the number of vehicles in Hungary: There were 3 million vehicles in 2002 and 3.5 million in 2008.



Fig. 8: Mitigation measures are so much more important due to ever increasing traffic intensity.



MAGYARORSZÁG ORSZÁGOS KÖZÚTI FORGALMA
Az Országos Közúti Keresztmetszeti Forgalmatszámolás
2015. évi adatainak feldolgozása alapján

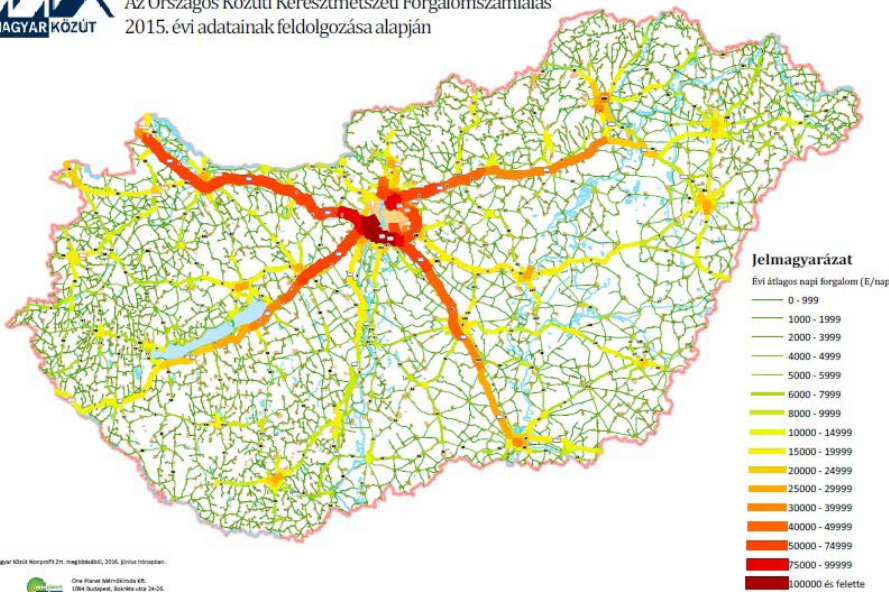


Fig. 9: Traffic intensity in Hungary, yearly average daily traffic. Traffic intensity in the pilot area is not as high as in some other parts of Hungary; currently it is between 5,000-1,000 vehicles per day. Source: Hungarian Public Road.

³ Source: http://ec.europa.eu/transport/themes/infrastructure/index_en.htm

5.1.2. Slovakia

Roads

Total road length in the area is 4,026 km. The 1st class roads cover 698 km, the 2nd class roads cover 752 km and the 3rd class roads, of mainly local significance, cover 2,470 km (Table 1). The motorway covers only 49 km, expressways cover 45 km and expressway feeder covers 13 km. Road density of the Košice Self-Governing Region (SGR), which covers the main part of the pilot area, is 0.353 km of roads per km². For comparison, traffic density rates of other counties and districts are listed in Table 2. According to the census realized by Slovak Road Administration (SSC) in 2015, the highest average daily traffic intensity is in the city of Košice, Prešov and Michalovce (20,000 – 50,000) and decreases a little bit in the surroundings of these cities (10,000 – 20,000). The average daily traffic intensity on the 1st class road I/16 is 5,000 – 10,000.

The busy 1st class road sections I/16 Zvolen-Lučenec-Rožňava-Košice and I/19 Košice-Michalovce-Vyšné Nemecké state borders SK/UA divide the pilot area in west-east direction. These roads make up a part of European transport network (E58, E 571, and E50). There also are several 1st class roads, which lead in north-south direction. The road I/71 connecting Lučenec-Šiatorská bukovinka-state border SK/HU, the road I/72 connecting the cities Rimavská Sobota-Brezno, and the road I/79 connecting Vranov nad Topľou-Trebišov-Slovenské Nové Mesto-Čierna

nad Tisou SK/UA state border. The city Košice is connected with Hungarian border by the road I/17 (in direction of Miskolc) and with the city of Prešov in the north by the road I/20.

Over the last decades, traffic volume on the second-class roads has seriously increased. Many of these roadways were not prepared for a rapid increase in traffic density and are in bad technical conditions. This can worsen security of drivers and affect traffic fluency. Furthermore, many road bridges in this area are also in a low technical standard.

Economic developments of the area lead to an increased number of transported persons and goods, and created a need for development of traffic infrastructure, preferable new motorways and expressways.

Current length of motorways and expressways in the pilot area has been insufficient so far. There are plans to finalize the D1 motorway and R2 and R4 expressways. Up until now there are only few sections of these roads in operation; however, the main part of D1 between Košice and Prešov is built already. R2 is in operation on total length of 40 km (section Zvolen East - Pstruša; bypasses – Ožd'any, Figa, Tornaľa). About half of this length is formed bypasses in half profile, which means that there is one traffic lane for each direction.

In accordance with the agreement made between the Slovak and Hungarian government, new expressway R4 was built between Košice and Milhošť - SK/HU state border. R4 represents part of the European corridor Via Carpatia, which leads from Lithuania to Greece.

District	Motorway	Motorway feeder	Express way	Expressway feeder	1 st class roads	2 nd class roads	3 rd class roads	Together
[km]	[km]	[km]	[km]	[km]	[km]	[km]	[km]	[km]
Banská Bystrica region								
Lučenec					82.696	37.963	218.301	338.960
Poltár						47.929	108.321	156.250
Revúca			7.759		11.785	89.160	127.333	236.037
Rimavská Sobota			10.420		93.543	83.394	324.655	512.012
Košice region								
Košice I				8.056	0.344	16.542	9.414	34.356
Košice II			9.605		1.679	2.620	21.460	35.364
Košice III					5.438		1.356	6.794
Košice IV			2.620	4.258	5.280	6.272	4.475	22.905
Košice - okolie	5.395		14.245	0.387	63.916	105.442	399.265	588.650
Michalovce					48.193	114.607	223.420	386.220
Rožňava					94.819	89.632	138.557	323.008
Sobrance					21.349	29.406	128.704	179.459
Trebišov					98.509	38.768	327.566	464.843
Prešov region								
Prešov	43.501				89.953	34.375	281.400	449.229
Vranov nad Topľou					80.289	55.556	155.687	291.532
Totally	43.501	0	44.649	12.701	615.097	751.666	2469.914	4025.619

Table 1: The length of the roads in the Slovak part of the pilot area. Source: (SCC, 2017).

District [km]	Area [km ²]	Number of inhabitants	Density of road infrastructure	
			km/km ²	km/1000 inh.
Banská Bystrica region				
Lučenec	826	74,401	0.411	4.556
Poltár	476	22,074	0.328	7.078
Revúca	730	40,205	0.323	5.871
Rimavská Sobota	1,471	84,752	0.348	6.041
Košice region				
Košice I	1,535	123,377	0.022	0.278
Košice II	85	67,842	0.414	0.521
Košice III	81	82,479	0.084	0.082
Košice IV	17	29,414	1.361	0.779
Košice - okolie	61	59,729	9.667	9.855
Michalovce	1,019	110,714	0.379	3.488
Rožňava	1,173	62,877	0.275	5.137
Sobrance	538	22,765	0.333	7.883
Trebišov	1,073	105,995	0.433	4.386
Prešov region				
Prešov	934	171,778	0.481	2.615
Vranov nad Topľou	769	80,508	0.379	3.621
Totally	10.788	1138.910	15.238	62.191

Table 2: Traffic density in the Slovak part of the pilot area. Source: SCC, 2017.

Main infrastructure

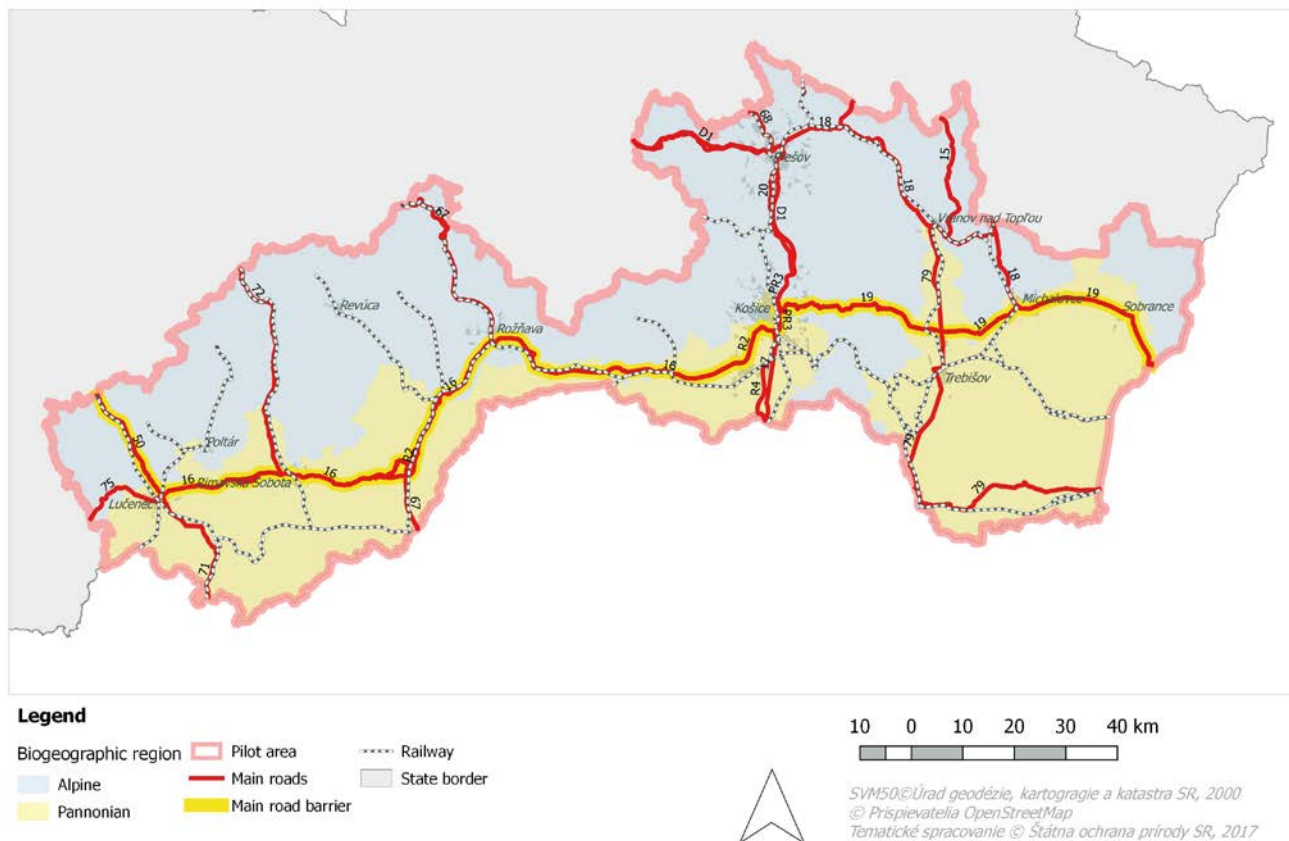


Fig. 10: Main transport infrastructure in the Slovak part of the pilot area.

Railway

Density of railway network in the pilot area is quite high. The use of this type of transport for public as well as cargo has been reduced and the capacity of railway is underestimated. The number of operating lines is decreasing. One of the problems is that lines only have a low speed and wagons are relatively old. Also, lot of railway stations are in a bad condition and modernization of railways is vital.

Railway line crossing the area is one of the key railway tracks in Slovakia. It connects the city of Zvolen, which is an important transport node, with the city of Košice (line No. 160 Košice-Plešivec-Zvolen). Zvolen is a transport node for the direction from Bratislava, the capital. Košice, the biggest city

in the pilot area is the second major railway node in Slovakia. The system of terminals in eastern Slovakia and wide-gauge railway connect the city also with Ukraine and Russia. The track Košice-Trebišov-Michalovce/Čierna nad Tisou (line 190) belongs to one of the most important tracks in the region.

International transport corridors

TEN-T network corridor crosses the pilot area. Total length of roads belonging to TEN-T network within this pilot area is 377 km. The pilot area is crossed by several roads of international importance: Transeuro-pean Transport Network, TEN-T (377 km), International "TEM" routes (200 km) and European International Road Network (376 km). Railway line Košice-Čierna nad Tisou is part of the railway corridor V.a.

District	International "E" roads	International "TEM" routes	"TEN-T" Multimodal and Additional "TEN-T" corridors
[km]	[km]	[km]	[km]
Banská Bystrica			
Lučenec	37.364		37.364
Poltár			
Revúca	8.712		8.712
Rimavská Sobota	36.174		36.174
Košice region			
Košice I	8.4	8.4	8.4
Košice II	10.484		11.284
Košice III	5.438	5.438	5.438
Košice IV	11.633	9.013	11.908
Košice - okolie	68.431	39.823	68.431
Michalovce	27.406	27.406	27.406
Rožňava	50.94		50.94
Sobrance	21.349	21.349	21.349
Trebišov	15.372	15.372	15.372
Prešov region			
Prešov	74.124	74.124	74.228
Vranov nad Topľou			
TOTALLY	375.827	200.925	377.006

Table 3: The length of International transport roads in the pilot area. Source: SCC, 2017.

European International Road Network in the area (the parts cutting through the pilot areas):

- » E50: Prešov-Košice-Michalovce-state border SK/UA, border crossing Vyšné Nemecké;
- » E58: Zvolen-Lučenec-Rožňava-Košice-Michalovce-state border SK/UA, border crossing Vyšné Nemcké;
- » E71: cross. with I/16, I/17 Košice-Staré mesto-Košice stred-state border SK/HU, border crossing Milhošť;
- » E571: Zvolen-Lučenec-Rožňava-cross. with I/16, MK, R4 Košice-old town-Košice-Middle, district Košice 1.

Out of the 7 TEM corridors crossing Slovakia there are 3 which cross the pilot area:

- » TEM 4: Prešov-Košice-Michalovce-Sobrance-state border SK/UA, border crossing Vyšné Nemecké;
- » TEM 6: cross. with I/60, MK, R4 Košice 1-state border SK/HU, border crossing Milhošť;
- » TEM7: cross with I/18, I/20 Prešov-Svidník-state border SK/PL border crossing Vyšný Komárnik.

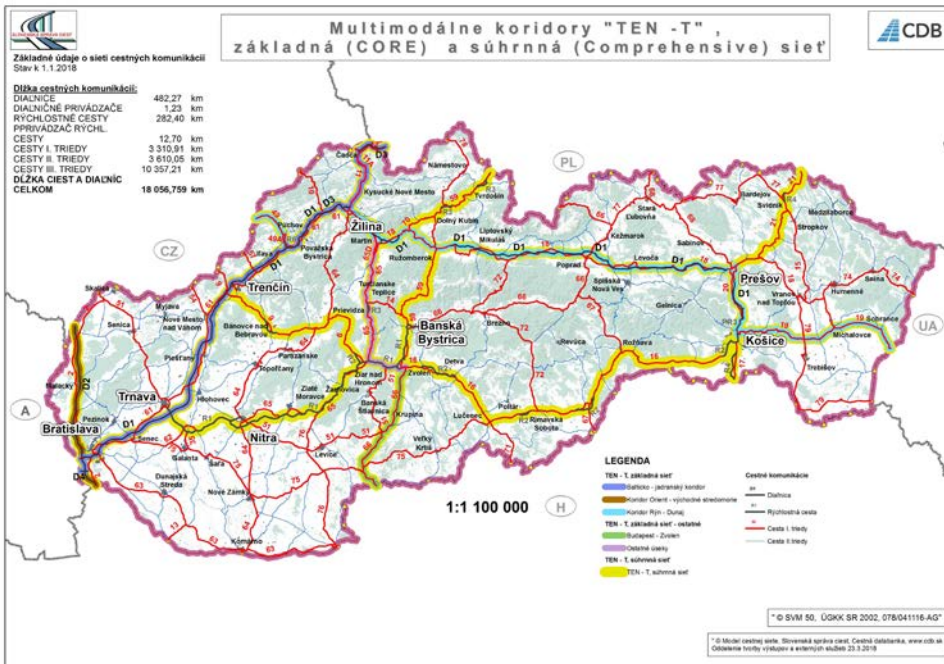


Fig. 11: The international transport corridors TEN-T in Slovakia

5.1.3. Ukraine

Total length of roads in Zakarpattya region is 3,329 km of which 99.7% are paved roads. Average density is 0.26 km/km², but the real density varies essentially. The highest density is on Tisza Plain (0.44 km/km² in Beregove and 0.41 km/km² in Mukacheve districts). Mountain areas have lower road density (0.12 km/km² in Rakhiv region). The roads in the mountain areas are mainly located along the rivers, on their terraces.

There are 1,298 bridges (total length is 23.137 km), including 29 large bridges (length over 100 m) and 157 medium bridges (25-100 m), and 6,112 culverts. Longitudinal directions of the roads in the mountain areas are explained by natural conditions as mountain ridges have altitudinal directions (except eastern part of Ukrainian Carpathians). The main traffic flow is concentrated on the following roads: Kyiv - Chop (I and II category, international), Rogatyn - Mukacheve (II category, national), Sambir - Uzhgorod (II category, national). There are few interregional roads such as Dolyna, Bogorodchany, regional roads such as Vynogradiv - Beregove and local roads. Wide system of forest roads is located mainly in the mountainous part of the region.

The motorways have a speed limit of 110 km/hrs. There are sections with a lower speed limit, these are signposted. In fact, due to inefficient speed control, the fines are not given for exceeding the speed limit of up to 20 km/hrs. Based on this information, higher speed limits (n+20 km/h) must be taken into account for the purpose of eco-network connectivity and road permeability evaluation.

The road capacity is insufficient, especially on the roads of international importance – the roads which are used for international transit and connect Ukraine with countries of Central Europe and Balkans.

M06 Road (Kyiv - Chop) is mainly the 2nd category road, only small parts of it correspond to the 1st category. In Zakarpattya region it is part of E50 transport corridor. Traffic intensity is approximately 22,000 cars per day (near Svalyava). It is the main road which connects Ukraine (as well as Belarus and Russia) with Hungary, Slovakia, Serbia, Croatia, Slovenia, the Czech Republic and Austria. The increase of capacity is planned through the construction of a new highway from Lviv to Chop as, according to the Ministry of Infrastructure of Ukraine, the natural conditions of the existing motorway Kyiv-Chop (mainly geological and hydrologic – the Author) does not allow to reconstruct it to the 1st or higher category.

Main railroads:

- » Lviv - Chop (2 lines) - national and international connections
- » Lviv - Uzhgorod (1 line) - national and international connection (the latter for freight trains only) (Dilove) Rakhiv - Ivano-Frankivsk (1 line) - no international connection (existing line connection to Sigetu-Marmatiei is not operable)
- » Regional railroads (local railroads) connecting Uzhgorod and Solotvyno,
- » Narrow-gauge railroad, connecting Beregove, Irshava and Vynogradiv and further.

Rail traffic intensity is correspondently low with maximum index at Lviv – Chop (potential capacity is 100 trains/day, the real capacity is 5 times less). Local railroads are used for passenger traffic only. Maximum train speed on the railroads is 70 km/h (Lviv- Uzhgorod, Lviv-Chop) and lower on the rest of the railroads. The speed limit is caused by difficult natural conditions in the mountains and bad conditions of local railroads. In the Carpathians the railroads pass through numerous tunnels and bridges which provide good opportunities for ecological connec-

tivity. There are no plans to construct new railroads in Zakarpattya region within the next 5 years.

The capacity of rail is sufficient, especially after the construction of new Beskidskiy Tunnel, which allows for increase in the existing railway traffic by 400%. The weak point of the railway infrastructure is a correspondently low speed limit (caused by conditions of railroad), which is, on average, 70 km/h. Rail traffic intensity on Lviv – Chop railways is approx. 20 trains per day. Rail traffic intensity on the other railroads is much lower.

5.2 Planned transport infrastructure

5.2.1. Hungary

Planned roads (I-III. class), highways (description of different planned variants) and railways; status of their plans implementation (consider plans within next 5 years). Roughly 500 km of new expressways are planned to be built from 2017 until 2022 in Hungary (estimation based on motorway planning map shown in Fig. 12). On the Hungarian side of the pilot area, three motorways are in the planning or already in the construction phase. Currently the focus is on M3 as there is an EIA procedure underway. Three

tracks are in the planning, documents regarding this motorway are under discussion and assessment by the EIA team and by the TRANSGREEN team. (Options for tracks A, B, C; Figure 14). The new motorway would connect Hungary with Ukraine. Currently (2018) the M3 motorway is built up to Vásárosnamény (city in Hungary with 9,325 inhabitants).

The construction works for M30 (Miskolc-Tornyosnémeti) motorway are ongoing; the motorway M3 prolongation is currently (2018) under the EIA process. Motorway M34 connecting Vásárosnamény and Záhony is also in the planning phase.

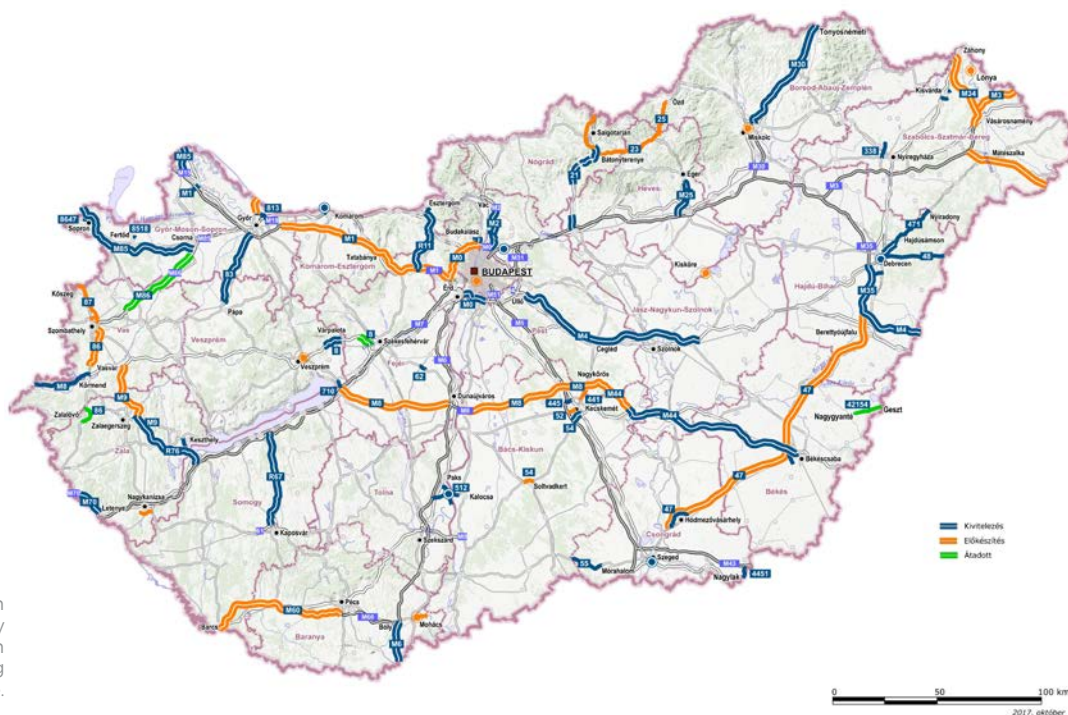


Fig.12: Roads to be built in the near future in Hungary (by 2022). Blue: construction phase; Orange: Planning phase; Green: Finished phase. Source: NID Ltd.

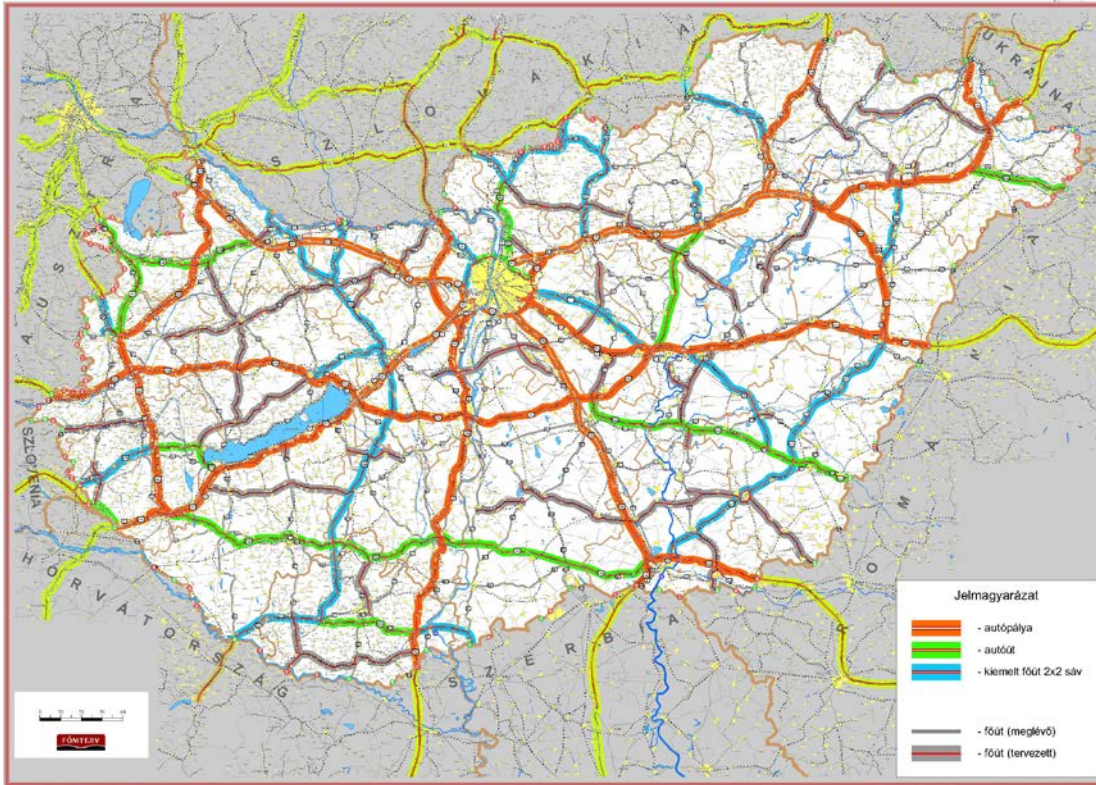


Fig. 13: Long-term bigger capacity road plans in Hungary. This shows what the country is planned to look like regarding bigger capacity roads. Red: motorway; Green: II. class road; Blue: important main road (2x2lane); Narrow Grey: main road (existing). Source: NID Ltd.

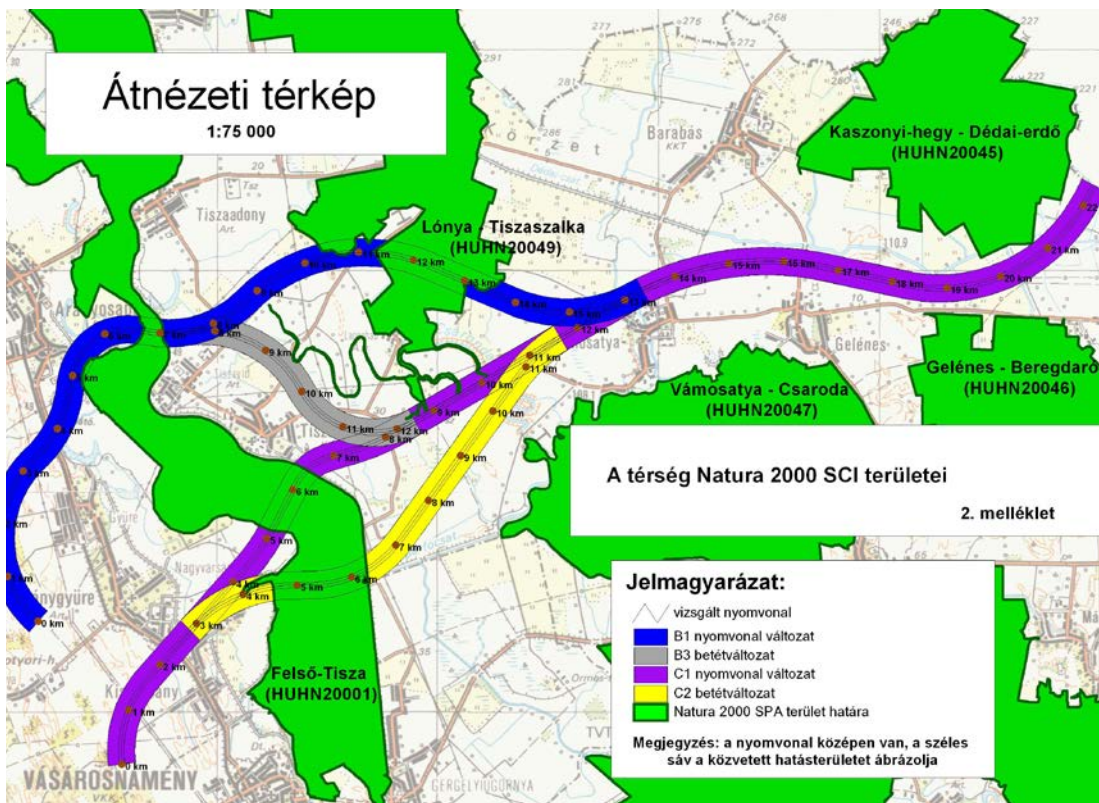


Fig. 14: Planned possible tracks of M3 motorway prolongation in Hungary. The Natura 2000 areas crossed by the suggested tracks are also shown. Currently TRANSGREEN is contributing to give recommendations on the planning of this motorway. Source: NID Ltd.

5.2.2. Slovakia

Motorways and expressways

Only few sections of motorways and expressways in the area have already been built. Other sections are in different stages of planning and preparation (Table 4). Their construction is one of the strategic goals of each Self-Governing Region.

One of the most important plans is to build a new R2 expressway along the existing 1st class road I/16, capacity of which is already insufficient. The total length of R2 road between Zvolen and Košice should be 230 km; so far only 40 km have been built. Few sections are in a very advanced stage of preparation (status of progress is shown in Table 4). Its planning and construction process is divided into several sections; those relevant for the pilot area are as follows:

- » Bypass Ožďany – 6.1 km long, functioning at the moment, will be even more enlarged.
- » Bátka-Figa – 6.18 km, to be built yet.
- » Figa-Tornaľa – 14 km, built already.
- » Tornaľa-Gombasek – 18 km, to be built yet in 2020, maybe 2023. There will be 15 bridges and

one resting area. There was an EIA Final Record already issued in 2016, which confirmed the tunnel Plešivec with length of 1,385 metres. This section of the road is in the process of preparation of documentation for land decision.

- » Šaca-Košické Olšany – 24 km long section will be part of Košice bypass, construction should take place during the years 2018 - 2021. There will be 15 bridges. EIA Final Record dated in 2014 confirmed its construction in the violet alternative. This section is in the process of elaborating documentation for a building permit.

In regard to D1 motorway, the section Budimír-Bidovce is currently under construction and it will function as a bypass of the city of Košice. It will improve the connection between Košice and Eastern Slovakia and Hungary.

The section D1 Košice - Michalovce and Uzhgorod (along the current road I/19) is currently under planning. This connection will be important for transit of goods in east-to-west direction. At present, it is only the D1 Košice-Bidovce section in operation. The priority now will be focused on building the section Bidovce-Dargov-Pozdišovce, near the city of Michalovce. The section Michalovce-SK/UA state border will be realized later on.

Motorway D1:

- » Bidovce – Dargov (12.60 km): EIA process
- » Dargov – Pozdišovce (18.18 km): EIA process
- » Pozdišovce – Michalovce (12.05 km): EIA process
- » Michalovce – Sobrance (15.81 km): EIA process
- » Sobrance – state border SK/UA (15.48 km): EIA process

Expressway R2

- » Mýtna – Lovinobaňa (13.50 km): Tender on construction contractor
- » Kriváň – Mýtna (9.15 km): Process of documentation for building permission
- » Lovinobaňa – Ožďany (20.74 km): Process of land-use proceedings
- » Ožďany – Zacharovce (10.56 km): Process of land-use proceedings
- » Zacharovce – Bátka (8.32 km): Process of documentation for building permission
- » Bátka – Figa (6.18 km): Process of documentation for building permission
- » Tornaľa – Gombasek (18.00 km): Process of documentation for land use decision
- » Gombasek – Rožňava (9.80 km): Process of documentation for land use decision
- » Rožňava – Jablonov nad Turňou (14.10 km): Process of documentation for building permission
- » Jablonov nad Turňou – Včeláre (7.80 km): Process of documentation for land use decision
- » Včeláre – Moldava nad Bodvou (14.00 km): Process of documentation for land use decision
- » Moldava nad Bodvou – Košice, Šaca (18.00 km): Process of documentation for land use decision
- » Košice, Šaca – Košické Olšany (21.25 km): Process of documentation for building permission

Expressway R4

- » Prešov, severný obchvat, I. etapa (4.30 km): Tender on construction contractor
- » Kuková – Lipníky (8.00 km): EIA process
- » Lipníky – Kapušany (4.00 km): EIA process
- » Prešov, severný obchvat, II. phase (10.20 km): MPV process

Expressway R7

- » Veľký Krtíš – Lučenec (32.80 km): EIA process

Table 4: The current state of construction preparation of motorways and expressways related to the pilot area. Source: NDS 2/2018.

International Corridors and other roads

The priority for next years is to construct a new superior road infrastructure, finish and improve a quality of TEN-T motorways and expressways, and improve accessibility of less developed regions through connecting them to TEN-T network and to the 1st class roads. The 2nd class roads, and in relevant cases also the 3rd class roads, should be reconstructed, modernized and built up. First of all, lower category roads which connect a region to the international road network should be repaired.

Railways

The next development of railway infrastructure will be focused on setting the minimum standard for railway lines and on modernization. In the pilot area, one of the plans is the electrification and modernization of lines which connect the capitals of the region with main corridors: Zvolen-Fil'akovo (up to Haniska pri Košiciach in the region of Košice).

mountains with difficult road construction conditions and lack of possibilities to upgrade the existing road. A highway through the Carpathians is announced without specifications as for its location. Currently, a pre-feasibility study is being carried out. The project is under question due to a serious lack of funds even for rehabilitation and maintenance of the existing road network.

There are no plans to construct new railroads in Zakarpattya region within the next 5 years.

5.2.3. Ukraine

Due to the lack of funds for road infrastructure, Ukraine is planning to develop road infrastructure in Zakarpattya, while only including the following:

- » Mukacheve – Beregove – Luzhanka (a border crossing between Ukraine and Hungary). According to the actual plans of the State Road Service of Ukraine, the reconstruction consists of two parts:
 - » Reconstruction of the existing road (II. category) between Mukacheve and Beregove. The reconstruction includes plans to repair, renew and reconstruct the existing road, which does not include any essential change in road parameters.
- » Construction of Beregove bypass. Total length 14.8 km. A new road to be constructed on the territory, which is used mainly for agriculture and has only top soil-road network. There will be 2 bridges and 2 viaducts on the road in the vicinity of Beregove.
- » The construction of this section faces serious obstacles due to the need to buy private agricultural plots and reluctance of landlords, and possible manipulation with the land documentation. Land rights arrangements can delay construction by 1-2 years.
- » Lviv – Mukacheve. There are plans to construct a new highway between Lviv and Mukachevo as the existing M-06 road passes through

6

Overview of protected areas within the pilot area



There are several protected areas within the pilot area. Some of them are protected at national level, some as Natura 2000 sites and Ramsar sites.

6.1 Overview of protected areas at national level

6.1.1. Hungary

The Hernád-valley

Total drainage area of the Hungarian part of the River Hernád (1,136 km²) belongs to the Aggtelek National Park. The Aggtelek National Park is situated in the Gömör-Torna Karst region, rich in natural and cultural assets. This was the fourth national park in Hungary (founded in 1985), but the first national park to be dedicated to the protection of abiotic values, superficial land formations and caves. The subterranean natural treasures, namely the caves of the Aggtelek Karst and the Slovak Karst were inscribed on the UNESCO World Heritage List in 1995.

The River Hernád (Slovak: Hornád) flows in from the eastern Slovakia to the north-east of Hungary. The whole drainage area of the river is 5,436 km². The River Hernád is the biggest tributary of the River Sajó (Slovak: Slaná). It springs under the Kráľova hoľa Hill (Hungarian: Király-hegy) at an altitude of 1,050 meters. It is located to the south of the Low Tatra (Nízke Tatry-Alacsony Tátra) mountains. The River Hernád is 286 km long, with 178 km located in Slovakia, and the remaining 118 km in Hungary. Spišská Nová Ves and Košice are Slovak cities located along the course of the river.

The River Hernád flows into the River Sajó southeast of Miskolc. There is a series of six separate limestone rocky cliffs and steep slopes along the river, which collectively make up the Site of Community Importance 'Hornádske vápence'. The River Hernád is attractive for both tourists and fishermen. It flows through the Slovenský raj National Park, where it creates a canyon called the Hornád Canyon. At the confluence of the River Hernád with the River Hnilec, the dam Ružín was built. After the dam it continues eastward through Veľká and Malá Lodina and underneath the beautiful sights from

Jánošíkova bastion. It turns in a southward direction near Kysak, flows through Košice, Nižná Myšľa, and Ždaňa. Its journey through Slovak territory ends in beautiful meanders close to the village of Trstené pri Hornáde. The Hungarian section of the River Hernád is influenced by dams and three hydropower stations (Felsődobosza, Gibárt, Kesznyéten). The river valley leads to the floodplain forest, grasslands and agriculture fields. After the 10 km long Hungarian-Slovak bordering river section, the River Hernád gains character of a lowland river. The valley of the River Hernád and Sajó are very important ecological corridors between the Carpathians and the Great Plain (Alföld) region. The main areas of Borsod-Abaúj-Zemplén County are protected under the Bükk National Park Directive and the Aggtelek National Park Directive.

Szatmár-Bereg Plain Landscape Protection Area

The Szatmár-Bereg Plain Landscape Protection Area belongs to the Hortobágy National Park. This was the first national park in Hungary and was founded in 1973. The Szatmár-Bereg Plain Landscape Protection Area was established by the National Environment and Nature Protection Office in 1982 which was operating as the top organization of nature protection of that time. The aim of preservation is "... to protect and maintain the protected plant and animal species, natural plant communities, the specific scenic characteristic features, the landforms, surface waters, grasses and different agricultural areas, forests, alleys determine the external character of the landscape in the region of the land protected area". Among all the regions of the Great Plain of Hungary, Szatmár and Bereg are the ones that have mostly preserved the former character of the land. The most natural,

scenic and cultural historical values can be found in this area. Together with some other co-institutions, the aim of nature protection is to preserve these values and salvage these and ensure its continuity to the future. The Landscape Protected Area is situated in the outskirts of 37 settlements. Its area is 22,246 hectares of which 2,307 hectares is protected to a greater extent. This protected area is nearly equally distributed between Szatmár- and Bereg-plain. The Landscape Protected Area (LPA) is structured in a mosaic way. According to the original plans, the area of the LPA would almost have been twice as large as the present one but unfortunately the former trade policy did not make it possible. The arrangements of enlarging the protected area started in 1999, so a further 25,000 hectares of the area would get the deserved and strongly justified protection.

Currently the percentage distribution by the use of the land for the protected area is as follows:

- Field lands (31%), grasses (35%), forests (24%), partitioned (marshlands, streams, drains, ditches, farms, roads, borrow areas, etc., 9%) - the remaining 1% are vine-lands, gardens, orchards, reeds and fish-ponds. 24% of the protected area (about 5,100 hectares) is state property, the remaining part is co-operative and private property. The trustees possessing the largest area of the territory owned by the Hungarian State are the Nyírerdő joint stock company (2,900 hectares), Upper-Tisza Water Conservancy (1,066 hectares), and the Hortobágy National Park Management (751 hectares). The nature protection trustee of the LPA is the Hortobágy National Park Management. Besides the leader of the landscape protected area, there are two reservation guards protecting and taking care of the area. The vocational guidance of this activity is done by the inspectors of the national park in close co-operation with the most famous research institutions of the country. The centre of Szatmár-Bereg Landscape Protected area is situated in Fehérgyarmat⁴.

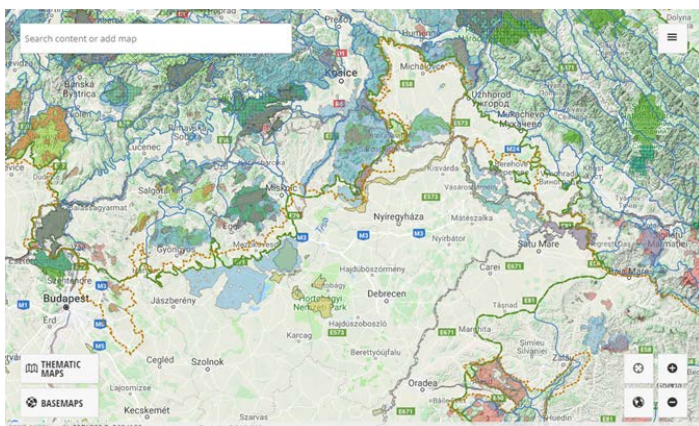


Fig. 15: Protected areas in the pilot area. CCIBIS, www.ccibis.org.

⁴ Source: <http://www.hnp.hu/en/szervezeti-egyseg/conservation/oldal/szatmar--bereg-plain-landscape-protection-area>

6.1.2. Slovakia

There are three large-scale protected areas in the pilot area: PLA Cerová vrchovina, PLA Vihorlat, NP Slovenský kras and 225 small-scale protected areas, covering 134,238 ha, which is 12% of the pilot area. These include 30 Protected Sites, 76 Nature Reserves, 51 National Nature Reserves, 28 Natural Monuments and 22 National Nature Monument. The main part of the area is administrated by NP Slovak karst, PLA Cerová vrchovina, Regional Centre of Nature Protection in Prešov and PLA Vihorlat. In the area of their competency there are the following numbers of small-protected areas:

- » Protected sites 22 (Cerová vrchovina 12, Slovak karst 2, Prešov 6, Vihorlat 2)
- » Nature Reserves 53 (Cerová vrchovina 12, Slovak karst 7, Prešov 21, Vihorlat 13)
- » National Nature Reserves 33 (Cerová vrchovina 4, Slovak karst 10, Prešov 14, Vihorlat 5)
- » Natural Monuments 25 (Cerová vrchovina 10, Slovak karst 3, Prešov 10, Vihorlat 2)
- » National Nature Monument 21 (Cerová vrchovina 2, Slovak karst 18, Prešov 1)

Other small-scale protected areas included only partially are administrated by NP Muránska planina and PLA Latorica.

6.1.3. Ukraine

There are more than 450 protected areas in Zakarpattia region, which cover an area of more than 181,000 hectares. There are 34 protected areas of national importance (almost 159,000 hectares) among them. 13.5 % of the territory of the region is included in different categories of the protected areas.

- » **Carpathian Biosphere Reserve** (53,630 hectares) – Established in 1968 as natural reserve (biosphere reserve since 1992) to protect typical and unique mountain landscapes of the Eastern Carpathians. It consists of 6 separate areas, connected by ecological corridors. 90% of the reserve's territory is covered by forest (mainly beech, spruce, oak, fir), including old-growing and virgin forest. The rest mainly consists of alpine and subalpine meadows, flood meadows, mountain lakes and rivers and streams. There are habitats of 72 protected animal species and 64 protected plant species in the Reserve (Red Book of Ukraine, IUCN Red Lists, Bern Convention etc.).

- » **Zacharovaniy Kray National Natural Park** (6,101 hectares) – Established in 2009 to protect unique and typical ecosystems of the Volcano Ridge and to support the development of tourism in the area. 87,5 % of the territory of the park is covered with forests (beech, oak, spruce), including virgin forests (beech), Chorne bagno bog – the biggest bog of the Carpathians. There are more than 30 protected species of animals in the park (Red Book of Ukraine, IUCN Red Lists etc.).
- » **Synevyr National Natural Park** (42,704 hectares) – Established in 1989 to protect unique mountain forest ecosystems, mountain lakes (Synevyr – Ramsar site) and mountain wetlands and development of tourism. Forests cover 90 % of the territory (spruce, beech, fir) and include large areas of virgin and

old-growing forests. The rest is covered with meadows and wetlands.

- » **Uzhanskiy** (39,159 hectares) – Established in 1999 for protection of virgin and old growing forest ecosystems (beech – fir – sycamore). Includes the UNESCO World Heritage Site Ancient and Primeval Beech Forests of the Carpathians and Other Regions of Europe. There are more than 40 protected species of animals in the park (Red Book of Ukraine, IUCN Red Lists etc.).
- » **Prytysyanskiy Regional Landscape Park** (10,330 hectares) – Established in 2009 to protect unique floodplain forest and swamp ecosystems. More than 20% of fauna species are protected by the national and international legislation.

6.2 Overview of protected areas at international level

6.2.1. Hungary

In the territory of the Szatmár-Bereg Protected Landscape Area there are several NATURA 2000 sites. The whole area of the Natura 2000 sites is 52,759.4 hectares. It is a designated Special Protection Area (SPA) and Important Bird Area (IBA)⁵.

The Felső Tisza (Upper Tisza) region is part of the Ramsar Wetlands. The site is located in North-Eastern Hungary in the floodplain along the river Tisza from the Hungarian - Ukrainian border (744.8 km of river) up to the village of Tiszadada in Szabolcs-Szatmár-Bereg County.

6.2.2. Slovakia

There are 117 SCI/SAC Special Conservation Areas in the whole pilot area and 13 Special Protection Areas (SPA). SCI/SCA cover 91,474 ha, which is 8.5% of the pilot area cover. SPA covers 326,388 ha, which is 30% of the pilot area cover.

Of these, the following are in the competency of LPA Cerová vrchovina, NP Slovak Karst, RCNP Prešov and LPA Vihorlat:

- » SCI: Cerová vrchovina 24, Slovak Karst 30, Prešov 21, Vihorlat 13
- » SPA: Cerová vrchovina 3, Slovak Karst 5, Prešov 4, Vihorlat 4

⁵ Source: <http://www.natura.2000.hu/hu/terkepek/huhn10001>

6.2.3. Ukraine

The following are the protected areas at international level:

- » Carpathian Biosphere Reserve (23,630 hectares)
- » Zacharovaniy Kray National Natural Park (6,101 hectares)
- » Synevyr National Natural Park (42,704 hectares)
- » Uzhanskiy (39,159 hectares)
- » Prytysyanskiy Regional Landscape Park (10,330 hectares)
- » Synyak Regional Landscape Park (4,631 hectares)

There is one Ramsar site, the Lake Synevyr, number 1400 in the List of Wetlands of International Importance. It covers an area of 29 ha with coordinates 48°37'N 23°41'E and is located in the Synevyr National Park.

The following wetland sites proposed include:

- » Ozirniy-Brebenescul (1,656.91 hectares – part of Carpathian Biosphere Reserve) – Rakhiv district
- » Atak-Borzhavske (283.4 hectares – part of Prytysyanskiy Regional Landscape Park) – Beregove and Vynogradiv districts
- » Pechera Druzhba (0.13 hectare – part of Carpathian Biosphere Reserve) – Tyachiv district
- » Chorne Bagno (15 hectares – part of Zacharovaniy Kray National Natural Park) – Irshava district
- » Fornosh reservoir (210 hectares) – Mukacheve district
- » Upper Uzh river (1,054 hectares) Velykiy Berezniiy district

6.3 Biodiversity of the pilot area

6.3.1. Hungary

Biodiversity in the Hernád Valley

The Zempléni-hegység (Zemplén Mountains), together with the Szerencsi-dombság (Szerencs Hills), is one of the most important habitats for large birds of prey. While the extensive forests provide suitable nesting place, the pastures, grasslands along with the cultivated areas on the fringes and the foothills provide an excellent feeding ground for them. In Hungary, one of the largest populations of the imperial eagle (*Aquila heliaca*) is found here, and the largest breeding population of the lesser spotted eagle (*Aquila pomarina*). The golden eagle (*Aquila chrysaetos*) only breeds in Hungary. The black stork (*Ciconia nigra*) also has a significant breeding population. Of the forest species, a large part of the Hungarian population of the Ural owl (*Strix uralensis*) breeds in the Zemplén forests, along with, for instance, a considerable part of the Hungarian population

of the white-backed woodpecker (*Dendrocopos leucotos*). The Hernád-völgyi (Hernád Valley) is partially the habitat as well as the feeding ground of the protected imperial eagle (*Aquila heliaca*). It also acts partly as the feeding ground of some other large birds of prey and is also an important migration route.

The River Hernád and the tributary streams are home to two protected native crayfish (*Astacus astacus*, *Pontastacus leptodactylus*), more than 34 fish species, 15 amphibian and nine reptile species. Large numbers of small mammals serve as a food supply for birds of prey. Several populations of large mammals (*Capreolus capreolus*, *Cervus elaphus*, *Dama dama*, *Sus scrofa*) use the valley as a corridor between the Carpathians and the Great Plain.

Biodiversity in the Szatmár-Bereg Plain Landscape Protection Area (HU-UA pilot area):

The habitat structure and the species composition

could be determined by several components like the soil, the movement of ground-waters and land-use. The Szatmár-Bereg Plain Landscape Protection Area has one of the richest fauna and flora in the Great Plain. The uniqueness of this area is that it comprises a mixture of fauna elements from the lowlands as well as the highlands. This could be because of the neighbouring Carpathian Mountains, the cold and wet microclimate of its forests and marshes and its relatively peaceful habitats. This mosaic landscape is rich in molluscs and insect fauna like the *Drobacia banatica*, the Tisza mayfly (*Palingenia longicauda*), the *Perla bipunctat* and the stag beetle (*Lucanus cervus*).

This landscape has plenty of streams and lakes and used to be rich in several fish species. The zingel (*Zingel zingel*) and the *Zingel streber* live in the river Tisza and can be found along with the striped ruffe (*Gymnocephalus schraetzer*), the barbel (*Barbus barbus*) and the *Barbus carpathicus*. The endemic European mudminnow (*Umbra krameri*), the European weather loach or European weather fish (*Misgurnus fossilis*) and the crucian carp (*Carassius carassius*) are the inhabitants of the marshes and the flatland streams. All species have become very rare, many of them on the IUCN red list, because of the decrease in their habitats and after the spread of the invasive Chinese sleeper or the Amur sleeper (*Percottus glenii*).

Several amphibian species are also present in this region along with a very interesting number of reptile species. The adder lives in hornbeam groves-oak woods (Bockerek-forest, Lónya-forest, Déda-forest) and its foretype (*Vipera berus berus*) occurs here. The Aesculapian snake (*Zamenis longissimus*) can also be found in the plains. The inhabitant of marshes is the viviparous lizard (*Zootoca vivipara*) and a rare presence of the green lizard (*Lacerta viridis*). It is also natural that the presence of the European pond terrapin (*Emy orbicularis*) is rich in these waters. The area is also typical for the presence of diverse avifauna. There are several huge mixed heronries where species such as the grey heron (*Ardea cinerea*), the black-crowned night heron (*Nycticorax nycticorax*) and the little egret (*Egretta garzetta*) are present. Within the floodplain forests along the River Tisza and the forests in the Szatmár-Bereg plain live several protected species of birds like the *Ciconia nigra*, the *Aquila pomarina*, and the *Iduna pallida*. The second largest population of the corncrake (*Crex crex*) in the country lives here and the presence of the quail (*Coturnix coturnix*) populations are also notable.

Among mammals, the European Pine Marten (*Martes martes*) and the Otter (*Lutra lutra*) are also worth mentioning. The Wildcat (*Felis silvestris*) and the Eurasian Badger (*Meles meles*) are also present in the larger forests. In severe winters a few Grey Wolf (*Canis lupus*) individuals wander around here from the mountains. The biggest mammal species of the forest is the Red Deer (*Cervus elaphus*). The Fallow Deer (*Dama dama*) that has colonized the forest in this area is not a native species. The regular game species of this area include the Roe Deer (*Capreolus capreolus*), the Wild Boar (*Sus scrofa*) and the common Red Fox (*Vulpes vulpes*). The Crowded bat colonies live in the bell towers of the churches in the villages and the Beech Marten is also frequent here.

6.3.2. Slovakia

Starting westwards of the pilot area, the main transport infrastructure (road I/16 and the future R2) splits the pilot area in northwest – east direction. A smaller part of this infrastructure is located in the Alpine biogeographic area (19.5 km); a larger part (53 km) is located in the Pannonian biogeographic area. This transport infrastructure (I/16) creates a barrier of various permeability levels for large carnivores (the grey wolf – *Canis lupus*, the Eurasian lynx – *Lynx lynx* and the brown bear – *Ursus arctos*), for smaller carnivores (the wildcat – *Felis silvestris*, the red fox – *Vulpes vulpes*, the European badger – *Meles meles*) and for even-toed ungulates. It also impacts on river ecosystem bound species, such as the Eurasian otter (*Lutra lutra*) and the Eurasian beaver (*Castor fiber*). Collisions with bird species are also frequent, namely with the birds of prey, owls and the passerine species. Transport infrastructure has a special impact on the population of amphibians, especially on the common toad (*Bufo bufo*), the European green toad (*Bufo viridis*), the agile frog (*Rana dalmatina*) and the common frog (*Rana temporaria*). This is especially visible in areas near to water reservoirs of Píla and Ožďany or near to rivers and various types of wetlands.

Safeguarding the area permeability for animal species through the existence of functional bio-corridors would be a case of supra-regional significance. Permeability is a key factor for maintenance and improvement of favourable conservation status of these populations in the south of Slovakia as well as the Hungarian part of the Carpathians (Bükk Mountains, Cserhát, Mátra) and all over in Central Europe.

Map of bioregions

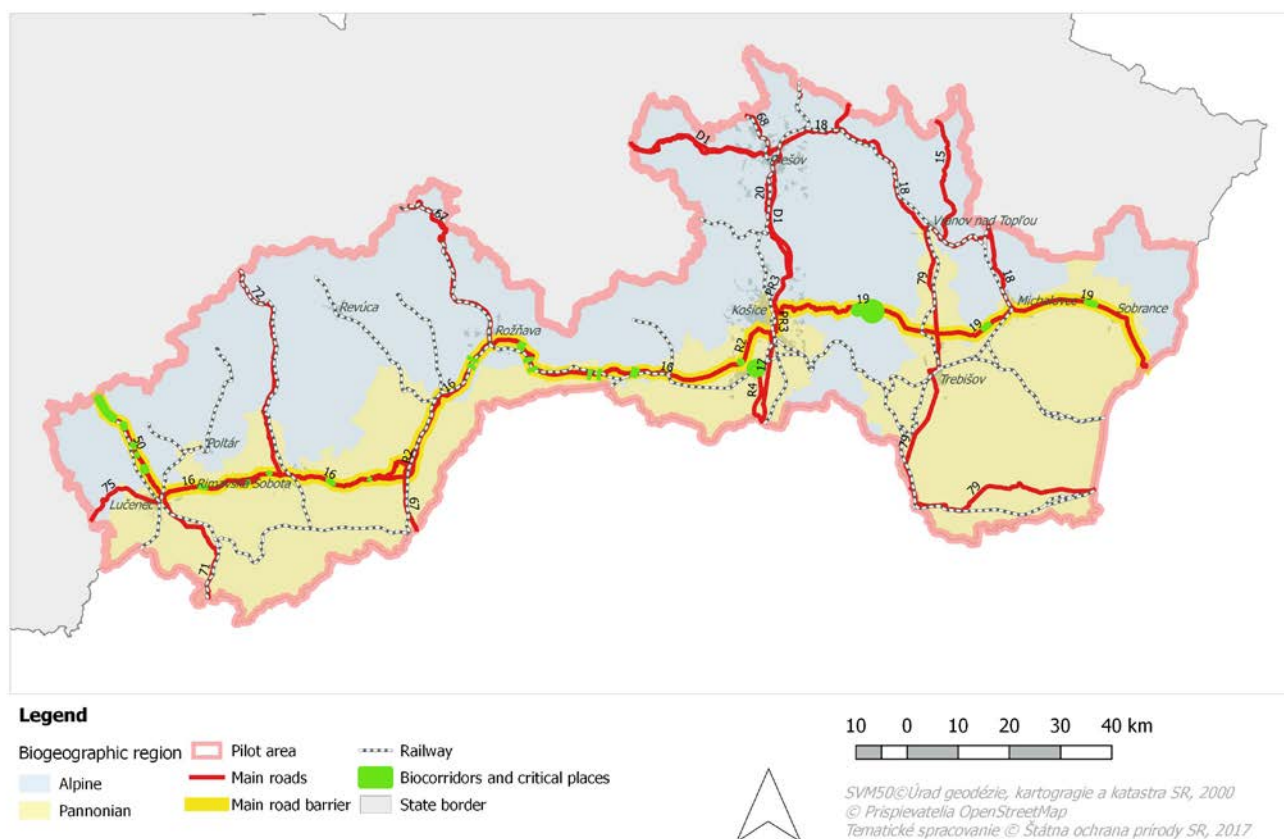


Fig. 16: Map of bioregions in the Slovakian part of the pilot area.

Further to the east, the transport infrastructure splits the pilot area into two in the west - east direction. This division more or less follows the division of this part of the pilot area to the Pannonian and Alpine biogeographic regions. It is a barrier which is variably permeable to both large and small carnivores. Impact on water-bound species such as the Eurasian otter, the Eurasian beaver and the mute swan can be seen. The European roe deer (*Capreolus capreolus*) is a dominant species across the whole area. Collisions with the bird species are frequent in areas near to pond networks (Hrhov, Turňa nad Bodvou). The influence of transport infrastructure can also be seen in areas near to Hrhovské rybníky ponds and near to Turniansky rybník pond, where there are frequent collisions with populations of amphibian species (the common toad, the agile frog and the European tree frog).

The most eastern part of the pilot area lies in the agricultural country with large areas of arable land mixed with grassland areas. Here, as well as in the western parts, the even-toed ungulates and middle range mammals could be seen moving across the roads. Movement of large carnivores was not confirmed in this part of the pilot area as

the foothills of Vihorlat mountains are further up and quite distant from the existing road E50 and the future planned motorway D1.

The proposed D1 motorway Pozdišovce - state border - Ukraine directly cuts through the biocorridors of supra-regional importance of Vihorlat - Senné rybníky fishponds - Kopčianske slanisko salt meadow - Latorický luh alluvial plain and the bio-corridor of Senné rybníky fishponds - Čierna voda - Zemplínska Šírava water reservoir.

There are water bio-corridors in the valleys of larger rivers as well, such as the supra-regional bio-corridor of Ondava, the existence of which is important for transport infrastructure planning due to the maintenance of the waterfowl migration route and resting places at Senné rybníky fishponds and Zemplínska Šírava water reservoir. Another water bio-corridor is a supra-regional bio-corridor of Uh and supra-regional biocenter of Senné. Both alternatives of proposed motorway cut through the regional bio-corridor of Laborec and the regional bio-corridor of RBk Revištia-Bežovce canal. Likewise, there are regional biocentres of Černiny, Močiar pri Kristoch and Tašulský les forest.

6.3.3. Ukraine

The vertebrate fauna of the investigated region is relatively rich. Due to its location, the fauna of this region includes both the Carpathian species and the animals of Mediterranean origin. About 60 mammal species occur here.

However, only for large and medium size mammal species we may evaluate the influence of transport traffic. Actually, the existing road potentially and in reality, may have affected (caused mortality) about 40 mammal species. Majority of them occurring in this area are very rare or only occur occasionally. Large mammals are the most sensitive to the transport infrastructure. Some very rare organisms found here include the red deer (*Cervus elaphus*) and the elk (*Alces alces*). Other mammals are more common and numerous, such as the wild boar (*Sus scrofa*), the roe deer (*Capreolus capreolus*), the badger (*Meles meles*), the red fox (*Vulpes vulpes*), the European hare (*Lepus europaeus*), and the different species of mustelids. Despite their relative rarity, the wild cat (*Felis silvestris*) and the otter (*Lutra lutra*) often become the victim of traffic. We recorded the mortality of the wild cat on the investigated road.

There is interrelation between animal migrations (and mortality caused by collisions automobiles) on the road and location of crops planted around. Mammals such as the wild boar, the roe deer, the European hare, the badger, the red fox etc., use fields (corn and crop fields mainly) as feeding areas. As soon as they need to cross the road, they are subject

to risk of traffic accidents since the traffic intensity is rather high. However, we recorded very low intensity of movement of the animals crossing the road. Abundance of feeding resources explains the fact that animals are of no need to cross the road to get to them. Some spoors of different animals were noted in the forest along the road and between the forest and scrubs and agricultural lands.

Other terrestrial vertebrate species can be affected by road traffic as well. We did not record such collisions in the investigation area during our field works. However, in some other regions of the Carpathians, such collisions have been recorded. According to investigations in other areas, the frequency of such collisions depended on the season and activity of animals.

About 20 bat species occur in the investigated areas. The most dangerous periods for all the bat species are the migrations and the young offspring beginning to fly. Similar situation is with the birds. About 100 bird species were breeding in the vicinity of the investigation plots. Generally, about 130-140 bird species may occur here during different periods of the year. However, small passerine birds seem to be more affected by transport in the investigated areas. During our investigations we noted the rest of different small bird species inhabiting the neighbouring forests and shrubs. There are mainly different species of tits (*Parus*), the white wagtail (*Motacilla alba*), the common chaffinch (*Fringilla coelebs*), and the song thrush (*Turdus philomelos*). According to our investigations, the dynamics of bird mortality is relatively similar to the one of bats.


6.4 Ecosystem services (if relevant) in relation to transport infrastructure

According to the Millennium Ecosystem Assessment (MA) (2003), "ecosystem services are the benefits which people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services, such as nutrient cycling, that maintain the conditions for life on Earth". Certain services are directly derived and related to one particular species, e.g. specific types of medicines or food, whereas other ecosystem services are

obtained from the functioning and healthy ecosystems, such as climate regulation or soil fertility.

These services and the evaluation of them not only help us understand how healthy our environment is, but also contribute to the knowledge of how our society and economy depend on these services and what possible consequences we could face in case we lost them.

To better understand the connection and



inter-linkages of nature, society and economy, an ecosystem services approach built on a participatory methodology involving local citizens has been also used within the TRANSGREEN project. One of the main objectives of the project was to explore the most important local ecosystem services, their actual values, the level of impact among these services due to motorway construction and the potential measures aiming to preserve these services during the motorway construction.

The research was focused on the Vasarosnameny sub region area, where the M3 Vasarosnameny/UA state boarder was in initial stage of its planning. The results of the research were finalised in good time to have a potential impact on the motorway construction. Here, the research elements included a desk research on the sub-region's environment, history, society and current key socio-economic drivers as well as deep interviews with local stakeholders to select the key ecosystem services and a focus group for validating the most important services.

Interviews with the local people reflected the richness of ecosystem services provided by the Nyirseg and Bereg landscape in the Vasarosnameny subregion as more than 20 ecosystem services and benefits were uncovered. Among cultural services, the most important were hunting, recreation provided by the river Tisza (activities including canoeing, rowing, bathing and just enjoying nature), bicycling and wild camping, recreational fishing, the canals of Tisza working as a natural system, the

preserved, rich landscape with various habitats, diversity of species and education provided by the environment. Among the provisioning services, the most crucial were the local fruit and fruit products (such as the traditionally famous pálinka, or jam made from apples or plums), traditional food, game meat and honey, wood fuel and other raw materials (e.g. mud and wood were often used for construction building), water (such as well water, water for agriculture and industry and hot springs especially for tourists). Among the regulating services, the most relevant proved to be fresh air and air quality maintenance, maintenance of habitats and species and pollination. As additional benefits of these services contributing to human wellbeing were deemed important, local identity and cultural heritage should also be emphasised here, because these notions are largely built on the natural environment and the ecosystem services.

To enable a more accurate focus on the research, further selection of the most important ecosystem services was implemented by a focus group of local experts of various backgrounds, who classified and merged certain services and judged that the most important services are the river Tisza with its branches and canals as well as its recreational activities it offers, the mosaic landscape, rich habitats and biodiversity, the so-called "spirit" of the area (which incorporates the cultural heritage, the local identity as well as the traditional landscape, the (eco)tourism and game.



7

Existing planning and strategic documents



7.1 Hungary

The fundamental document of road and railway developments is the National Transport Strategy (issued in 2013). The document determines the transport strategy until 2030 with an outlook until 2050 and with the first phase until 2020. The National Transport Strategy includes:

- » Main road number 37 beginning from the proximity of Miskolc and connecting to Slovak road 79/553 is planned to be developed to a 4-lane road up to the city of Szerencs.
- » A new main road (number 39) is planned between Tiszanagyfalu and Encs.

The Land Use Plan of Borsod-Abaúj-Zemplén County (2009) does include regulations for the ecological corridors. All settlements are listed that have ecological corridors in their area. The Regional Development Plan of Borsod-Abaúj-Zemplén

County (2013) does not include the development of ecological corridors.

The national transport strategy is revised every five years with the last one being done in December 2013. This strategy was enforced on January 1, 2014, and also includes the national ecological corridors. Each county in Hungary has a development strategy and the last strategy document (an 80-page document) for one of the counties, the Szabolcs-Szatmár-Bereg County, was done in 2013. The development strategy includes the motorway infrastructure (M3 motorway). It highlights the fact that without a satisfactory number of exits from the M3 motorway, it will not contribute to reaching faraway decentralised cities and that there is a need to give more importance to sustainable transport. This document also suggests the need for improvement in the level of rail transport.

7.2 Slovakia

The spatial plan of Košice self-governing region was elaborated in 2009 (Regional Spatial Plan Košice (ÚPN – VUC) 2009⁶. It was amended in 2014 and 2017 (Regional Spatial Plan, ÚPN – VUC 2014 – changes and amendments <https://web.vucke.sk/sk/kompetencie/uzemne-planovanie/uzemny-plan-regionu/rok-2014/>)

The Regional Spatial Plan (ÚPN – VUC) 2017 – changes and amendments – (<https://web.vucke.sk/sk/kompetencie/uzemne-planovanie/uzemny-plan-regionu/rok-2017/>) Municipality Spatial Plan (one level lower than Regional Spatial Plan) is elaborated and valid in 2/3 of the municipalities of Košice SGR.

The Regional Spatial Plan 2009 safeguards the protection of bio-corridors in the process of transport infrastructure construction in the following ways:

- » 5.2. to maintain the supra-regional and regional bio-centres and bio-corridors within functional use and management of the area, to give priority

to realisation of ecological bridging of regional bio-corridors and bio-centres when constructing linear features; to adjust the routes of transport and technical infrastructure accordingly in order to keep the unity of forest complexes,

- » 5.3. to support planting of areal and linear green infrastructure, a natural way of renewal and revitalisation of the landscape in supra-regional bio-centres and bio-corridors”.

The Spatial Plan of Prešov self-governing region was elaborated in 2015 (Regional Spatial Plan Prešov – I. stage, 2015. - <https://www.po-kraj.sk/sk/samosprava/urad/odbor-regionalneho-rozvoja-uzemneho-planu-a-zivotneho-prostredia/dokumenty-oddelenia-up-a-zp/>) Amendments elaborated in 2017 - <https://www.po-kraj.sk/sk/samosprava/urad/odbor-regionalneho-rozvoja-uzemneho-planu-a-zivotneho-prostredia/dokumenty-oddelenia-up-a-zp/>).

⁶ https://web.vucke.sk/files/dokumenty/pub/uzemny_plan/2_zavazna_cast_zad_uplne_zenie_2009.pdf

Section H of the spatial plan deals with ecological corridors through the requirements of nature and landscape conservation, including the requirements for Terrestrial system of ecological stability in accordance with the Act 543/2002 Coll. on Nature and Landscape Protection. This Act defines nature conservation as prevention and limitation of interventions which threaten, damage or devastate the conditions and life forms, natural heritage and landscape features, or which lower its ecological stability. This also includes a removal of the consequences of these interventions.

The proposed solution: "Distribution of supra-regional and regional features of terrestrial system of ecological stability – bio-centres and bio-corridors."

The Spatial Plan of Banská Bystrica self-governing region was elaborated in 1998 (ÚPN VÚC Banskobystrický kraj) 8, Nariadením Vlády Slovenskej republiky č. 263/1998 Z. z. (PDF dokument, 379 kB). Further changes and amendments were accepted in 2004, 2007, 2009 and 2014.

» ÚPN VÚC Banskobystrický kraj – Changes and Amendments 2004 Všeobecne záväzným nariadením BBSK č.4/2004 (PDF dokument, 36 kB)

» ÚPN VÚC Banskobystrický kraj – Changes and Amendments 1/2007 Všeobecne záväzným nariadením BBSK č. 6/2007 (PDF dokument, 220 kB),

» ÚPN VÚC Banskobystrický kraj – Changes and Amendments 2009 Všeobecne záväzným nariadením BBSK č. 14/2010 (PDF dokument, 17781 kB),

» ÚPN VÚC Banskobystrický kraj - Changes and Amendments 2014 Všeobecne záväzným nariadením č. 27/2014 (PDF dokument, 1033 kB), 2015.

Protection of bio-corridors is stated as a priority in section 4 of Spatial Plan:

» 4.5 to respect the features of the regional terrestrial system of ecological stability,

» 4.6 to respect inclusion of these areas within the ecological network of the Slovak Republic

The List of Municipality Spatial Plans (one level lower than the Regional Spatial Plan) of Slovakia can be viewed at <http://www.uzemneplany.sk/zoznam-uzemnych-planov>.

7.3 Ukraine

The Land Use Plan of Zakarpattya Region (until 2031) was approved by the resolution of Zakarpattya Regional Council No. 731 dated May 17, 2013. It includes the following information and maps:

4 Books which include explanatory information. The information about natural conditions and nature protection, transport infrastructure and communication facilities is included in the Book 2 and it only has limited availability (confidential).

There are 10 maps included into the Plan.

» General Map

» Existing Land Use Map

» Transport Map

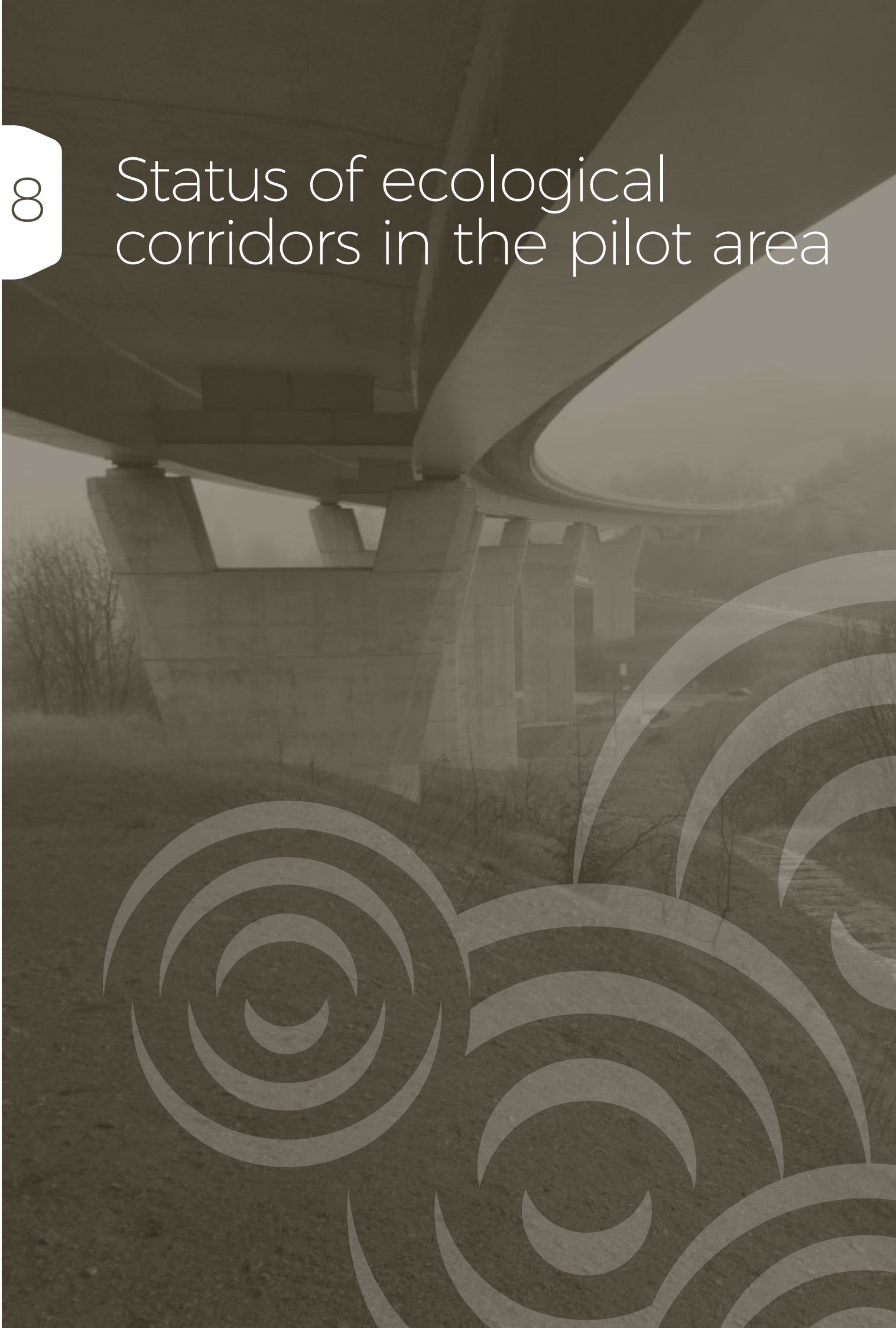
» Natural Assets Map

All maps listed are accessible by general public.



8

Status of ecological corridors in the pilot area



8.1 Role and importance of ecological corridors for animal movement and/or dispersal

Ecological corridors connect the so-called zones of primary habitats. Highly functional and wider areas interconnecting primary habitats are called linkage zones. However, in fragmented landscapes with a high degree of urbanisation, linkage zones are becoming narrower. In this case, these connection zones are rather called corridors. Scientists distinguish between highly functional corridors with less fragmentation or less and very narrow corridors with a lot of fragmentation around (for further details see e.g.: Graves et al. (2006) Frequency and distribution of highway crossings by Kenai Peninsula brown bears. *Wildlife Soc B* 34: 800-808).

In a human dominated landscape, people fragmentise natural environments via urbanization, agricultural activities, and the increase in road infrastructure. Urbanization is defined as habitat destruction whereas road infrastructure rather fragmentizes and transects wildlife habitats. By the identification of ecological corridors, wildlife scientists can reduce the level of habitat fragmentation by implementing suitable mitigation measures. Thus, development of new human structures is not necessarily blocked, but its impact on natural wildlife habitat is rather reduced. Therefore, identification needs to be done as precisely as possible. Wildlife species often use traditional passageways in order to move among patches with a suitable habitat. This knowledge is often transmitted to their offspring. Consequently, if mitigation measures aiming at improvement of wildlife movements are placed inappropriately, their effect is doubtful.

Ecological corridors secure normal movement of wildlife for fulfilling daily needs such as search for food and shelter or finding of breeding partners. Further, some wildlife species undertake migration during the year, for example many red deer stags have two different, not overlapping home ranges, the summer and the winter range. Migrating wildlife species do need ecological corridors in order to reach the other temporary home range. And last, functional ecological corridors are necessary for successful dispersal of individuals in order to establish a new home range somewhere else. Dispersing individuals can establish new sub-populations and/or

enhance genetic exchange among various sub-populations.

Role and importance of the ecological corridor in the Hernád Valley

The whole Hernád Valley has got three important ecological functions, not only in Hungary but in Slovakia, too.

- » The river Hernád, its tributary streams and the whole valley ensure the connection between the aquatic and wetland habitats. Transport infrastructure in this area has direct and indirect impact on several species, for example: aquatic and terrestrial invertebrates (*Astacus astacus*), fish (*Barbus carpathicus*), amphibian (*Salamandra salamandra*), reptile (*Emy orbicularis*), birds (*Ciconia nigra*, *Crex crex*), several species of small insectivores (bats, shrews) and mammals (*Lutra lutra*).
- » The valley is used as a corridor between the Carpathians and the Great plains by several large mammals, namely *Capreolus capreolus*, *Cervus elaphus*, *Dama dama*, *Sus scrofa*.
- » Based on the historical hunting datasets and the new results from biological conservation research, the large carnivores (*Canis lupus*, *Lynx lynx*, *Ursus arctos*) cross the valley between the Aggtelek and Slovak Karst and Zemplén-mountain. Also, small carnivores (*Martes foina*, *Martes martes*, *Mustela erminea*) and several bat species use this region as their feeding habitats.

Role and importance of the ecological corridor in the Szatmár Bereg Plain Landscape Protection Area

Based on the field work it can be concluded the streams, old alleys, verges and the valley of the river Tisza represent important ecological corridors for animal movement and/or dispersal. The wetland and aquatic habitats characterize the valley of Tisza and its streams. It is typical, that the verges of roads, old orchards become higher during the floods and inland water periods. Heterogeneity of landscape and low density of settlements provide a lot of different possibilities of migration paths for various animal species of organisms.

8.2 Main threats to ecological connectivity

8.2.1. Hungary

Main threats to ecological connectivity in the Hernád Valley

Two linear infrastructures pass through the Hernád Valley, the main road No: 3 (E71) and the railway line between Budapest-Miskolc- Kosiče, both of which have negative impact on ecological connectivity in the Hernád Valley. Road networks in the pilot area pose threat to ecological connectivity.

In the Hungarian part of the pilot area, there is an important TEN-T road leading across the Hernád River Basin, which provides the north-south connection between the two branches of the V. line of the so called "Helsinki corridors". The Hungarian part of the road is established as a main road (main road No. 3) but there is a plan to establish the high-speed motorway, M30, collaterally with the main road. The M30 would be a part of Via Carpatia. Currently, there is one motorway (M3) which touches the south-western side of the Hernád area. Road No 3: Budapest - Hatvan - Gyöngyös - Füzesabony - Mezőkövesd - Miskolc - Szikszó - Encs - Tornyosnémeti - (Slovakia) and Road No. 37: Felsőzsolca - Szerencs - Sátoraljaújhely - (Slovakia), which pass across this area and there is a road in the plans (44 km) which would link these two main roads which falls in the pilot project area.

In the Hungarian part of the pilot area there are two TEN-T railway lines (Budapest - Hatvan - Miskolc - Felsőzsolca - Mezőzombor and Felsőzsolca - Hidasnémeti - Slovakia), the network with local importance (Mezőzombor - Sátoraljaújhely - Slovakia) and the branch (Szerencs-Hidasnémeti) which touches the Hungarian pilot project area in 165 km. The connection Miskolc - Felsőzsolca - Hidasnémeti - Slovakia is of regional importance.

Population and settlements: The population of 213 settlements in the middle and upper section of the Hernád Valley area is about 453,000 inhabitants (2009). Out of this, there is 108 settlements in Slovakia with the population of about 313,000 inhabitants (234,000 in Košice) and 105 settlements in Hungary with the population of 140,000 inhabitants. Demographic indicators are significantly affected by the city of Košice, which is the largest city of Eastern Slovakia. Demographic indicators are also significantly affected by the city of Miskolc, but it influences the south side of the pilot project area only (about 170,000 inhabitants).

Main threats to ecological connectivity in Szatmár-Bereg Plain Landscape Protection Area

Road networks in the pilot area pose threat to ecological connectivity, even though the main road (No.41) is not far from the south part of the HU-UA pilot area and in the pilot area there are only secondary roads. The planned M3 and M34 will pose a great threat to the whole area due to changes in the ground and surface water systems in the area.

Population and settlements: In the Vásárosnamény District there is about 35,323 inhabitants in 28 settlements. The number of inhabitants in 21 settlements (68%) is under 1,000.

8.2.2. Slovakia

The southern project area includes three protected landscape areas and one national park. So far, just few sections of express ways have been built. Up until recently, the main connection to the Hungarian and Ukrainian border was secured via roads of 1st class. However, traffic intensity dramatically increased since Slovakia entered the European Union in 2004. Therefore, the existing road infrastructure is overloaded, and cannot serve in an effective way. For this, the expressway R2 is in the process of construction. On many sections, traffic intensities exceed more than 6,000 vehicles per 24 hours which is known to have a barrier effect for wildlife movement. The construction of the expressway R2 can worsen the permeability of the landscape. Therefore, it is very important to implement mitigation measures during the planning process of R2. Suitable wildlife passages have a high potential to keep a landscape permeable for wildlife movement even in case of newly build infrastructure.

Landscape and urban planning can also threaten the ecological connectivity of primary habitats of wildlife. Growing of human settlements is destroying wildlife habitat. Further, especially agricultural activities including livestock grazing, crop farming and orchards are other negative factors for reducing landscape permeability for wildlife species. Especially the usage of fences excludes many animals of these areas. Wildlife can seriously harm agricultural crops and thus, farmers start to fence fields, even over many hectares. It is doubtful if this management practise is not even contra-productive under the aspect of habitat fragmentation in a human dominated landscape. Therefore, important ecological corridors for wildlife should be kept free of any fence, even in their surroundings. This challenging management question should be more analysed and debated in order to find an appropriate solution for all involved parties.

8.3 Corridors identification

8.3.1. Hungary

The main methods used for the corridor identification are box-type live-traps, pitfall live-traps, camera traps for the small mammals. The camera traps along with identification of traces were used for monitoring large and medium-sized mammals. Ultrasound observations were used for bats. Monitoring of other bird species along with the amphibian and reptiles were carried out using visual, acoustic observation. The larval and juvenile individuals were monitored by using electrofishing and handling nets. The arthropods were monitored using pitfall traps (5 traps per sampling site). The assessment was carried out for three seasons (spring, summer and autumn) for mammals, birds, reptiles and amphibians but only for two seasons (spring and summer) for aquatic macroinvertebrate species. The sampling section and the methods of research programs were summarised in Table 5.

Monitoring of live animals

At all the 15 sampling points, there was one phototrap which was installed at a place where the road will cross the animal migration corridors. 15 box-type live-traps and 15 portable acoustic recorders (Sony, Japan) were installed in all sampling sections; two in the place of M34, three in the place of M30 and 10 in the place of different planned section of the M3. 27 pitfall traps sampled the terrestrial invertebrate species in 9 sampling sections and 7 sections were sampled for the aquatic macroinvertebrate species with handling net. Monitoring of different taxonomical groups was carried out during different time period since 01/2018-07/2018 and continued until October 2018. Recorded number of species of winter and spring sampling periods are summarized in the table below (Table 6). The total number of recorded animal species was 112 and the total number of sampled and registered individuals was 10,245. During the field works the tracks of large mammals were found, in particular of gray wolfs (*Canis lupus*) near road M30, not so far from Hernádszurdok. Previous research work confirmed the presence of West-East corridor of this species in this area.

Road number	rkm	Animal groups	Habitat type
M30	44+000-46+000	mammals	different types of grassland, old orchard without maintenance
M30	78+000-79+000	amphibians, reptiles, birds, mammals	floodplain forest
M30	81+700	amphibians, reptiles, birds, mammals	floodplain forest
M34	area of proposed wildlife mitigation measure	reptiles, large mammals	forest, verges of agriculture fields
M34	area of proposed wildlife mitigation measure	reptiles, large mammals	forest, verges of agriculture fields
M3	278+245 (Hizlalda-channel)	birds, mammals	agriculture area
M3	21+130 (Déda-channel)	aquatic and terrestrial invertebrates, fishes, amphibians, reptiles, birds, mammals	habitats of channel, forest, grassland, verges
M3 B1	12+310 (Csaronda-stream)	aquatic and terrestrial invertebrates, fishes, amphibians, reptiles, birds, mammals	habitats of streams, marshlands
M3 B1	6+690-7+330 (River Tisza)	aquatic and terrestrial invertebrates, fishes, amphibians, reptiles, birds, mammals	aquatic and floodplain habitats
M3 B1	9+460	terrestrial invertebrates, amphibians, reptiles, birds, mammals	different trenches, temporal wetland habitats
M3 C1	5+905 (River Tisza)	aquatic and terrestrial invertebrates, fishes, amphibians, reptiles, birds, mammals	River Tisza: aquatic and floodplain habitats
M3 C1	10+210 (Csaronda-stream)	aquatic and terrestrial invertebrates, fishes, amphibians, reptiles, birds, mammals	habitats of stream, verges, forest
M3 C1	17+765	terrestrial invertebrates, amphibians, reptiles, birds, mammals	grassland, verges, alley
M3 C2	5-6+970 (River Tisza)	aquatic and terrestrial invertebrates, fishes, amphibians, reptiles, birds, mammals	aquatic and floodplain habitats
M3 C2	10+505 (Csaronda -stream)	aquatic and terrestrial invertebrates, fishes, amphibians, reptiles, birds, mammals	aquatic, semiaquatic, terrestrial

Table 5: The sampling sections of the pilot area in Hungary.

Road number	rkm	number of detected species
M30	44+000-46+000	3 reptiles, 27 birds, 7 mammals
M30	78+000-79+000	9 amphibians, 6 reptiles, 31 birds, 8 mammals
M30	81+700	10 amphibians, 4 reptiles, 37 birds, 8 mammals
M34	area of proposed wildlife mitigation measure	5 reptiles, 17 birds, 6 mammals
M34	area of proposed wildlife mitigation measure	2 amphibians, 19 birds, 3 reptiles, 5 mammals
M3	278+245 (Hizlalda-channel)	2 reptiles, 5 amphibians, 6 birds, 3 mammals
M3	21+130 (Déda-channel)	7 fishes, 11 amphibians, 6 reptiles, 41 birds, 9 mammals
M3 B1	12+310 (Csaronda-stream)	5 fishes, 14 amphibians, 7 reptiles, 47 birds, 16 mammals
M3 B1	6+690-7+330 (River Tisza)	29 fishes, 7 amphibians, 4 reptiles, 35 birds, 15 mammals
M3 B1	9+460	6 amphibians, 6 reptiles, 39 birds, 12 mammals
M3 C1	5+905 (River Tisza)	27 fish, 5 amphibians, 3 reptiles, 29 birds, 18 mammals
M3 C1	10+210 (Csaronda-stream)	7 fishes, 13 amphibians, 7 reptiles, 19 birds, 20 mammals
M3 C1	17+765	2 amphibians, 7 reptiles, 31 birds, 9 mammals
M3 C2	5-6+970 (River Tisza)	21 fishes, 5 amphibians, 1 reptile, 23 birds, 7 mammals
M3 C2	10+505 (Csaronda-stream)	7 fishes, 12 amphibians, 8 reptiles, 37 birds, 19 mammals

Table 6: The number of species recorded up to the end of 2018 in the Hungarian part of the pilot area.



Fig. 17: Sampling section at the road M30 in Hungary.

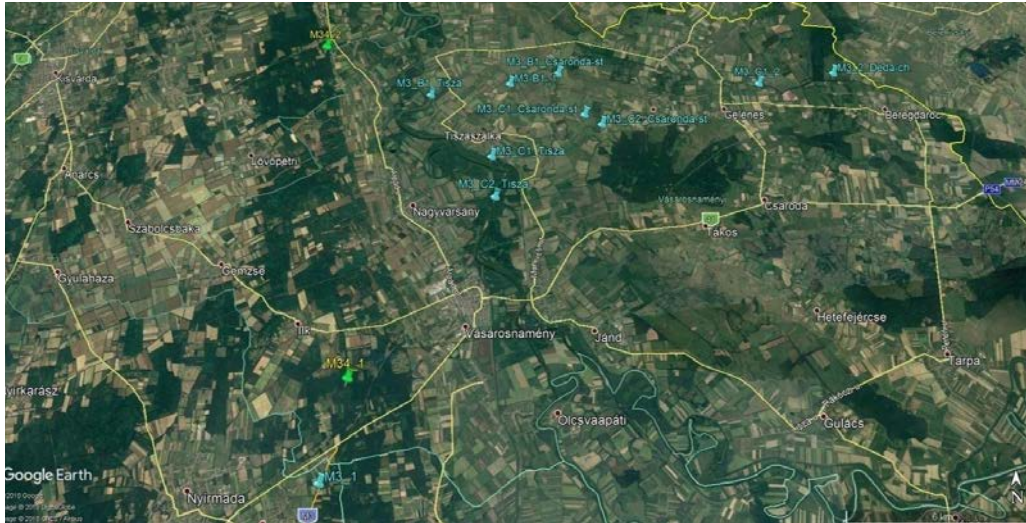


Fig. 18: Sampling section at the road M3 and M34 in Hungary.

8.3.2. Slovakia

Due to previous knowledge, the location of several migration corridors was already known. We tried to ascertain the importance of these places for animal movement. Further, we monitored occurrence of wildlife alongside the road infrastructure by the help of photo traps. Another data source was the evidence of traffic related mortality of wildlife species on 1st class roads.

One of the aims of the project was to identify or verify corridors and critical places on the existing transport infrastructure. Existing data on road and railway mortality was collected from relevant institutions and new data has been added from seasonal field monitoring carried out in the Slovak sites. Four SNC SR Units participated in field monitoring of this pilot area: NP Slovak Karst Administration, PLA Cerová vrchovina Administration, PLA Vihorlat Administration and Regional Centre of Nature Protection in Prešov. Photo traps were installed on selected bio-corridors near the roads. Particular sections of the roads were

selected for mortality monitoring and for mapping of live animals and residence signs of animals near the roads.

Monitoring of live animals

40 photo traps were installed in places situated near the roads, which were selected according to previous knowledge on migration corridors and road kills (Figures 19, 20). 10 photo traps were installed in Cerová vrchovina, 16 in Slovak Karst, 6 in Prešov area and 8 in Vihorlat. Monitoring was realised during different time period during 05/2017-03/2018 and will continue until June 2018. Recorded species are summarized in the Table 7 below. In Cerová vrchovina photo traps were installed later, since December 2017. Before it, mapping of residence signs near the roads was realised in Cerová vrchovina mountains during 2 months, from September 2017 until November 2017. Total number of recorded individuals was 212, of which 36 is *Capreolus capreolus*, 35 *Cervus elaphus*, 138 *Dama dama*, 2 *Sus scrofa* and 1 *Lepus europaeus*.

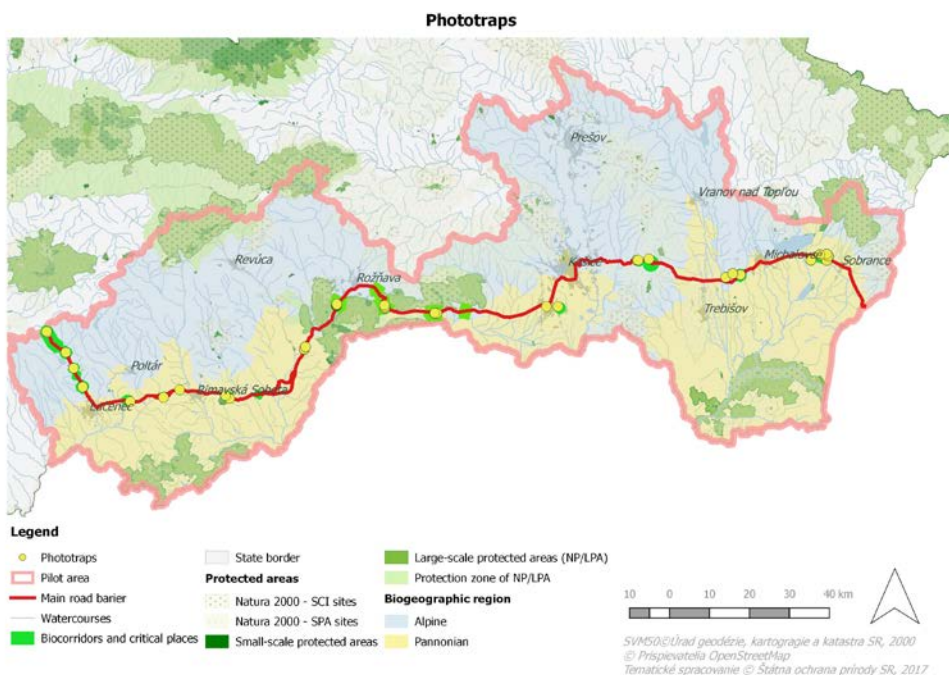


Fig. 19: Phototraps installed in the Slovak part of the pilot area.



Phototraps



Legend

- Phototraps with no. of records
- Group of phototraps with no. of records
- Pilot area
- Competency area of NP/LPA
- Watercourses
- Biocorridors and critical places
- State border
- Protected areas
 - Natura 2000 SCI sites
 - Natura 2000 SPA sites
 - Small-scale protected areas
- NP/LPA
- Protected zone of NP/LPA
- Biogeographic region
 - Alpine
 - Pannonian



Fig. 20: Number of records collected by phototraps.

Residence signs mapping



Legenda

- Species**
 - Cervus elaphus
 - Capreolus capreolus
 - Dama dama
 - Lepus europaeus
 - Sus scrofa
- Biogeographic region**
 - Alpine
 - Pannonian
- Protected areas**
 - Natura 2000 - SCI sites
 - Natura 2000 - SPA sites
 - Small-scale protected areas
 - NP/LPA
 - Protected zone of NP/LPA
- Others**
 - Pilot area
 - Main road barrier
 - Municipalities
 - Watercourses
 - State border
 - Biocorridors and critical places



Fig. 21: Residence signs mapping in Cerová vrchovina.

Taxon	Cerová vrchovina	Slovenský kras	Prešov	Vihorlat
No. of phototraps	10	16	6	8
Period	12/2017-03/2018	05/2017-02/2018	09/2017-12/2018	09/2017-11/2017
Artiodactyla				
<i>Capreolus capreolus</i>	38	790	88	136
<i>Cervus elaphus</i>	273	4.829	4	2
<i>Dama dama</i>	3			
<i>Sus scrofa</i>	40	134	50	4
Other mammals				
<i>Vulpes vulpes</i>	4	505	91	18
<i>Felis silvestris</i>	2	7	3	1
<i>Lepus europaeus</i>		90	38	11
<i>Martes foina</i>		1	4	
<i>Martes martes</i>		1		
<i>Meles meles</i>	1	35	8	
<i>Mustela putorius</i>		5		
<i>Nyctereutes procyonoides</i>			1	
<i>Sciurus vulgaris</i>			4	
<i>Glis glis</i>			26	
<i>Mous</i>			10	
Birds				
<i>Buteo buteo</i>		35		
<i>Strix aluco</i>			1	
<i>Ciconia ciconia</i>		2		
<i>Ciconia nigra</i>			7	
<i>Ardea cinerea</i>			2	
<i>Parus major</i>			1	
<i>Passer montanus</i>		1		
<i>Phasianus colchicus</i>		1	1	
<i>Pica pica</i>		49		
<i>Garrulus glandarius</i>			1	
<i>Turdus merula</i>			1	
<i>Turdus pilaris</i>			2	
Domestic animals				
<i>Dog</i>		8		
<i>Cat</i>		1		
<i>Unknown</i>	1	130		
TOTAL	362	6.624	343	172

Table 7: Species recorded by photo-traps in the Slovak part of the area.

Mortality monitoring

Mortality monitoring was realised on selected road sections regularly during the period 05/2017 - 03/2018 (Figures 22, 23). Evaluated were also data collected by the Slovak Karst Administration since 2014, which are available in different databases. Totally, 294 records have been evaluated, with total number of dead animals - 1,037. Amphibians and reptiles have the highest mortality in the pilot area (752 cadavers). The fox was the second most

common animal killed on roads (104 cadavers). From medium-sized animals, species of *Martes spp.* and *Mustelas pp.*, and European badgers were killed quite often. From large carnivores, one wolf was killed in Cerová vrchovina in April 2018 and one lynx was killed in Slovak Karst in November 2017. 11 individuals of the European wild cat were killed in the whole area. During the monitoring period, 12 individuals of *Artiodactyla* (red deer, European roe deer and wild boar) were killed in the area (Table 8).

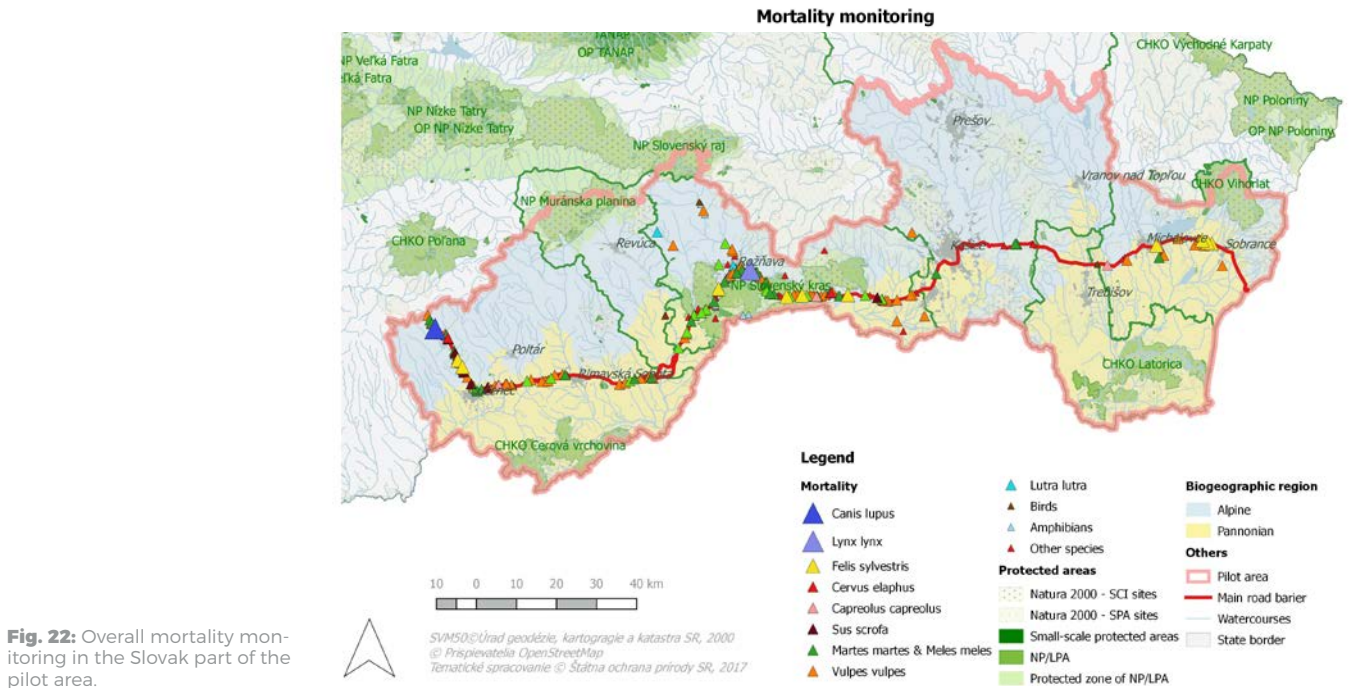


Fig. 22: Overall mortality monitoring in the Slovak part of the pilot area.

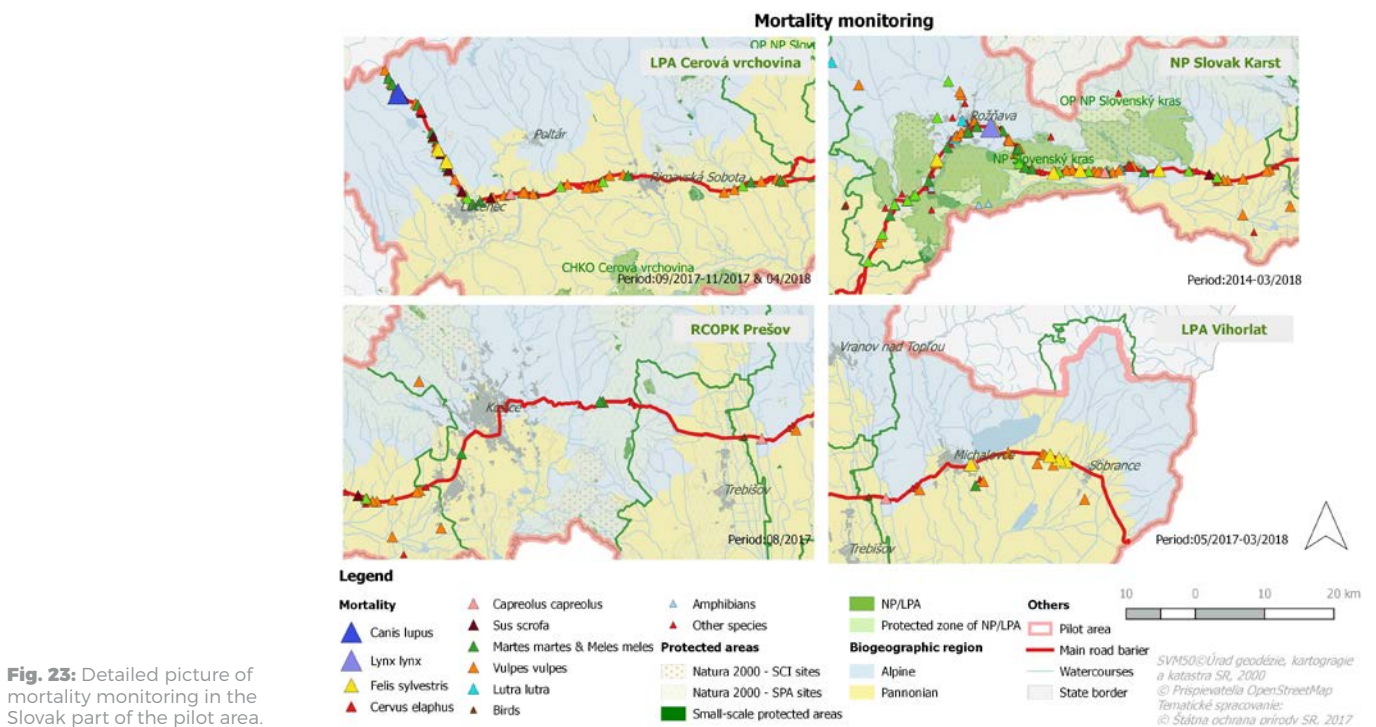


Fig. 23: Detailed picture of mortality monitoring in the Slovak part of the pilot area.

Taxon/ Taxon group	Sum of cadavers
Artiodactyla	
<i>Capreolus capreolus</i>	8
<i>Sus scrofa</i>	3
<i>Cervus elaphus</i>	1
Large carnivores and wild cat	
<i>Canis lupus</i>	1
<i>Lynx lynx</i>	1
<i>Felis silvestris</i>	11
Medium-sized animals	
<i>Vulpes vulpes</i>	104
<i>Martes & Mustela</i>	30
<i>Meles Meles</i>	18
<i>Sciurus vulgaris</i>	16
<i>Lepus europaeus</i>	14
<i>Lutra lutra</i>	6
Small terrestrial animals etc.	19
Chiroptera	1
Raptors and owls	12
Birds	6
Reptiles/amphibians	752

Table 8: Species killed on monitored sections of the roads in the Slovak part of the pilot area (mortality monitoring 05/2017 - 03/2018 and data from Slovak Karst databases since 2014).

Railway mortality

The Slovak Railway Administration collects data on animals killed on railways each year. Data for the period 2014-2017 was obtained and evaluated. A lot of data, however, miss some important information about the animals killed. One of the most important information is the exact GPS location; however, in this case, the mortality was recorded only per section of railway line. Different lines have different lengths, which in this pilot area can differ from few meters to 16 kilometres. Therefore, even though most of the records can be displayed in GIS, the information

is not precise. Railway lines with different relative mortality per km of the section are visualized in Figure 24. The absolute number of cadavers killed on railway line sections is depicted in Figure 25. Animal mortality on railways in the pilot area has increased during the last years. There were 144 cadavers recorded in 2014, and 270 cadavers recorded in 2017 in the pilot area. Species, which were most often killed by railway in the whole area of Slovakia were the European roe deer (*Capreolus capreolus*), the wild boar (*Sus scrofa*), the red deer (*Cervus elaphus*) and the brown bear (*Ursus arctos*).

Relative railway mortality (2014-2017, Slovak Railway)

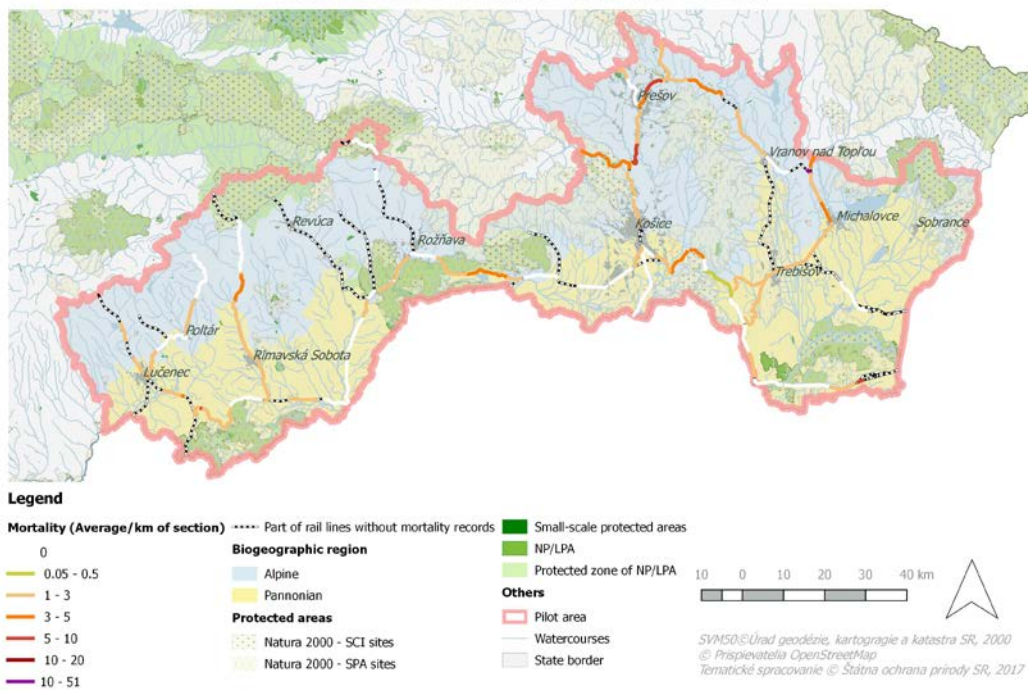


Fig. 24: Relative railway mortality in the Slovak part of the pilot area.

Absolute railway mortality (2014-2017, Slovak Railway)

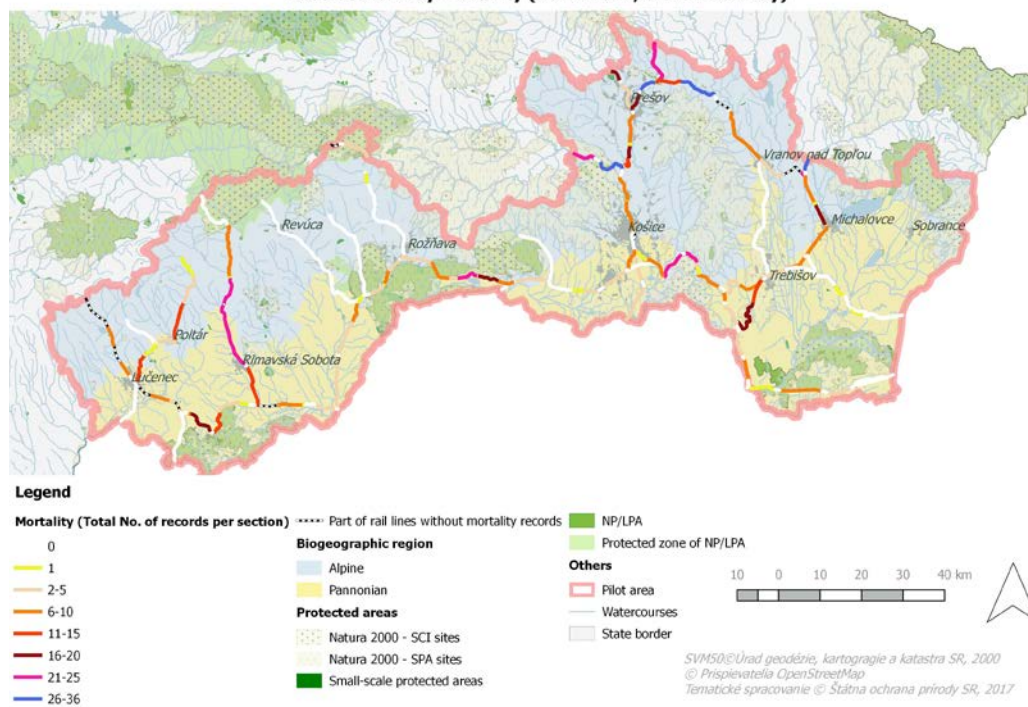


Fig. 25: Absolute railway mortality in the Slovak part of the pilot area.

The NGOs and national agencies do not have long-term systematically sampled faunistic datasets that could be used to identify changes in the status of ecological corridors.

8.3.3. Ukraine

There is the following legislation which defines status and regime of ecological network (including corridors) in Ukraine:

The National ecological network includes the following areas:

- » Key areas – provide condition for preserving the most important and typical components of landscape diversity for a certain region.
- » Connective areas (eco-corridors) – connection between key areas, provide conditions for animal migration and exchange of genetic materials.
- » Buffer areas – protect key areas and connective areas from external impact.

Zakarpattya is the only region in Ukraine, which developed a Scheme of Ecologic Network of Zakarpattya Region. The Ecologic Network of Zakarpattya Region is based on the "Methodology Recommendation for the Development of Schemes of Regional Ecologic Networks". The Ecological Network in Zakarpattya region includes core areas (natural protected areas according to the Law on National Protected Areas of Ukraine, both existent and reserved for protection (planned) and connecting areas, which include forest lands, lands of watercourses and water reservoirs, lands of natural waters and their protective stripes and lands for recreation, agriculture lands used for extensive farming (pastures, hay-fields) as well as some other lands belonging to the state or the region. Buffer areas were not defined and mapped. Taking into account difficulties to enforce required status of lands by private land owners, private lands were not included into the network. Zakarpattya region has a long border line with rather good conditions of natural continuity, the parts of state border where natural or semi-natural ecosystems prevail. It was included as part of the regional ecologic network.

Ecological Network of Zakarpattya Region (project)
List of ecological corridors of Zakarpattya region:

- » Svydovetsko – Kuziyskiy. Connects Svydovetsiy and Kuziyskiy mountain ridges of Carpathian Biosphere Reserve through Kisva River.
- » Svydovetsko – Marmaroskiy. Connects Svydovetskiy and Marmaroskiy mountain ridges through Kisva, Shopurka, Tisza and Biliy Potik River and forested slopes of the mountains.
- » Chornogirsko – Polonynskiy. Connects Chornogirskiy and Marmaroskiy parts of

Carpathian Biosphere Reserve through mountain pastures and natural alpine meadows. Both mentioned parts are connected with the Carpathian National Natural Park (Ivano-Frankivsk region), natural protected areas of Chernivtsi region and natural territories of Romania.

- » Bilotysyanskiy. Connects Chornogirskiy and Marmaroskiy mountain ridges through Bila Tisza and its tributaries. Has connection with Tisza ecological corridor.
- » Gorgansko – Chornotysyanskiy. Connects National Natural Park Synevyr with Chornogirskiy and Svydovetskiy parts of Carpathian Biosphere Reserve through Bradulskiy Reserve and ridges of Gorgany. Connected to Tysyanskiy corridors through Chorna Tysa River. The corridor includes a number of small key areas, such as Andromeda and Apshynetskiy wetland reserves. The corridor is connected to the national ecological network through Gorgany National Reserve (Ivano-Frankivsk region).
- » Synevyrsko-Svdovetskiy. Cuts through the valley of Tereblya River through the river of Brusturyanka. Connects National Natural Park Synevyr and Ugolsko-Shyrokoluzhansky, parts of the Carpathian Biosphere Reserve and smaller protected areas, such as Kedrynskiy, Strazhnyk, Zadnya, Tavpishyrka, Arshychna Meadow etc.
- » Synevyrsko – Khustskiy. Located in the valleys of Tereblya and Rika rivers, as well as on the mountain ridge between Tereblya and Rika. It connects Dolyna Nartsysiv of Carpathian Biosphere Reserve and Ugolsko-shyrokoluzhanskiy parts in the Carpathian Biosphere Reserve, Synevyr and with river Tisza through Khustets River.
- » Ugolsko – Uzhanskiy. Crosses the valleys of Rika River, Borzhava River, Latorytsya River, small protected areas to connect Ugolsko-Shyrokoluzhanskiy part of Carpathian Biosphere Reserve and Uzhanskiy National Natural Park. Connects to Bieszczadski National Park (Poland) and Tatranski Park (Slovakia).
- » Synevyrsko – Beskidskiy. Connects Uzhanski and Synevyr National Natural Parks through watershed divide ridge. Connected to Skolivsky Beskydy National Natural Park (Lviv region).
- » Shayansko – Vygolratskiy. Connects the mountains of Shayan to Zacharovaniy Kray National Natural Park. Connected to forest areas of Slovakia.
- » Marmarosko – Shayanskiy. Connects Marmarosh Part of Carpathian Biosphere Reserve and Shayan mountains along state Border of Ukraine.
- » Shayansko – Yuliyivskiy. Connects Shayan mountains and Yuliyivska Gora part of Carpathian Biosphere reserve along state border of Ukraine.
- » Yuliyivsko – Chopskiy. Connects Yuliyivska Gora of Carpathian Biosphere reserve and Prytysyanskiy Region-

al Landscape Park along state border of Ukraine and a number of smaller protected areas. Connected to protected areas of Romania and Hungary.

- » Borzhavskiy. Located in the valley of Borzhava River. Connects Prytysyanskiy Regional Landscape Park and planned Zhdymyr National Park and Tsyanskiy corridor.

» Tsyanskiy. Connects Rakhov parts of Carpathian Biosphere Reserve, the valley of Tisza. Connected to ecological network of Hungary.

- » Latorytskiy. Located in the valley of Latorytskya River and Veretskiy Pass. Connects Prytysyanskiy Regional Landscape Park and protected areas of Lviv region and Slovakia.

8.4 Migration corridors in the pilot area

8.4.1. Hungary

in Hungary, the following corridors were identified:

- » River Hernád, Vadász stream, Vasonca, Béluas stream, Bársonyos stream, Szerencs stream, Vilmány stream, Blehi stream, Gönczi stream, Perény stream, Szártos stream,
- » River Tisza, Csaronda stream, Szipa channel, Gelénesi channel, Dédai channel

The amount of data gained during the field research is not sufficient for the identification of ecological corridors. For that reason, it is impossible to determine their precise location. However, it can be stated, that several wildlife mitigation measures should be redesigned.

8.4.2. Slovakia

In Slovakia, 17 critical points were identified:

1, Píla-Mýtňa	10, Zemné hradisko
2, Fafáky	11, Drienovec
3, Halier	12, Šaca
4, Čierna lúka	13, Haniska
5, Ťahan	14, Svinica
6, Ožďany	15, Košický Klečenov
7, Brzotín	16, Gajdoš
8, Krásnohorské Podhradie	17, Pozdišovce
9, Soroška	

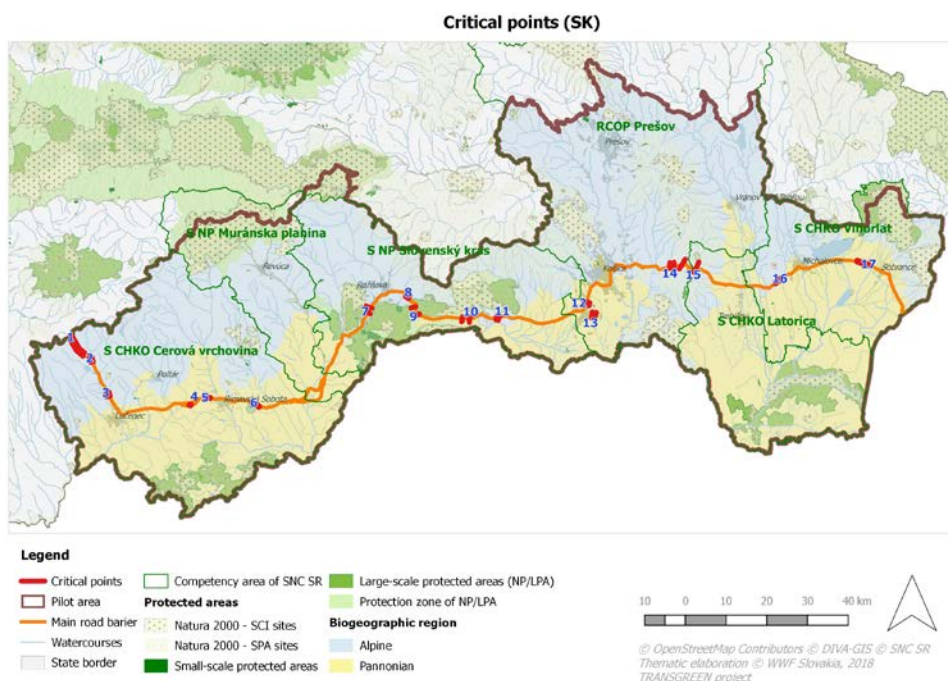


Fig. 26: Critical points in the pilot area identified in Slovakia

8.4.3. Ukraine

In Ukraine, 5 critical points were identified:

1. Dyida	4. Syurte
2. Yanoshi	5. Svaliava
3. Mukachevo	

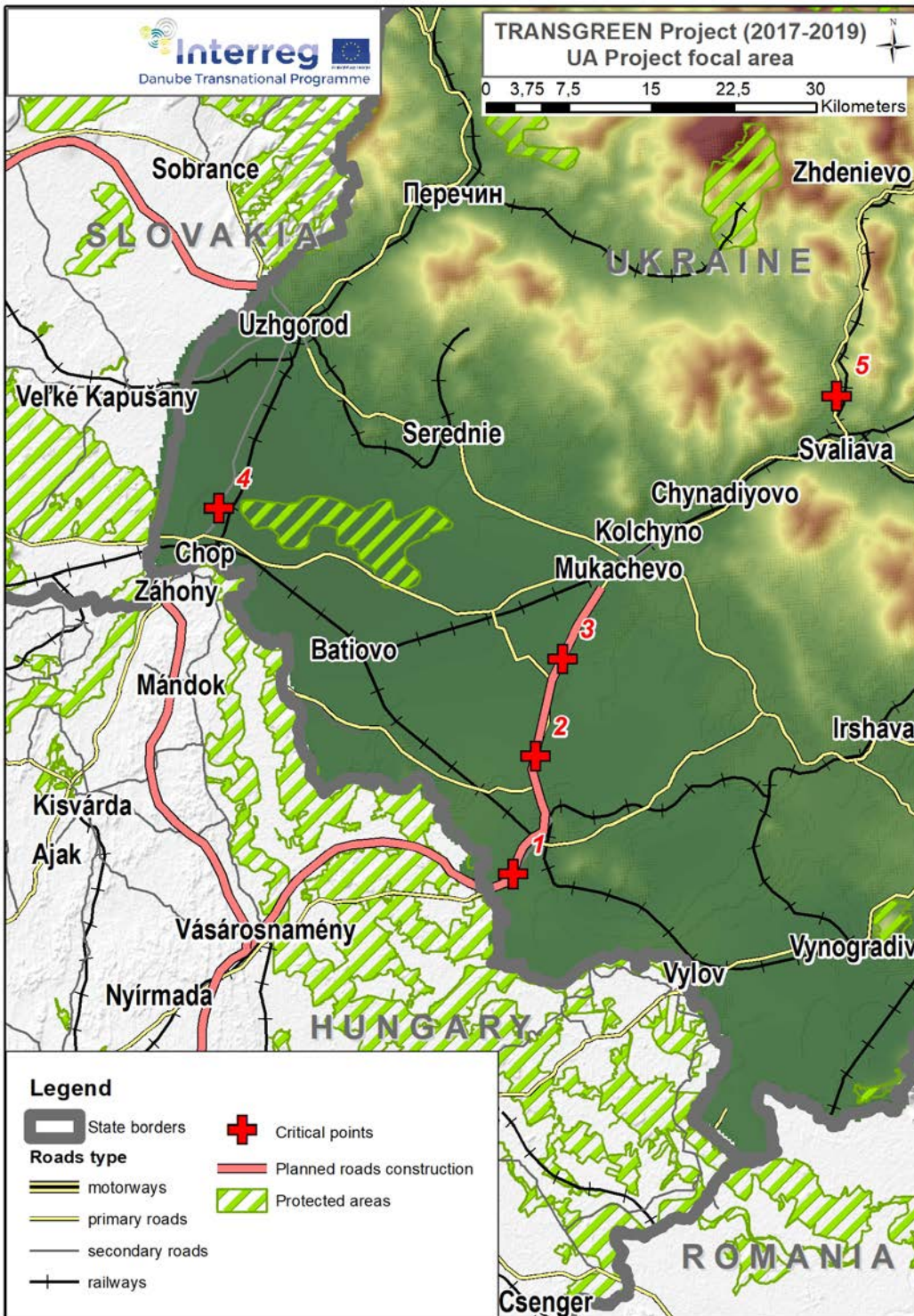


Fig. 27: Critical points in the pilot area identified in Ukraine

8.5 Potential for conflict management

8.5.1. Hungary

Some movement corridors are very wide, e.g. in the Csaroda stream in the case of M3, and in some extreme cases they are up to a length of at least 3 km. Therefore, detailed monitoring in the field is needed. Heterogeneity of habitats, large number of protected species and population size of game create many questions with regards to the development of the M3 motorway. Traffic intensity at selected sections of the M30 can account for the building of a new road, but in parallel there is the road No. 3 and TENT-T railway line between Miskolc and Košice. Both linear infrastructure elements have significant negative impact on the wildlife today.

8.5.2. Slovakia

We tried to locate the bio-corridors fairly accurately, their description is part of the

Chapter 8.4. Thus, during the final planning process of the expressway R2, the positions of critical places should be taken into account. However, some movement corridors are very wide, in extreme cases up to a length of 5 km. Therefore, we strongly recommend further detailed monitoring in the field by tracking and recording all other signs of activities, in order to find the exact place for a mitigation measure. At last, intensive cooperation of partners with sometimes contradictory interests is suggested during the entire planning process. If investors, road building engineers, wildlife scientists, and conservationists try to find a compromise, wildlife could benefit from it via a permeable landscape despite new road infrastructure. The traffic volume at selected sections on 1st class roads nowadays can seriously impede animal movement already now.



Best practices



9.1 Hungary

» Road M31 Gödöllő-Budapest, 6+370 km section

The bridge is 24 m high, 300 m long and 34 m deep. Wildlife crossing, underpass, connecting two sections of the forest as well as different types of agricultural areas is used by various game species (deer, roe deer and wild boar), as well as various other large animal species (fox, badger, wildcat). Sand traps are used in order to monitor the movement of animals. Based on monitoring data this mitigation measure is frequently used by mammals. The number of mammal species occurring at this site has grown continuously since 2011.



Fig. 28 and 29: Landscape under the bridge in Hungary (Picture by Zoltán Ilonczai)

» 257+940 bridges of M3 motorway from Budapest to Vásárosnamény

There is a green 20 m wide overpass which connects two sections of the forest. It is used by roe deer, fox and badger. Medium-sized population of wild boar is present in the area, but this species does not use the overpass. The edge of the overpass is covered by a 2 m high palisade fence. The overpass also uses sand traps to monitor the animal movement.

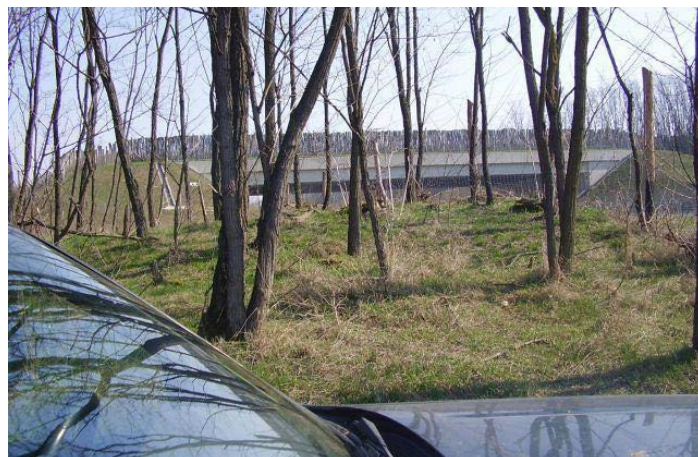


Fig. 30: The view of overpass from the forest in Hungary. Author: Zoltán Ilonczai

» M246+600 overpass bridges of M3 motorway from Budapest to Vásárosnamény

Green 20 m wide overpass. It connects two sections of the forest used by roe deer, fox and wild boar and it also is covered on the edge by a 2 m high palisade fence. At this overpass sand traps were used to monitor animal movement. There is an unpaved road that runs along the overpass which is used by hunters as well.



Fig. 31: The sand trap monitoring zone on the bridge. Author: Zoltán Ilonczai

» Road M30 from Emőd to Felsőzsolca (6+060 km section)

The bridge is 3.7 m high, 34 m long and 21 m wide. The underpass connects different types of agricultural areas with alleys. Vegetation present in the underpass is humid grass with native bush species along the fences. North part of this underpass was planted with lime (*Tilia* sp.) in 2002. Total of 684 mammals crossed the underpass during 2009-2012 including badger, fox, roe deer, wild boar, *Mustella* sp. (a weasel species) as well as rodents. This exemplary mitigation measure is maintained by the NRA company. The company monitors the underpass, mows the grass several times a year and manages the lime forest as well.

The underpass is monitored for animal movement since 2009. The company uses several maintenance methods. It does not use chemicals near the underpass and also changes the periodic mowing time.



Fig. 32: The underpass zone of valley-bridge in summer season. Author: Zoltán Ilonczai

9.2 Slovakia

Fortunately, during the construction of particular sections of the expressway R2, two useful viaducts were implemented. Especially viaducts are preferred for movements of wildlife across roads. They have an open view on the other side which enables frequent movements.

Viaduct near the village Oždany

The viaduct near the village Oždany is located at a place which is a known corridor in the project area Protected Landscape Area Cerová vrchovina. During the monitoring period, we confirmed functionality of the mitigation measure by installing photo traps in the surrounding area.

The corridor is located in Lučenecko-košická zníženina. Its width is approx. 1,600 m with traffic intensity up to 8, 399 vehicles per 24 hours.

The construction of a long viaduct near the village Oždany allows frequent wildlife movement even of large mammal species.

Viaduct near the village Figa

Some parts of the expressway R2 is already realized. Near the village Figa, located in the Protected Landscape Area Cerová vrchovina, wildlife movement including large mammal species was known. Fortunately, a viaduct

was implemented which can secure wildlife movement under the bridge on the other side of the road. This viaduct is very important as it connects Cerová vrchovina with more southern parts of Slovakia.



Fig. 33: Viaduct near the village Figa. Source: NDS



10

Negative examples



10.1 Hungary

- » In 2006, highway No. 2 was restored to include fences for amphibians between Hont and Parassapuszta. Even though this was a great step towards ensuring safe passage for amphibians, lack of maintenance, deliberate damages, erosion and poorly built fences lead to its failure to fulfil its purpose.
- » The construction of a rest area and a petrol station close to the wildlife overpass on M7 in Balatonlelle

affects the usage of this overpass due to the lights and cars using this area⁷.

- » The wildlife underpass along the M30 motorway connecting different agricultural areas - the NRA regularly maintains and monitors the underpass. However, despite their efforts, the number of wildlife-vehicle collision is quite high⁸.

10.2 Slovakia

Very close to the border of the pilot area and related to the R2 expressway, finalisation of the R2 section Zvolen – Kriváň could be used as a negative example.

This section of the R2 road was realized and finally finished in 2017. The entire sum for the express-road is 315 Mio Euro (Zvolen – Pstruša: 137 Mio Euro; Pstruša – Kriváň: 178 Mio Euro). The section has dramatic negative impacts on the movement of wildlife because of its construction and absence of useful wildlife crossing structures. In general, it can be said that express roads can have a more negative impact on wildlife migration. Roads of this type are allowed to cover the design of the landscape more than a highway. Consequently, much less viaducts need to be planned for dual carriageways (express roads) than on highways.

In case of the mentioned R2 section, the construction is even worse. Nearly the entire section is located on an embankment which creates a complete barrier for the movement of any wildlife species (Fig. 10). Not a single mitigation measure is implemented. The road section cuts off the valuable Poľana Mountain range from the south of the country and further from Hungary. Poľana is home to many wildlife species including large ungulates and the three large carnivore species brown bear, European wolf, and European lynx in very healthy population numbers. Large predators originating of the Poľana Mts. had a potential to disperse further into the south of Slovakia and even up to Hungary, which is nowadays impossible. Vice versa, genetic exchange between Hungarian subpopulation and Poľana is now blocked alongside this section. Tragically, even if there would be attempts to re-connect the area again, the embankment makes the construction of a green bridge nearly impossible.



Fig. 34: View on the dual carriageway R2 from the village Pstruša onward.

7 Source: http://kozadat.nemzetiutdij.hu/doc/AAK_FENNTARTHATOSAGI_MAGYAR_2011.pdf

8 Source: http://vadelutes.elte.hu/content/pdf/wildlife_vehicle%20collision%20Hungarian%20study.pdf

As seen in Figure 60, the road is over many kilometres located on an embankment without any mitigation measures for wildlife. Thus, the important mountain range Poľana on the left of the Figure 60 is completely cut off from the south of Slovakia (and Hungary).

It is worth to mention that the NGO Carpathian Wildlife Society carried out a two-year study concerning migration routes of large mammals alongside the 50 km section Zvolen – Pstruša – Kriváň – Lučenec. One output of this study was the English brochure *Brown Bear Corridors in Slovakia, 2007* (Findo et al. 2007). The brochure includes several detailed maps of the section Zvolen – Lučenec with the identified wildlife crossings. Further, the results were delivered to the National Motorway Company NDS. However, NGO's in Slovakia do not have the power to influence decisions and can just participate in road planning processes in form of a consultancy. Thus, the results were ignored in the end and the embankment realized. Fig. 11 illustrates the identified wildlife crossing zones alongside the section Zvolen – Kriváň based on 8 involved target species (large ungulates, wild cat, and large predators).

After the building plan to localize the section R2 on an embankment was published, the National Forest Centre Zvolen under leadership of Dr. Slavomír Findo even wrote a petition against the construction to the Ministry of Transport in

Bratislava. Sadly, the Ministry did not even react, indicating a reduced interest in keeping the landscape permeable for wildlife in the future.

As a resume we would seriously insist on the implementation of mitigation measures for wildlife in the planned section Kriváň – Lučenec. After Kriváň, it is the junction to Bzová which is the last remaining possibility for wildlife of the Poľana Mts. to move to the south and vice versa. We would strongly recommend keeping this place permeable for future wildlife movement either by realizing a long and high (< 7 m) viaduct, or by a properly planned green bridge.

Another negative example is just planned dual carriageway R4, section Kapušany – state border SK/PL, which has a very high potential to seriously impede movement / dispersal of brown bears between central and eastern Slovakia (and further to the Ukraine). Genetic differences among the two sub-populations are already proved (Straka et al. 2012). Without implementation of mitigation measures on properly identified bear movement / dispersal routes, the re-connecting of the two sub-populations in Slovakia is nearly impossible. We strongly recommend starting intensive tracking efforts in the field and to cooperate with the National Motorway Company. The entire section should have a length of 55.1 km and will cost minimum of 839 Mio Euro (www.cesty-ineko.sk).

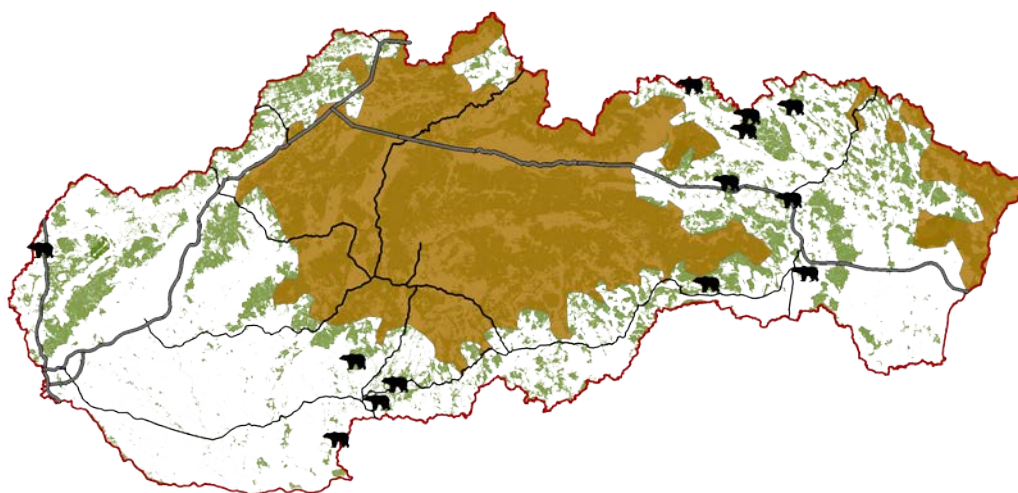


Fig. 35: Brown bear range including single individuals. The planned dual carriageway R4 could seriously hinder genetic exchange between the Eastern and the Central sub-populations. Source: Findo et al. 2014

11. Recommendations to fill in the gaps

Data on animal mortality on roads and railways in one database

It will be very useful to have one common central database for animal mortality on roads and railways. Data should be collected following the same methodology and each record should have the same attributes. By this, missing the important information will be avoided (e.g. taxon name, GPS position, sex, age etc.). Database should be accessible to all relevant institutions in the sector of environment as well as transport.

Free GIS data

Basic transport GIS data (network of roads, network of railways) as well as basic nature conservation GIS data (network of protected areas, datasets on animal movement and mortality) should be freely available for download on public portal, or at least it should be freely available to state institutions and relevant stakeholders. Datasets should be regularly updated.

Development of more sophisticated studies on wildlife movement, also in relation to roads and railways

There are only few studies which focused on wildlife telemetry. Movement data acquired by GPS telemetry can help to identify important wildlife routes. More telemetric studies of wildlife should be realised in order to have data available for future development plans.

Map of migration corridors

Reliable map with potential movement corridors of large mammals is absent and should be developed. Sophisticated methods should be used to gain reliable data (telemetry, statistical mapping procedures). This map would contribute to identification of places where mitigation measures are needed, and which areas should be kept free of any building activity.

Such a map should be updated periodically (e.g. between 5-10 years), as changing structure of settlements, agriculture methods along with water and forest management measures cause a lot of changes and thus can modify the habitat use and migration of animals.

The spatial planning documentation should respect the map of ecological corridors. In case of new infrastructure development, the best route should be designed, and any mitigation measures should be already proposed during the planning stage.

Gaps of biodiversity data availability

The system of traffic accident record should specify the kind of animal which caused the accident (wild or domestic).

12. Conclusions

The importance of ecological corridors and landscape permeability for wildlife was underestimated for many decades. Therefore, at some important places for wildlife movement, no mitigation measures were built. Moreover, there were no concrete studies aiming at identification of ecological corridors and / or critical places. In general, there is still lack of sufficient data on wildlife behaviour in respect to roads.

The TRANSGREEN project offered an opportunity to start with filling the gaps in respect to landscape permeability. Pilot areas benefited by having ecological wildlife corridors analysed at least partially. Therefore, they could serve as a useful example for other areas.



Project co-funded by the European Regional Development Fund (ERDF)

Overall Budget: 2.481.321,16 Euro **ERDF Contribution:** 2.109.122,95 Euro

Project Partners

Austria – WWF Central and Eastern Europe (former WWF DCP, project lead)

Czech Republic – Friends of the Earth Czech Republic – branch Olomouc, Nature Conservation Agency, Transport Research Centre

Hungary – CEEweb for Biodiversity

Romania – Association “Milvus Group”, WWF Romania

Slovakia – National Motorway Company, State Nature Conservancy of the Slovak Republic, SPECTRA – Centre of Excellence of EU – Slovak University of Technology in Bratislava

Associated Strategic Partners

Austria – Ministry for Transport, Innovation and Technology

Czech Republic – Ministry of the Environment

Hungary – National Infrastructure Developing Private Company Ltd.

Poland – Ministry of Infrastructure and Construction

Romania – Ministry of the Environment, Ministry of Transport

Slovenia – Ministry of Infrastructure

Ukraine – Ministry of Ecology and Natural Resources, Transcarpathian Regional State Administration – Department of Ecology and Natural Resources