CONVENTION ON THE CONSERVATION OF EUROPEAN WILDLIFE
AND NATURAL HABITATS

Kresna Technical Workshop in line with Recommendation 212 (2021):

"Challenges & opportunities for the conservation of reptiles and large carnivores during linear infrastructure development in South-East Europe: a case study for the Kresna area, Bulgaria"

22-24 April 2024, Sandanski, Bulgaria

Book of Abstracts

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Contents

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1. Introduction

Hosting a wide range of important species, from invertebrates to large carnivores, and being a critical ecological corridor in the Southwestern Bulgaria region, the Kresna area, including the Kresna Gorge along with the Struma River, is one of the key biodiversity hot spots in the Balkans and Europe. The area is 18 km long between the Mountains of Pirin to the East and Malashevska to the West and is included in two Natura 2000 sites (SAC BG0000366 "Kresna-Ilindentsi" and SPA BG0002003 "Kresna") as well as other strict nature reserves.

At the same time, the Kresna Area is intersected by one of the most important European transport routes for the Orient/East-Mediterranean Corridor, and at present new and/or upgrading infrastructure projects are being discussed for the area.

In order to exchange experience and best practices on the sustainable and integrated development of transport corridors by responding to the needs of ensuring ecological connectivity, conserving biodiversity and achieving resilience to climate change challenges, the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) in collaboration with the Bulgarian Ministry of Environment and Water and with BALKANI Wildlife Society and Infrastructure & Ecology Network Europe (IENE) organised a Technical Workshop entitled "**Challenges & opportunities for the conservation of reptiles and large carnivores during linear infrastructure development in South-East Europe: a case study for the Kresna area**".

The workshop has been organised in-line with the Recommendation 212 (2021) of the Standing Committee of the Bern Convention, on the project to build a motorway through the Kresna Gorge (Bulgaria): #10: "*Consider organising a technical workshop/s in Kresna focused on best practices relevant for the Kresna Gorge and Struma Motorway case involving all concerned stakeholders, and possibly in collaboration with the Bern Convention, Infrastructure & Ecology Network Europe, or other international bodies*".

2. Organisation of the Workshop

The workshop followed the initial concept note agreed by the parties and the Bern Secretariat, while the final agenda has been developed by the organisers together with the key stakeholders, having in mind the following key aspects:

a. It followed the Infrastructure & Ecology Network Europe (IENE) guidelines for workshops.
b. It was a technical workshop dealing with key species groups, connectivity/fragmentation, best approaches and technical solutions, strategic planning, and engineering and safety matters. The outcomes of the discussions on technical approaches and solutions to defragmentation and species and habitats conservation will inform the planning of new linear infrastructure in the Kresna Gorge. Political aspects will not be a subject of discussion.
b. The workshop has been organised in cooperation with the Ministry of Environment and Water of the Republic of Bulgaria and the Bulgarian NGO BALKANI Wildlife Society and the support of JASPERS and CEDR (Conference of European Directors for Roads).
c. While the focus is on the Kresna local specifics, its regional context and on best practices from Europe, it is important to underline its relevance for the wider South-eastern European transport corridors.

d. Its output should be an official written document (but not another Bern Recommendation) in line with the agreed common aim as it is described below.

The workshop took place in the town of Sandanski, Bulgaria, at the hotel "Interhotel" on 22-24 April 2024.

The Aim of the workshop was the exchange of technical knowledge in order to help the parties to work together towards solutions to the Kresna case.

The organisation of the Workshop was a result of collaboration of the Bern Convention Secretariat with the Infrastructure & Ecology Network Europe - IENE, leaded by the independent consultants Lazaros Georgiadis (Biologist – Environmental Consultant, Greece) and Radu Mot (Association Zarand, Romania) who moderated the workshop.

The hosts organisations were the Bulgarian Parties - Ministry of Environment and Water and complainant NGOs leaded by BALKANI Wildlife Society, while key-supporters of the workshop were JASPERS and CEDR.

Three IENE experts have been engaged as special consultants for issues related with biodiversity and infrastructure:

- Lars Briggs (AmphiConsult, Denmark) for reptiles,
- Djuro Huber (University of Zagreb, Croatia) for large carnivores, and
- Niki Voumvoulaki (Egnatia Odos S.A., Greece) for defragmentation strategies and practices.

A preparatory field visit in the Kresna area with the IENE experts was carried out on the 12-13 of March.

The workshop took place in a hybrid format in English and Bulgarian with simultaneous interpretation.

The Organising Team of the workshop consisted by:

- Mr Mikael POUTIERS, Bern Convention Secretariat, France
- Mr Eoghan KELLY, Bern Convention Secretariat, France
- Mr Miroslav KALUGEROV, Ministry of Environment and Water of Bulgaria
- Ms Malina KROUMOVA, Ministry of Environment and Water of Bulgaria
- Mr Andrey KOVATCHEV, Balkani Wildlife Society, Bulgaria
- Mr Lazaros GEORGIADIS, Biologist – Environmental Consultant, IENE, Greece
- Mr Radu MOT, Zarand Association, Romania

The Workshop was funded by the Bern Convention and the Bulgarian Government. The Bern Convention financed the independent IENE experts, while the Bulgarian Government kindly provided funding for local logistics (e.g., venue hire, local transportation, Bulgarian-English interpretation).

3. The topics of the Workshop

In pursuit of bringing together experience and knowledge in the field of transport ecology best practices, the Workshop invited organizations and experts from Europe and all over the world to prepare and submit their abstracts. The topics were related to research or practices for reptiles and large carnivores during Linear Infrastructure development towards understanding the impacts, challenges, and the exchange of knowledge for developing the best solutions adapted to the local context.

The following are some of the research directions and themes in transport ecology that were proposed as the focus of the workshop:

Key species in Kresna Gorge:

Reptiles: *Eurotestudo hermanni*, *Testudo graeca*, *Elaphe quatorlineata*, *Zamenis situla*;

Large carnivores: *Canis lupus*, *Ursus arctos*.

- Biology and ecology of the key species
- Biogeographical role of the Kresna Gorge for the coherence of the NATURA 2000 network and threats
- Habitat loss, degradation, and fragmentation
- Road / rail traffic impact (avoidance, barrier effect, wildlife mortality; human safety, wildlife-vehicle collision)
- Environmental impact assessment
- Pairing/doubling linear infrastructure and assessment of cumulative effects
- Population dynamics
- Biodiversity and resiliency of linear infrastructure
- Defragmentation strategies, ecological reconstruction
- Policy and management
- Strategic planning
- Effective mitigation measures; Avoid – Minimise – Compensate – Decommissioning Hierarchy
- Standards and regulations
- Technical solutions
- Stakeholder engagement
- Animal passages (wildlife crossing structure)
- Infrastructure Habitats
- Landscape integration
- Transportation technology innovation to support environmental protection
- Operation of sustainable linear transport infrastructure
- Monitoring efficiency of solutions

4. The Programme of the Workshop

Day 1, Monday 22nd April 2024, Presentations' Day

All times are stated in Eastern European Summer Time (UTC+3)

WELCOME SESSION	
08:30 - 08:45	**Welcome and opening remarks** Miroslav Kalugerov, *Director of National Nature Protection Service, Ministry of Environment and Waters of Bulgaria,* and Mikaël Poutiers, *Secretary of the Bern Convention on the Conservation of European Wildlife and Natural Habitats, France,* and Elke Hahn, *Chairwoman of IENE Governance Board, Austria.*
08:45 - 09:15	**Brief introduction to Kresna area – specifics, importance, existing and foreseen impacts, aims and challenges**
09:15-09:40	**Keynote speech 1** **Introduction: Defragmentation measures in linear infrastructure projects – perspectives of planning, development, operation and monitoring in light of EU environmental protection requirements** Lise Praestegaard, *JASPERS, EIB / Regional Transport Advisory Division, Austria.*
09:40-10:00	*Coffee break + Poster exhibition**
Reptiles' Session **Reptile species in Kresna, specifics, conservation challenges, impacts and technical solutions for avoidance – mitigation – compensation, defragmentation, ecological reconstruction, best practices and recommendations**	
10:00-10:25	**Keynote speech 2** **An Overview: Reptiles and transport infrastructure** Lars Briggs, *IENE / AmphiConsult, Denmark.*
10:25-10:40	**P I-1: Monitoring of the populations of *Testudo hermanni, T. graeca, Zamenis situla, and Elaphe quatuorlineata* along the section of the first-class international road E-79 (I-1) passing through the Kresna Gorge** Emanuil Mitrevichin, *South-West University "Neofit Rilski" Blagoevgrad, Bulgaria*
10:40-10:55	**P I-2: Fine-scale distribution in four reptile species of high conservation value in the Kresna Gorge, Bulgaria** Emiliya Vacheva, *Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Bulgaria.*
10:55-11:20	**Q & A Session**
11:20-11:35	**P I-3: Fragments of snake sheds as a species identification guide** Nikolay Natchev, *Road Infrastructure Agency, Bulgaria*

11:35-11:50	**P I-4: Barriers and underpasses as a method to decrease reptile road mortality.** **The case of Milos Viper (*Macrovipera schweizeri*) in Greece** Ioannis Ioannidis, *Ecostudies PC, Greece* (*online*)
11:50-12:05	**P I-5: Evidence, tests and unknowns in reptile road ecology and infrastructure mitigation** Silviu Petrovan, *Conservation Science Group, University of Cambridge, UK.*
12:05-12:30	**Q & A Session**
12:30-14:00	*Lunch Break*
<u>Large Carnivores' Session</u> **Large carnivore species in Kresna, specifics, conservation challenges, impacts and technical solutions for avoidance – mitigation – compensation, defragmentation, ecological reconstruction, best practices and recommendations**	
14:00-14:25	**Keynote speech 3** **An Overview: Large carnivores and transport infrastructure** Djuro Huber, *IENE / University of Zagreb, Croatia*.
14:25-14:40	**P II-1: Wolf Canis lupus studies in Kresna-Ilindenci SCI and Kresna Gorge, 2002 – 2024** Elena Tsingarska, *BALKANI Widlife Society, Bulgaria*
14:40-14:55	**P II-2: The role of Kresna river Gorge for brown bear dispersion** Aleksandar Dutsov, *WWF Bulgaria*
14:55-15:10	**P II-3: The use of motorway crossing structures by wolves in Poland** Robert W. Mysłajek, *Association for Nature "Wolf", Poland* (*online*)
15:10-15:40	**Q & A Session**
15:40-15:55	*Coffee break + Poster exhibition**
<u>Session on defragmentation strategies and practices</u> **Specifics, conservation challenges, impacts and technical solutions for avoidance – mitigation – compensation, defragmentation, ecological reconstruction, best practices and recommendations**	
15:55-16:20	**Keynote speech 4** **Sustainability strategies of the Conference of European Directors of Roads (CEDR)** Konstantinos Andreopoulos, *CEDR, Belgium*
16:20-16:45	**Keynote speech 5** **An Overview: EGNATIA Motorway in Greece, a 25 years' experience: from conflict to cooperation for joint-solutions** Niki Voumvoulaki, *IENE / Egnatia Odos S.A., Greece*
16:45-17.00	**P III-1: A new online tool to benefit biodiversity and achieve safe, resilient transport networks: the IENE Biodiversity and infrastructure handbook** Luis M. Fernández, *Minuartia, Spain* (*online*)

17:00-17:15	**P III-2: Defragmentation programme in the Netherlands** Dennis Wansink, *The Netherlands* (*online*)
17:15-17.30	**P III-3: Austria's defragmentation efforts: successes and challenges on stakeholders' engagement** Elke Hahn, *IENE / Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology of Austria* (*online*)
17.30-18:00	**Q & A Session**
18:00-18:15	**Closing of the 1st day + Presentation of the field trip!**
*Posters	

Day 2 – Tuesday 23rd April 2024, Field visit in the Kresna Gorge

Stops of the day	
08:00	Departure from the Interhotel Sandanski
08:30-09.30	1st Stop: Railway Station visit
09:30-12:30	2nd Stop: Stara Kresna coffee and visit above the east alignment tunnel
12:30-14:00	**Lunch (*at participant's own cost*)**
14:00-15:00	3rd Stop: Existing tunnel visit
15:15-16:00	4th Stop: Petrol Station (with coffee)
16:15-17:00	5th Stop: Culvert visit
17:15-18:00	6th Stop: Walking trail visit
18.30	Return to the hotel

Day 3 – Wednesday 24th April 2024, Round Tables day

All times are stated in Eastern European Summer Time (UTC+3)

Welcome session	
08:30-08:45	Introductory remarks (Organisers)
Round Table 1 – Reptiles and strategic solutions	
08:45-09:00	**Setting the scene / Questions and challenges identified by the experts**
09:00–10:30	**Moderated round table discussions** ➢ Raising key questions from participants ➢ Feedback & Discussion ➢ Directions for Solutions
10:30-10:45	Wrap up and short conclusions of the Round Table discussions

10:45-11:00	*Coffee Break*
Round Table 2 – Large Carnivores and strategic solutions	
11:00-11:15	**Setting the scene / Questions and challenges by the experts**
11:15-12:45	**Moderated round table discussions** ➢ Raising key questions from participants ➢ Feedback & Discussion ➢ Directions for Solutions
12:45-13:00	Wrap up and short conclusions of the Round Table discussions
Wrap up and Conclusion	
13:00-13:30	**Wrap up and main conclusions of the Workshop**

The following posters were available during the Workshop:

Poster 1. **Content and use of the European Defragmentation Map.** Marita Boettcher[1,2].
[1]*Bundesamt für Naturschutz (BfN), Germany,* [2]*IENE Governance Board member*

Poster 2. **The Sibiu – Pitesti motorway in Romania: a case study on integrating infrastructure development and nature conservation.** Silvia Borlea[1], Marius Nistorescu[1], Alexandra Doba[1], Radu Mot[2],
[1]EPC *Environmental consultancy,* [2]*Zarand Association, Romania.*

Poster 3. **Defragmentation of motorway project for 4 species of reptiles and 2 species of large carnivores Struma motorway in the NATURA 2000 area of Kresna Gorge**. Andrey Kovatchev[1],
[1]*BALKANI Wildlife Society, Bulgaria.*

5. Abstracts of presentations (Per session)

Welcome Session

Opening words by Ministry of Environment and Waters of Bulgaria

Miroslav Kalugerov[1],

[1] *Director of National Nature Protection Service, Ministry of Environment and Waters of Bulgaria,*

Dear representatives of the Secretariat of the Bern Convention,

Dear experts of IENE, CEDR and JASPERS,

Dear representatives of the scientific and academic community,

Dear representatives of the local community,

Dear representatives of NGOs,

Dear representatives of Bulgarian Authorities,

Dear Guests,

My name is Miroslav Kalugerov and I am Director of the National Nature Protection Service Directorate at the Ministry of Environment and Water.

Allow me to extend a warm welcome to all of you!

This workshop is being held in conjunction with Recommendation 212 (2021) and the resolutions of the 43rd meeting of the Standing Committee of the Bern Convention. The seminar is organized by the Bern Convention Secretariat, in cooperation with the Infrastructure & Ecology Network Europe (IENE), the Bulgarian Government, Balkani Wildlife Society, and other NGOs. The subject of this workshop is extremely interesting and important. For three days, we will have the opportunity to exchange experience and knowledge on the challenges and opportunities for the conservation of reptiles and large carnivores in the course of the development of linear infrastructure.

In order to avoid any confusion, I must specify that this forum aims at exchanging experience and good practices for sustainable integrated development of transport corridors in response to the needs of ensuring ecological connectivity, road safety, biodiversity conservation, and achieving resilience to the challenges of climate change, and not for concrete solutions to the implementation of the Struma Motorway section in the Kresna Gorge region.

We will discuss the challenges to the construction of large infrastructure projects and the way in which the objectives of economic development are reconciled with the objectives of biodiversity conservation, in particular the protection of reptiles and large carnivores.

For the many years that I have been working in the field of environmental and biodiversity conservation, I have convinced myself of one very important thing, namely that it is only through balance that we can achieve the objectives of sustainable development. The most important thing to ensure the nature conservation is to make science-based decisions and implement applicable and feasible measures by which to optimally balance all objectives of environmental conservation, infrastructure development, human safety, and the ensuring of the effectiveness of complex systems of social relations in this regard.

I hope the event will be beneficial for all participants.

Opening words by the Bern Convention Secretariat

Mikael Poutiers[1]
[1] *Secretary of the Bern Convention, France*

Good morning all. My name is Mikaël Poutiers.

I am the Secretary of the Bern Convention on the Conservation of European Wildlife and Natural Habitats. I don't have time now to elaborate on the Bern Convention. I only wish to stress that the aims of the Convention are to conserve wild flora and fauna and their natural habitats, in particular endangered and vulnerable species.

The Bern Convention mechanism provides a platform for different stakeholders from across society to discuss issues. The Convention ensures, among other tasks, a monitoring of the obligations of the countries.

One way of doing monitoring is through the case-file system. The case-file system is a unique monitoring tool based on complaints for possible breaches of the Convention that can be submitted by NGOs or even private citizens against a state party to the Bern Convention. The Convention's institutions then take action to enable a process of finding solutions to the issue at stake.

In certain cases, an on-the-spot appraisal, conducted by an independent expert, can take place in the site concerned. The on-the-spot appraisal results in a recommendation to the government concerned, but the purpose of this appraisal is more than just that piece of paper. It's also about bringing together the different stakeholders in dialogue, so the process is as important as the results.

Let's come to the Kresna issue.

A complaint was first issued in 2001 by a group of NGOs in Bulgaria on the construction of a motorway from Sofia to Thessalonica through the Kresna Gorge. We are all aware of the importance of the Kresna gorge for biodiversity in the region, but the strategic importance of the international road connection should also be considered.

An on-the-spot appraisal was carried out in 2002. It emphasised that the construction of the motorway by enlarging the current road would substantially increase damage to a unique site without possible measures of compensation, and the Standing Committee – which is the governing body of the Bern Convention – asked the authorities to continue to study alternative routes located outside the gorge.

In 2009, the Standing Committee decided to close the case as Bulgaria informed it that the decision to avoid the Kresna Gorge has been taken and that a "tunnel" alternative was being considered. However, in 2015 eight Bulgarian NGOs informed the Committee that the Bulgarian government planned to construct the last section of the Struma motorway through the Kresna Gorge and to reject the tunnel alternative. Subsequently, the Committee decided to consider this closed file as a possible file again and decided in 2020 that another on-the-spot appraisal should be carried out.

In 2021, an online advisory mission was carried out. It resulted in Recommendation 212 (2021), which, in particular, encouraged a better collaboration between parties and efficient use of available data to make informed and holistic decisions.

In particular, it recommended to the Government of Bulgaria to (I quote):

"Consider organising a technical workshop in Kresna focused on best practices relevant for the Kresna Gorge and Struma Motorway case involving all concerned stakeholders, and possibly in collaboration with the Bern Convention, Infrastructure & Ecology Network Europe, or other international bodies".

This is exactly what we are doing today and until Wednesday.

I therefore thank the Bulgarian authorities and the NGOs for their involvement in the preparatory phases of this event, as well as IENE and our independent experts. We are here to learn about the specific situation of the Kresna Gorge from those who know it best, and to listen and discuss challenges and possible solutions amongst competent experts both from Bulgaria and further afield.

While we cannot expect to find final solutions during these 3 days, I am sure that there is good will in this room and that we will arrive to provide our Bulgarian colleagues from both the governmental and non-governmental side with a pathway towards identifying solutions to ensure a safe road connection while preserving the vitally important biodiversity in the Kresna Gorge.

I wish us the best in this technical workshop and every success in our work.

Thank you very much.

Opening words by Infrastructure & Ecology Network Europe (IENE)

Elke Hahn[1,2]

[1] *Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology, Vienna, Austria*

[2] *IENE Governance Board Chairwoman*

IENE is a network of experts working with various aspects of transportation, infrastructure, and ecology. The network was initiated in 1996 to provide an independent, international, and interdisciplinary arena for the exchange and development of expert knowledge – and with the aim to promote a safe and ecologically sustainable pan-European transport infrastructure. Since 2019 IENE is a non-profit, nongovernmental, non-political, formalised association based in Paris.

IENE arranges international conferences, workshops, training seminars and symposia, initiates collaboration projects and helps answering questions that require a joint international expertise. In particular, the IENE workshops are used to organise a framework for the exchange of knowledge and best practices on a specific topic or geographical area in order to contribute the collection of the best available information, the support of networking and to the strengthening of multidisciplinary and multisector cooperation.

In Eastern Europe there are a lot of defragmentation challenges as there are still pristine and wild areas important for biodiversity and the survival of wildlife, while at the same time there is a demanding pressure for economic development and the upgrading and expanding of existing transport networks. IENE has made several initiatives and has set up a special regional working group for Eastern Europe and the Balkans (the GreenWeb) contributing to the development of defragmentation policies and effective practices in the area.

Recognizing the mistakes of Western Europe as one of the most fragmented areas of the planet, and adopting the principle of the Mitigation Hierarchy to give priority to the avoidance of fragmentation was highlighted by the Declaration of IENE 2022 International Conference in Cluj-Napoca by its participants.

It is essential to address the above-mentioned challenges to develop a resilient transport system, which harmonizes economic development with biodiversity protection. In the name of IENE we wish all the best for the Kresna Technical Workshop and would like to share an invitation for the next IENE 2024 International conference, September 9-13, in Prague.

Brief introduction to Kresna area – specifics, importance, existing and foreseen impacts, aims and challenges

Malina Kroumova[1], Andrey Kovatchev[2]

[1] Representative of the Bulgarian Authorities
[2] Balkani Wildlife Society, Bulgaria

Keywords: South-western Bulgaria, Nature protection, linear infrastructure development, defragmentation, Hermann's Tortoise, Spur-thighed Tortoise, Leopard Snake, Four-lined Snake, Wolf, Bear, habitat functioning, challenges

Abstract

The 18 km long Kresna gorge is situated on the Struma River, which runs through Southwest Bulgaria from North to South between the third highest mountain on the Balkans – Pirin (2914 m) and the Malashevska Mountain (1803 m). The average altitude of the gorge is ca. 220 m. It is a ravine with steep stony slopes and smaller rocky habitats on the border of two climatic zones with an abundance of flora and fauna species.

Nature protection efforts in the area have a long history with the first nature reserve "Tissata" established already in 1949 to preserve the only compact site of Greek juniper (*Juniperus excelsa).* In 2006 two NATURA 2000 sites were proposed – SPA BG0002003 "Kresna" for the protection of 147 bird species and SAC BG0000366 "Kresna-Ilindentsi" for the protection of 35 types of habitats, 15 mammals species including bats, 7 amphibians and reptiles, 4 fish, 16 invertebrates, 1 plant.

Due to the topography of the region, the area is also the only viable transport corridor part of the Trans-European Transport Network. The existing road is the busiest international road, connecting Romania, Bulgaria and Greece, carrying heavy international traffic with increasing intensity. It is accident prone with a high road death toll. It also currently lacks appropriate mitigation measures to address fragmentation and wildlife collisions.

Studies for the development of the Struma Motorway, a major project for the EU, have started more than 20 years ago and over the years, more than 20 options for this section have been discussed. In 2008, EIA/AA for the entire Motorway assessed eight alternatives and approved Long tunnel (subject to further improvement). The implementation of the Long tunnel met serious challenges in the subsequent design phases, which lead to the development of more alternatives. The 2017 EIA/AA assessed five alternatives, approving the so called Eastern G10.50, which includes two separate carriageways each 10.5 m wide – a new bypass of the gorge to the east for South-North traffic, and the existing road to be used in the North-South direction.

The development of linear infrastructure through the area faces a number of technical challenges but more importantly affects the rich biodiversity in the area. Relevant to the point of the workshop are four key reptile protected species (*Zamenis situla, Elaphe quatuorlineata, Testudo graeca* and *Eurotestudo hermanni)* and two large carnivores (*Ursus arctos, Canis lupus).* For the reptiles the Kresna gorge represents a regional narrow bio-corridor important for the long term dispersal of populations (south-north).

For the snakes, the gorge functions as a linear habitat with individual homeranges structured along valleys. Habitats are important for daily and seasonal migrations. The population of the two tortoise species is much more abundant both in the area and nationally and they inhabit the gorge as well as the surrounding area. Nevertheless, as for the snake the existing road presents a serious barrier and fragments the population.

In regard to reptiles, the challenges posed by the existing linear infrastructure and development plans are related to the lack of sufficient data and increasing pressure from the existing road on which defragmentation measures cannot be implemented without stopping the traffic - and there is no alternative route. It is important to focus on the restoration of populations in the gorge and the implementation of sufficient and effective defragmentation measures in the gorge as much

as possible. This should be the case regardless of how the option chosen for the Motorway to reduces/eliminates wildlife - vehicle collisions (WVC) and guarantee daily movements of individuals (it is unclear whether traffic reduction without defragmentation will be enough to provide restoration). All efforts need to be supplemented by systematic, continuous monitoring of key species and the effect of traffic on their conservation status.

The "Kresna-Ilindentsi" site is also important for the protection of the wolf and the bear. For both species it functions as a bio-corridor in the East-West direction. The site is too small to maintain an independent bear breeding population (sharing individuals and population with adjacent sites), but it is an important bio-corridor for dispersal of the species and a summer feeding habitat. Occasional migrations through the gorge are observed but there is no viable population to the west, although historically there was a population (extinct since the 20th century) there.

The wolf has a permanent population in the area with a rich feeding base. East-west movements through the gorge are observed more often than for the bear. There are viable populations on both sides of the gorge. Having in mind the functioning of the habitat it is important to ensure effectively planned and properly managed defragmentation facilities are present in the new infrastructure to avoid the establishment of barriers in the construction of new linear infrastructure. It is also important to avoid as much as possible the destruction of feeding and hunting habitats for the two species, but also consider the effects of infrastructure on other habitats and species protected in the area, such as birds, bats, etc.

Keynote Speech 1

Introduction: Defragmentation measures in linear infrastructure projects – perspectives of planning, development, operation and monitoring in light of EU environmental protection requirements

Lise Praestegaard[1]

[1] *JASPERS, EIB / Regional Transport Advisory Division, Austria.*

Contact: Lise Praestegaard, **E-mail**: l.praestegaard@eib.org

Keywords: EU environmental Directives, EU environmental policies and strategies, Impacts assessments, development of defragmentation measures in assessments, tools in impact assessments, conflicting interests in mitigation measures.

Abstract

The presentation introduces road and rail linear infrastructure and the impact assessment requirements and practices as per the relevant environmental directives. The main directives covered are the Strategic Environmental Assessment Directive (SEA), the Environmental Impacts Assessment Directive (EIA), the Habitats (HD) and Birds Directives (BD), and the Water Framework Directives (WFD). The links between the environmental directives and the EU policies and strategies such as the European Green Deal and the Biodiversity Strategy will also be included.

A further focus will be on the intention of the directives (referring to the TFEU – the Treaty of the Functioning of the EU) as well as on the timely and integrated application of the directives in the project cycle of the development and operation of linear infrastructure from the early idea of a transport strategy to the monitoring of a realised project.

Some road and rail projects cases from across Europe that have included the development of defragmentation measures in the conducted impacts assessments will be presented.

Related to this, the presentation will touch upon a defragmentation baseline (methods for assessing and the meaning and use of the precautionary principle), project impacts assessments, best practices and tools, the definition/development/testing/iteration principles of Impacts Assessments used to develop defragmentation measures as well as the differences between mitigation and compensation measures. The aspect of conflicting interests in mitigation measures will also be covered.

Finally, the presentation will focus on monitoring defragmentation measures and on the feedback from monitoring results into project operation.

I. REPTILES' SESSION

Reptile species in Kresna, specifics, conservation challenges, impacts and technical solutions for avoidance – mitigation – compensation, defragmentation, ecological reconstruction, best practices and recommendations

Keynote Speech 2

An Overview: Reptiles and transport infrastructure

Lars Briggs[1,2]

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[2]*IENE expert*

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Keywords: Reptiles, fauna passages, tunnels, fence, pilot projects, process projects.

Abstract

As society develops, the traffic increase on existing roads and new roads are often built in areas of high herpetological importance. For 30 years I followed the development of fence and tunnel systems for herpetofauna in Europe and the literature on this topic in the USA. The talk will give an overview of the technical solutions for tortoises, snakes and lizards.

Examples of pilot projects in different countries will be presented - Denmark (2 lane road, 2006), Sweden (2 lane road, 1997), Poland (2 lane road, 2002), Denmark (motorway, 2008), Lithuania (2 lane road, 2013), and Estonia (2 lane road, 2015), all funded by the respective countries' National Road Agencies.

Another type of project important for herpetofauna will highlight the facilitation of knowledge transfer in the context of societal challenge in countries during transition from planed economy and communism towards democracy and rapid economic development. Examples from herpetological planning in relation to roads,during the pre-EU accession period and afterwards will be presented - Poland (DANCEE project 2000-04), Slovenia (LIFE Amphicon 2000-2026), and similar LIFE projects.

Presentation I-1: Monitoring of the populations of *Testudo hermanni, T. graeca, Zamenis situla,* and *Elaphe quatuorlineata* along the section of the first-class international road E-79 (I-1) passing through the Kresna Gorge

Emanuil Mitrevichin[1], Denitza Pavlova[2], Krasimir Stoyanov[1], Alexander Pulev[1]

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Keywords: Balkans, South-western Bulgaria, biology, ecology, threats, Hermann's Tortoise, Spur-thighed Tortoise, Leopard Snake, Four-lined Snake.

Abstract

Although studies on *Testudo hermanni* and *T. graeca* have been conducted for more than a century in Bulgaria, little or no data have been published on some aspects of their biology and ecology. Moreover, most of the local populations have still not been examined.

The aim of the study, carried out from 2020 to 2023, was to examine two local populations of the Hermann's and the Spur-thighed Tortoise that coexist.

Here we present data on the numbers, age structure, sex ratio, diet, and morphometry of the two populations. We also provide information on the threats identified in the study area.

The results showed that *T. hermanni* was more abundant than *T. graeca* – 2.3:1, respectively. The age structure of both species was similar – the adults outnumbered the subadults and the juveniles. The sex ratio was in favour of males in the Hermann's Tortoise – 1.6:1 (n = 346), whereas it was in favour of females in the Spur-thighed Tortoise – 1.84:1 (n = 142). *Testudo graeca* fed exclusively on plants, whereas *T. hermanni* was more opportunistic and supplemented its diet with other sources of food. The morphometric data showed that *T. graeca* was larger than *T. hermanni* and that females of both species were larger and heavier than males.

The biggest threat identified for both species of tortoises was the traffic on the European road E79. Our results indicated that *T. graeca* was more vulnerable to mortality caused by traffic than *T. hermanni*, with mortality rates of 14.9% (n = 174) and 8% (n = 412), respectively.

In addition to providing data on the two species of tortoises, we also present some information on two other species of reptiles inhabiting the Kresna Gorge: *Zamenis situla* and *Elaphe quatuorlineata*. Similar to the tortoises, road traffic posed the greatest threat to the populations of *Z. situla* and *E. quatuorlineata*. Approximately 94% (n = 35) of the registered Leopard snakes and 80% (n = 15) of the registered Four-lined snakes were found dead on the road. In both species, the juveniles were the most frequently road-killed age group: approximately 67% in the Leopard snake population and 83% in the Four-lined snake population.

Presentation I-2: Fine-scale distribution in four reptile species of high conservation value in the Kresna Gorge, Bulgaria

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Keywords: Kernel Density Estimate, *Elaphe*, *Testudo*, *Zamenis*

Abstract

Kresna Gorge is an important natural bio-corridor for numerous plant and animal species, and the Northern end of the gorge marks the Northern limit of the distribution of several Mediterranean species in Bulgaria. The gorge was included in the Natura 2000 Network as the SCI BG0000366 “Kresna-Ilindentsi”.

A total of 11 amphibian (3 Caudata and 8 Anura) and 23 reptile species (3 Testudines, 7 Sauria and 13 Serpentes) inhabit the SCI. All of these species are protected by at least one or several national or international acts (i.e., Bulgarian Biological Diversity Act, the EU Habitats Directive, Bern Convention). Two amphibian (*Triturus ivanbureschi* and *Bombina variegata*) and five reptile species (*Emys orbicularis*, *Testudo hermanni*, *T. graeca*, *Elaphe quatuorlineata* and *Zamenis situla*) are also included in the Annex II of Directive 92/43/EEC, and two of them have very limited distribution ranges in Bulgaria: *Z. situla* is distributed only along the southern Black Sea cost as well as along the Struma River Valley in South-Western Bulgaria, while *E. quatuorlineata* is distributed only in the South-Western Bulgaria, and for both species, the Kresna Gorge marks the Northern limit of their ranges.

For *Testudo hermanni, T. graeca, Elaphe quatuorlineata* and *Zamenis situla***,** the species’ distribution data within the Kresna Gorge was collected by the authors between 2000 and 2023. Kernel Density Estimate (KDE) in Geospatial Modelling Environment (GME) was used to determine the important sites for the four species. The combined locations of the four species were used to calculate the utilisation spread (UDs). "Fixed Kernel" with a bandwidth value determined by the "Plug-in" evaluation principle ("Plug-in estimator") was used for the analysis. The resolution (cell size) of the UD surface was set at 10 m. 95%, 90%, 50% and 25% isopleths (isolines, density contours) were calculated based on all locations of the 4 key species. A total of 2,189 individual locations of reptiles and amphibians were established during the course of the study. From them, 645 were of the four key species: 230 *Testudo hermanni*, 326 *T. graeca*, 34 *Elaphe quatuorlineata* and 55 *Zamenis situla*. Although the locations fall across a large part of the study area (and not only in the Gorge), the main concentration is in the central and Southern part of the Gorge, as well as a smaller cluster at the South-eastern part of the town of Kresna.

Our goal was to combine all available data concerning the distribution of the four species of main conservational importance within the Kresna Gorge - *T. hermanni, T. graeca, E. quatuorlineata* and *Z. situla*. We believe that the results of the study would support the decision-making process for the “Struma” motorway, in accordance with the relevant EU legislation.

Presentation I-3: Fragments of snake sheds as a species identification guide

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Keywords: Protocol for identification of snake species, Wildlife Vehicle Collisions, Oberhauchen cells, interscale follicles, ventral scales

Abstract

A large variety of snake species is present on Bulgarian territory and for many the road surface and its vicinity may represent a component of their habitats. While road effects may attract or repel different snake species, they may be involved in Wildlife Vehicle Collision (WVCs) events and would usually be severely injured or killed as a result.

Mapping of WVCs hotspots and the identification of the killed specimens represents important information for the planning and designing of proper mitigation measures. Unfortunately, in the case of snakes very often only a few body parts and body liquids remain after a WVC.

As a response to this, we developed a special protocol for the identification of snake species based on the analysis of tiny pieces of skin collected as a result of WVCs. We performed a special algorithm, which allows for the production of permanent microscope slides and, based on morphology of the Oberhauchen cells from the basal scale area and of the Interscale follicles, we can positively identify the snake species. In the case when only ventral scales could be collected, we were able to identify the species by the cells from the free end of the scale.

We have prepared a catalogue of the analysed species from the Bulgarian fauna but we will be able to complete it in the future with species from other regions of the world.

Presentation I-4: Barriers and underpasses as a method to decrease reptile road mortality. The case of Milos Viper (Macrovipera schweizeri) in Greece

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Keywords: Road mortality, reptiles, barriers, tunnels, underpasses, monitoring

Abstract

Milos Viper (*Macrovipera schweizeri*) is considered to be one of the most threatened reptile species in Europe. The high mortality rate is a serious threat for the main population of this species on the Milos island in Greece. Since 1990, the main source of human-caused mortality are road casualties. Between 1993 and 2006, it has been estimated that 183-537 vipers were killed annually on the road network of Milos, a mean of more than 10% of the total viper population per year.

The main viper population survives in the Western part of the island, a somewhat “remote” area due to the absence of asphalted roads.

The plan of improving the main road that runs around the western part of Milos emerged as a new and significant additional threat for the species. As an experiment for a viable long-term solution to this problem, during the December 2005, we constructed concrete “L”-shaped barriers with a total length of 800 meters in three parts of the road network with high mortality rates. Six underpasses were built in between the barriers and four different designs for underpasses were used in order to test their effectiveness.

To evaluate the efficiency of the barriers and underpasses, the monitoring of their usage by the vipers was carried out between 2006 and 2008, with daily inspections of tracks on a sand layer and by using of an IR-camera.

No vipers, dead or alive, were found on the road surface in the areas where barriers were constructed while the underpasses permitted the vipers to pass safely under the road with no significant signs of avoidance. In the 2006-2008 period, a mean of 0,8 vipers/ day used the underpasses to cross the road. 84% of the vipers that have met an underpass have used it to cross the road.

The results were considered very positive and it was proposed to expand the network of barriers and underpasses in order to minimize road mortality. This has not happened until now, but the

roads of Western Milos were not improved either. However, many lessons were learned during this pilot-project

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Presentation I-5: Evidence, tests and unknowns in reptile road ecology and infrastructure mitigation

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Keywords: reptile, systematic data, mitigation and needed measures, risks, robust evidence, optimisation of monitoring data, decision-making, effectiveness of mitigation, cost-effectiveness.

Abstract

The global road network is the largest man-made infrastructure, with enormous impacts on species and habitats. However, not all mitigation actions are cost-effective, and many knowledge gaps remain. A critical and systematic review of the effectiveness of mitigation actions could guarantee optimal spending of public budgets and clarify evidence gaps.

For reptiles, the information on specific road impacts and mitigation in Europe is substantially scarcer compared to amphibians, but snakes and lizards are known to sometimes be attracted to roads and road verges for basking and reptiles are often forced to move across roads during longer-distance movements (e.g., for mate searching or dispersal).

There is a growing literature on European reptiles as roadkill and the threat of fragmentation from road building, but population-level impacts of roads are rarely demonstrated, meaning comparative site mitigation prioritisation is difficult. Unlike amphibians, reptiles are mainly diurnal and thus tend to get killed on roads during the day, meaning carcasses are often rapidly removed by widespread scavengers such as corvids, further reducing the evidence of impact.

Numerous reptile species are legally protected in Europe and thus mitigation can be required as part of planning, especially for newly built roads, where negative impacts are expected on reptiles.

I discuss systematic data on reptile mitigation and needed measures, risks with reptile mitigation implementation in the absence of robust evidence (e.g., especially for comparative mitigation structures such as round versus box culvert underpasses) and present a pragmatic view forward, especially on guidance, optimisation of monitoring data and their value for better decision-making.

II. LARGE CARNIVORES' SESSION

Large carnivore species in Kresna, specifics, conservation challenges, impacts and technical solutions for avoidance – mitigation – compensation, defragmentation, ecological reconstruction, best practices and recommendations.

Keynote Speech 3

An Overview: Large carnivores and transport infrastructure

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Keywords: Brown bear, wolf, lynx, large carnivores, movement corridors, green bridges, permeability of highway, Croatia, Kresna Gorge

Abstract

Large carnivores (bears, wolves, lynx) need very large ranges as individuals and much larger as populations. Their living space (defined as habitat) is globally very diminished by urbanization, industry, agriculture exploitation of natural resources and pollution. However, even the remaining adequate habitat is highly fragmented by various anthropogenic linear infrastructures (mostly highways, roads and railroads) and the remaining patches are simply too small. Genetic isolation resulting in the loss of variability and vitality is the most serious limitation adding to the insufficient space for finding food and shelter (including denning areas for wintering and reproduction). The positive side is that the effect of fragmentation by highways can be mitigated by making them permeable for large carnivores to a certain minimum level. The operation is sensitive, requires expertise and is costly (although it represents a minor share of the total highway construction costs.) The structures where large carnivores and other larger mammals can cross the highway route have to be large: a rough rule is over 100m of width of the pass for an animal crossing. The best places are where the road is in the tunnel, followed by viaducts and bridges. In Croatia, if there is no such structure within a range of about 2 km, a special overpass called a green bridge over 100 m wide should be constructed.

The presentation illustrates and describes how this was solved in Croatia on over 500 km of highways built since 1999 transecting the range of large carnivores. A total of 13 green bridges (100 – 250 m wide) were placed in critical corridors. Together with tunnels and viaducts, the total permeable share of highway length now ranges between 11 and 25% on various sections. The subsequent monitoring showed that the large carnivores and all other species of animals are crossing the new highways and the effect of fragmentation is sufficiently mitigated. The challenge is the maintenance of highway fencing and managing the appearance and removal of all obstacles from the crossing structures.

Presentation II-1: Wolf Canis lupus studies in Kresna-Ilindenci SCI and Kresna Gorge, 2002 – 2024

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Keywords: Wolf, *Canis lupus*, habitats, home ranges, dispersal, gene flow, animal passage, highway, structures, Kresna Gorge

Abstract

Wolf ecology has been studied in the NATURA 2000 SCI Kresna-Ilindenci site since 2002. The existence of family groups and their dynamics have been monitored here for more than 20 years. Methods like snow-tracking, recording all signs of the species' presence, telemetry, genetic analysis, camera trapping, wolves' interactions with livestock, records of killed wolves etc. were used. Data on wolf pack home-ranges, utilization of habitats, pack sizes, movements, dispersal and mortality has been obtained.

The permanent presence of two wolf packs has been recorded and regularly monitored in the Eastern part of the Natura 2000 site, and the collected data also prove the existence of wolf packs in the Western part of the Kresna-Ilindeni SCI.

The pack's home-range sizes are around 100 – 160 km^2. The habitats in the area of the planned route of the motorway are optimal for wolves and they are part of the established wolf packs home ranges. Dispersal of individuals was recorded through telemetry, camera trapping, and genetic analysis. In 2009, a young male wolf crossed the Gorge at least 11 times during his dispersal period. Wolves were recorded in the Gorge by camera traps and killed in traffic in 2014, 2018, and 2023. Kinship genetic analyses reveal close relations between individuals from the Pirin Mountains in the East and those from the mountains West of the Gorge.

There is a clear indication that the habitats within the Kresna Gorge play a role of bio-corridor in wolf dispersal in the area and are crucial for the exchange of individuals (gene flow) between Pirin Mts. (i.e. the Rilo-Rhodopean massive) and the mountains to the West.

According to the Wolf Action Plan for Bulgaria (2022 – 2031), Kresna Gorge is a critical point at which fragmentation of the species population in the region would occur if the planned motorway was not provided with a sufficient number of effective passageways for large mammal species.

Records of wolves' daily movements using telemetry show frequent movements of 10- 15 km per day. In summary, there is a permanent presence of wolves in the mountains around the Kresna Gorge and within the Gorge itself.

Presentation II-2: The role of Kresna river Gorge for brown bear dispersion

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Keywords: Brown bear, dispersion, barrier effect, habitat use

Abstract

Kresna Gorge is a key habitat from a biogeographical and ecological point of view. Mediterranean influence forms a biodiversity hotspot of a very high level. The gorge itself is a unique habitat, the least cost migration path and, at the same time, a natural barrier for movement of wildlife.

The Brown bear in Bulgaria exists in two subpopulations, the Central Balkan and Rilo-Rhodopean. There are two published models of brown bear habitat suitability in Bulgaria and both models indicate the high suitability of the Kresna area for bears.

The average distance travelled by bears is estimated to be around 6 km per day. Telemetry data shows that bears are travelling large distances and need huge individual territories (between 53 and more than 300 sq. km.). In order to avoid inbreeding and sustain a healthy population, bears have to maintain connectivity in order to ensure the geneflow.

The only contact zone between the Rilo-Rhodopean subpopulation in Bulgaria and the mountains in Republic of North Macedonia (where bear presence is scarce although the habitats are suitable), is the area of Kresna Gorge where the Pirin and Malishevska mountains are in close contact, separated only by the Struma River and the steep slopes of the gorge. However, within the Gorge the crossing spots for bears and the intensified traffic on the existing European road increases significantly the barrier effect.

The recorded activity of bears (feeding, excrements, direct observations, camera traps, footprints, damages on livestock and beehives etc.) shows the importance of this territory for feeding, shelter, seasonal presence and the dispersion of different individuals.

Maintaining population connectivity is essential to facilitate the recovery of bears in suitable habitats historically inhabited by them.

Presentation II-3: The use of motorway crossing structures by wolves in Poland

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Keywords: *Canis lupus*, habitat defragmentation, road mortality, mitigation measures

Abstract

The grey wolf (*Canis lupus*) is strictly protected in Poland and inhabits major forest tracts nationwide. After Poland's accession to the European Union, the development of transport infrastructure accelerated, affecting the integrity of wolf habitats and increasing road mortality. However, these problems were partly mitigated, mainly by building various types of wildlife crossing structures on motorways.

To reveal the patterns in the use of motorway crossing structures by wolves, we applied GPS-GSM telemetry to 25 individuals. We also conducted on-site monitoring of the various types of crossing structures with camera traps and sand beds. The research projects were undertaken across Poland's mountains and lowlands from 2010 to 2024.

We found that wolves frequently cross various types of public roads within their home ranges and are especially threatened by vehicle collisions during dispersal through unknown areas. All motorways and express roads in Poland are obligatorily fenced, thus, wolves often seek crossing structures to overcome such barriers. Individuals tracked with GPS-GSM collars used all types of crossing structures but were most often recorded on wide overpasses. Monitoring on crossing structures also revealed that wolves used underpasses, overpasses, and widened bridges, but their crossing rate was highest on wide overpasses.

Data from camera traps showed a significant difference in activity patterns between wolves, humans, and pets. While wolves were nocturnal, people and dogs tended to be diurnal. The activity patterns of wolves had a strong overlap with prey species (wild ungulates and lagomorphs). Moreover, we recorded an increase in the number of crossings by wolves in the subsequent years of the monitoring, which provides further evidence for the hypothesis that wild animals require time to adapt to newly established crossing structures.

III. SESSION ON DEFRAGMENTATION STRATEGIES AND PRACTICES

Specifics, conservation challenges, impacts and technical solutions for avoidance – mitigation – compensation, defragmentation, ecological reconstruction, best practices and recommendations

Keynote Speech 4

Sustainability strategies of the Conference of European Directors of Roads (CEDR)

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Keywords: Biodiversity, wildlife, road infrastructure, road management, strategy, sustainability, safety, mitigation, invasive species, habitats

Abstract

The presentation focused on the recent and ongoing work undertaken by CEDR on the impact of roads on biodiversity and wildlife. The necessary links between this topic and the strategy of CEDR on sustainability and road safety were also highlighted.

In 2012 CEDR published a report entitled 'mobility for humans and wildlife' which included cost-effective ways forward and proposed solutions aimed at reducing the adverse effects of road infrastructure on biodiversity. In more recent years, five projects were concluded as part of CEDR's Research Calls on Roads and Wildlife (2013) and Biodiversity and Invasive Species (2018). The overall aim of these projects was to create a more efficient European road management in compliance with the needs of wildlife including the necessary links with EU legislation, procurement and road maintenance. The scope of the projects also included the protection of alien invasive plant species and the improvement of Europe's infrastructure habitats along roads.

Another recent CEDR initiative was the report on maintenance of ecological assets on transport linear infrastructure produced in 2020, which dealt with the critical issue of developing appropriate maintenance of ecological assets in Europe to guarantee the long-term performance of wildlife mitigation measures. This report has contributed to IENE's handbook focused on best practices to benefit biodiversity and achieve sustainable and resilient infrastructure. CEDR has also been involved through its members in additional relevant projects such as BISON and LIFE SAFE CROSSING, among others.

Now in order to reach the aims of the initiatives mentioned above, the development of an overarching European strategy on sustainability is needed together with a much more systematic approach to road safety. Sustainability should be seen holistically and through its three main pillars which are the protection, restoration and enhancement of the environment including wildlife (1), the economic efficiency (2) and social wellbeing (3). In this context, CEDR is currently working on a sustainability strategy with common language and specific goals.

On road safety, which is a vital part of sustainability too, the focus of CEDR has expanded to include aspects such as new types of road users and vehicles as well as training and education, among others. This is the so-called safe system approach which goes beyond the traditional theme of road infrastructure safety. Moreover, road safety means safety for everyone

irrespective of mode, vulnerability, behaviour or purpose – and to make the link with biodiversity and wildlife, everyone means animals too.

Keynote Speech 5

An Overview: EGNATIA Motorway in Greece, a 25 years' experience: from conflict to cooperation for joint-solutions

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Keywords: Motorway management, Brown bear, defragmentation, permeability improvement of structures, bear-proof fence, cooperation with NGO's, stakeholder commitment

Abstract

The development of road networks constitutes a fundamental prerequisite for the economic growth of human communities, since roads are one of the main infrastructure networks that ensure the movement of goods and the communication of people. The development and implementation of roads should nevertheless have no environmental impacts whatsoever and should ensure at the same time the genetic communication between wildlife species and the continuity of natural habitats.

The subject of the presentation is the case of the Egnatia Motorway and the lessons we extracted from more than 25 years' experience for effective and sustainable planning, construction and operation of its 1,000 km-long road network.

From the era of conflicts with NGOs, legal interventions at the Council of Europe and the Council of State for several cases, in order to avoid loss of biodiversity (namely the brown bear) in the Region of Western Macedonia, Greece, as well as to ensure the genetic communication of the species, EGNATIA ODOS S.A. proceeded gradually to the era of cooperation with the NGOs, to assure joint solutions for the protection of the environment.

EGNATIA ODOS S.A. has worked with general principles for sustainable transportation infrastructure, in the framework of IENE (Infra Eco Network Europe) guidelines, aiming at the protection of biodiversity and ecological connectivity of natural habitats, with the adoption of:

1. The general principle of prioritizing the selection of Avoidance - Mitigation-Compensation in "grey" infrastructure design.
2. The recognition of Ecological Corridors as basic "green" infrastructure sections, and
3. The implementation of the ecosystem approach in environmental monitoring of all development plans.

The experience shows that a "coalition" is needed between technocrats and environmentalists and a pro-active approach for more robust results, concerning not only environmental protection but also gain in all sectors: life safety, time, money, animal lives etc.

Multi-disciplinary cooperation is also a need, as well as to share and use experience and innovation, training for technical staff and ongoing monitoring, considering the dynamics of animal populations.

Finally, MAINTENANCE is the action that will ensure the effectiveness of any possible environmental protection measures taken.

Presentation III-1: A new online tool to benefit biodiversity and achieve safe, resilient transport networks: the IENE Biodiversity and infrastructure handbook

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Keywords: Handbook, Biodiversity, Infrastructure, Mitigation measures

Abstract

Mainstreaming biodiversity in the planning, design and operation of transport infrastructure may help to reduce biodiversity loss as well as achieving a safe, resilient, sustainable infrastructure when facing extreme weather events linked to climate change. The '*Biodiversity and infrastructure. A handbook for action*' (www.biodiversityinfrastructure.org/) is an online tool developed by IENE in the framework of the Horizon 2020 BISON project which aims to promote the deployment of evidence based action to mitigate impacts (Avoid-Reduce-Compensate) of infrastructure on nature but also to restore ecological connectivity across existing infrastructure. It was developed by a collaborative work of more than 50 coauthors and 30 reviewers from ecology and transport fields and builds upon decades of research and practice on transport ecology. It provides detailed instructions on solutions that have proven effective, while encouraging the implementation of new innovative solutions and technologies, their evaluation, and the dissemination of results. To foster a collaborative approach, the online handbook also includes a 'Glossary', jointly developed with the cooperation of transport organisations (such as PIARC and UIC), to lay the foundations for effective communication between professionals from both sectors. Furthermore, a 'Transport Ecology Guidelines Portal' provides access to more than 100 guidelines from different countries. Feedback from users will be compiled, as well as new knowledge being made available allowing to update contents.

Presentation III-2: Defragmentation programme in the Netherlands

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Key words: Habitat fragmentation, defragmentation programme, connectivity, fauna passageways, collaboration.

Abstract

In 2005, three ministries and twelve provinces sat around the table with the water authorities and the nature terrain management organisations to set up a Long-term Defragmentation Programme for the Netherlands. The goal was to resolve more than two hundred bottlenecks between the National Ecological Network (NEN), existing motorways, canals and railway lines. In 2018, the programme finished and most of the bottlenecks were resolved.

The collaboration of the different stakeholders from the onset of the programme was essential for its success. Another important cause of its success was the systematic and holistic approach. Defragmentation does not stop when a fauna passageway is built. The whole life cycle of the construction should be considered, from the concept to demolition or refitting. For example, the first fauna passageways, tunnels for badgers, were not maintained or managed. After a few years, a survey showed that most of them didn't function properly because they were overgrown by vegetation, filled with garbage or water, or were broken. Also, many couldn't be found because their location wasn't registered after being built.

Another important aspect of a defragmentation programme is to consider all functions the area under consideration fulfills. These are not only the animals for which measures have to be taken. Locals might also have wishes (access to their land) or fears (noise disturbance during construction) that need consideration. Or there are factors of cultural heritage to consider. Maybe there are existing tunnels and bridges nearby that can be modified to offer passageways for fauna. And don't forget the maintenance people and the emergency services. They need easy access to the road. This again underlines the importance of involving all stakeholders in road design and mitigation of habitat fragmentation. It also implies good communication among the stakeholders and clear agreements about everyone's responsibilities, from the concept to the realisation phase.

Coming back to the animals, an important question is: which function should the passageway support? Daily movements between a resting and a feeding site, seasonal movements between winter and summer habitat or dispersion and (re)colonisation? Reptiles, for example, have small home ranges. Supporting daily movements would require a passageway every 50 meters and for seasonal movements every 100 to 200 m. For this species group, it might be more reasonable to improve or restore the habitat on both sides of the (rail)road, so that passageways are only needed to support dispersal.

A lot can be learned from the experiences in other regions or countries but remember that every situation is unique. You can't just copy solutions from abroad to your situation. You'll have to come up with locality-specific solutions, and for this, you'll have to involve local and regional stakeholders.

Presentation III-3: Austria's defragmentation efforts: successes and challenges on stakeholders' engagement

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Key words: Fragmentation, defragmentation, cumulative barrier effect, stakeholder engagement

Abstract

Austria has a total of about 2,000 km of motorways. Since 1986 when it was obligatory to fence them on both sides for traffic safety reasons, Austrian motorways became a barrier to most of the terrestrial fauna species.

In the early 1990s, the first wildlife overpass was built above the A4 motorway. In 1997 the first version of the Guidelines for wildlife protection were released and several studies about fragmentation of wildlife corridors lead to a Directive of the former Ministry for Transport, Innovation and Technology (currently the Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology) regarding "Habitat connectivity". The Directive obliged the Motorway company, ASFINAG, to install 20 wildlife overpasses above existing motorways in order to re-connect the internationally-important ecological corridors within the next 20 years.

Currently, the Directive "habitat connectivity" is being implemented in locations where the circumstances allow it. Five bridges have been built and five more will be constructed in the near future. However, about half of the necessary locations face serious difficulties, like the lack of legal protection of the ecological corridors in spatial plans, the lack of effective cooperation on assessing and management of cumulative impacts on cases of bundled linear transportation infrastructures, or missing consent with local communities, hunters and landowners.

One of the biggest challenges is to develop a framework of cooperation with stakeholders at local and regional level. Habitat connectivity is a multi-stakeholder topic, which could only be effective when implemented in a long-term, sustainable way where all parties cooperate and will do their piece of work.

In order to address these challenges, a cooperation between ASFINAG and OEBB (Austrian Railways Company) has started recently under the coordination of the Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology.

6. Abstracts of Posters

Posters as well all the presentations are available on the Bern Convention and IENE websites

Poster 1: Content and use of the European Defragmentation Map

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Keywords: European Defragmentation Map (EDM), Transeuropean Transport Network (TEN-T), indicators, planning scale, EEA, Impact Assessment, Parity reconnection plan.

Abstract

Connectivity between protected and non-protected but important habitats is a fundamental basis for the maintenance of biodiversity. This applies even more to landscapes which are increasingly more and more dominated by man-made features (e.g. transport, renewable energies) and agriculture.

Many EU member states therefore developed national concepts for habitat networks and for connecting habitats. The compilation of these concepts on a map creates an initial overview of an important part of Europe's Green Infrastructure – the ecological core areas and the connecting ecological corridors, within and between member states, which form a Europe-wide network of Green Infrastructure that strengthens, inter alia, the EU Natura 2000 Network.

An overlay of this map with the planned, and in some cases established, corridors of the Trans-European Network-Transport (TEN-T) showcase the existing and future fragmentation of this European Green Infrastructure by TEN-T.

In a further development, indicators (e. g. Natura 2000, Ecological Networks, strictly protected nature reserves) were used to identify particularly important European defragmentation areas that can form the basis for a European Defragmentation programme. The proposed defragmentation areas must be examined in further planning steps at national level.

The poster illustrates the various stages of the development of the European Defragmentation Map (EDM) and provides important information for the following planning and implementation stages.

Poster 2: The Sibiu – Pitesti motorway in Romania: a case study on integrating infrastructure development and nature conservation

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Keywords: EIA process, ecological corridors, Natura 2000, cumulative impacts, adjacent infrastructure, defragmentation measures

Abstract

The integration of infrastructure development and nature conservation has been a challenge in Romania in the last few years, especially considering the accelerated need for extending the motorway network, seen by many stakeholders as a key driver of economic growth. A potential conflict can occur on this issue, and one such example was the need to develop the sector of motorway linking the cities of Sibiu and Piteşti. This was proposed as a crossing through a narrow, mountainous river valley (the Olt valley), which is also an area with many Natura 2000 sites, covering the whole valley and the adjacent mountains without any gaps.

The EIA process focused heavily on assessing the permeability of the proposed motorway and on including in the project as many "permeable" structures as needed (tunnels, viaducts, bridges, culverts). A novel methodology was used to indicate the sectors of motorway where additional crossings were needed, and these were integrated in the project design. This feedback process resulted in making the motorway 100% permeable for all types of fauna. However, due to existing pressures, such as a national road, a railway and a river, the ecological corridors could not be considered functional without implementing some type of defragmentation measures. The EIA focused on assessing the cumulative impacts in regards to fragmentation, and was the first in Romania to propose two ecoducts, not on the proposed motorway itself, but on the adjacent infrastructure, in order to ensure the continuity of ecological corridors at the landscape level.

This case study shows a successful situation, where the development of infrastructure was allowed to proceed together with adequate measures to ensure its permeability for wildlife movement, and was also used as an opportunity to address existing pressures and to contribute to the reestablishment of ecological connectivity in a previously fragmented landscape.

Poster 3: Defragmentation of motorway project for 4 species of reptiles and 2 species of large carnivores Struma motorway in the NATURA 2000 area of Kresna Gorge

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Keywords: Reptiles, large carnivores, defragmentation, motorway, Kresna Gorge.

Abstract

Kresna Gorge in south-western Bulgaria is a NATURA 2000 site with a special biogeographic role for the conservation of 4 species of reptiles (2 species of tortoises *Testudo graeca* and *Eurotestudo hermanni*, 2 species of snakes *Elaphe quatorlineata* and *Zamenis situla*) - a corridor with a narrow front for their long-term migrations. The Gorge has a linear formed habitat in which key seasonal habitats for these reptiles are located on both the dry slopes and the wetter river valley. For both Mediterranean species of snakes, the area is also the northern limit of distribution.

For two species of large carnivores (*Ursus arctos* and *Canis lupus*), the area is a biocorridor between their habitats on the neighboring mountains, essential for preserving the connectivity of these habitats. For Ursus arctos, it is also an important corridor for restoring the historical distribution of the species in the mountains on the border between Bulgaria and North Macedonia.

The Struma motorway, part of the European TEN-T network, was planned and approved in 2017 to divide the linear habitat of the reptiles in the Kresna Gorge, thereby creating a barrier for the seasonal and daily movements of the reptiles between the slope and the habitats in the valley. The high international traffic in recent years on the existing two-lane road in the valley and the high mortality of the reptiles on it have already led to damage to the populations of these 4 species. A discussed alternative to this solution is to completely build the motorway outside these habitats.

The two alternatives are analyzed from the point of view of the legal requirements for the protection of NATURA 2000 and from the point of view of the biological possibilities for effective defragmentation.

The steep relief in the gorge and the high requirements for defragmentation of the daily movements of these species (including juvenile individuals) make it impossible to undertake defragmentation measures along the river valley that are proven to be effective. On the one hand, it is almost impossible to plan facilities that can be assumed to have any efficiency due to the creation of inappropriately steep slopes to the exits of such small animal underpasses. On the other hand, the defragmentation of daily movements implies the deployment of efficient facilities at very short distances – which is not practically possible. Thirdly, there is insufficient scientific evidence that species such as *Elaphe quatorlineata*, but also *Testudo graeca* and *Eurotestudo hermanni* would use such facilities effectively enough.

The only alternative to mitigate the impact of a motorway on reptiles is to build the motorway entirely outside of these vulnerable valley habitats. With such an alternative, the challenge of effectively defragmenting the migrations of the two species of large carnivores remains. A task that can be solved successfully with the construction of a sufficient number of tunnels and viaducts along the low mountain branches adjacent to the Kresna Gorge and providing effective motorway fencing and proper management of those facilities.

7. Results And Conclusions On Next Steps

After the completion of the Kresna Technical Workshop and the fruitful discussions that took place during the round tables, the results of the Workshop can be summarized as the following:

1. **The topics of the Workshop were of high interest**, as it is shown in the graph below.

- 19 presenters, from 12 countries (Bulgaria, Austria, Denmark, Greece, UK, Croatia, Poland, Belgium, Spain, The Netherlands, Germany and Romania) gave oral presentations or poster displays, sharing their research results and practical experiences.
- 94 participants (50 in person and 44 online), from 23 countries (17 of Europe, 2 of Asia and 3 of Africa) attended the Workshop.

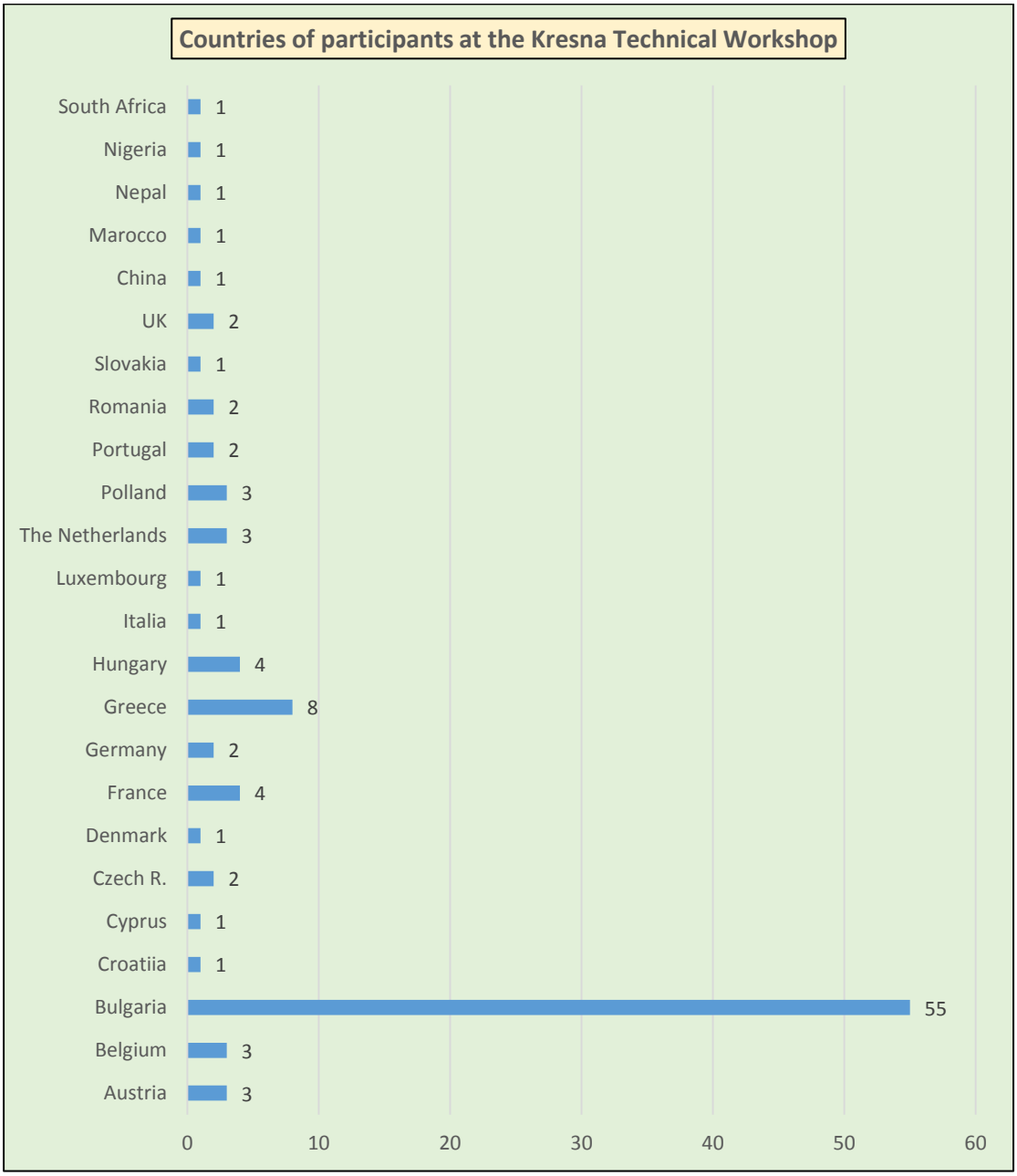

Fig 1. *Graph of 94 participants from 23 countries*

2. **A Statement in a form of Joint Conclusions of the Kresna Technical Workshop was developed by the representatives of Bulgarian parties (government and complainant)**, in line with Bern Convention Recommendation no.212 (2021). The Statement, entitled "Challenges and opportunities for the conservation of reptiles and large carnivores during linear infrastructure development in South-East Europe: a case study for the Kresna Area, Bulgaria", was presented to the participants and adopted during the Workshop. The joint conclusions for addressing the challenges of the case and establishing a common ground for cooperation are presented in **Annex I**.

3. **A draft Work Plan** (presented in **Annex II**) has been shaped as a living document to be further used by Bulgarian parties in order to define objectives and actions for each challenge identified by the Government and the NGOs at the opening session of the Workshop.

4. An IENE experts feedback will be submitted to the Bern Convention Secretariat, Bulgarian Parties, JASPERS, CEDR and EC, expressing IENE position on the next steps for reaching to a solution.

8. Acknowledgments

We would like to acknowledge the joining of forces by the organizers and the supporters of the Kresna Technical Worskhop, the keynote speakers - Lise Praestegaard (JASPERS, EIB / Regional Transport Advisory Division, Austria), Konstantinos Andreopoulos (CEDR, Belgium) and the IENE experts - Lars Briggs (AmphiConsult, Denmark), Djuro Huber (University of Zagreb, Croatia), and Niki Voumvoulaki (Egnatia Odos S.A., Greece) as well as the presenters for their very much appreciated contribution to the Workshop and to all of the participants, in person or online.

Finally, we would like to thank Mr. Eoghan Kelly of the Secretariat of the Bern Convention for his contribution to the Kresna case over the years.

On behalf of all the members of the Organising Team we hope that the workshop, as a tool of exchanging of knowledge and best practices, will be used as one step forward in order to find the best final solution towards serving both the biodiversity conservation and the sustainable transport development in the area.

Annex I: The Joint Conclusions of the Workshop

Joint Conclusion

Of the participants in the Kresna Technical Workshop in line with Bern Convention Recommendation no.212 (2021): "Challenges & opportunities for the conservation of reptiles and large carnivores during linear infrastructure development in South-East Europe: a case study for the Kresna Area, Bulgaria",

Connectivity is essential for both human society and natural systems. The transport sector is crucial for the development of human society but it should not become a barrier for wildlife movement. The development of sustainable, resilient and biodiversity-friendly transport networks requires that a holistic and inter-disciplinary approach is taken during the design, building and operation of infrastructure.

Acknowledging that the case is complex and challenging because:

- Technically difficult terrain with complex features (landslides and collapses, narrow gorge) located on a major fault zone with a high seismic risk;
- The route is situated on a major Trans-European Transport Network corridor and is the busiest international road going through Bulgaria in the North-South direction with increasing strategic importance;
- Unique biodiversity is concentrated in the narrow Kresna gorge with habitats and species with importance to Bulgaria and Europe;
- The gorge is an important bio-corridor for dispersal of a number of different species both in the north-south direction and in the east-west direction including, but not limited to *Testudo graeca, Testudo hermanni, Elaphe quatorlineata, Elaphe situla, Ursus arctos, Canis lupus*;
- Traffic in the gorge poses increasing pressure on wildlife in the gorge and damages the populations of reptiles including *Testudo graeca, Testudo hermanni, Elaphe quatorlineata*, and *Elaphe situla*. All 4 species have linear habitats in the area, and individual home ranges are structured along valleys with seasonal/daily movements from slopes to valleys and key seasonal (mid-summer) habitats situated in the bottom of valleys (thermal and water regime);
- The gorge functions as an important ecological connection between the Rhodope Mountains and mountains on the border between Bulgaria and North Macedonia for both priority species of large carnivores *Canis lupus* and *Ursus arctos* (the whole length of the gorge is a connectivity habitat). The mountain slopes above the gorge are a habitat of both species (summer feeding for *Ursus arctos* and hunting habitat for *Canis lupus*). Occasional migration through the gorge is observed for *Ursus arctos*, but there is no viable population established west of the gorge. For *Ursus arctos*, the gorge provides the only possible bio-corridor for dispersal and for the restoration of the historical population in the mountains at

the border of North Macedonia (extinct since the 20th century). East-west movements of *Canis lupus* through the gorge are observed more often than for *Ursus arctos* and there are viable populations on both sides of the gorge;

- It is unclear whether traffic reduction on the existing road without defragmentation will be enough for the restoration of populations. Furthermore, defragmentation measures cannot be implemented on the existing road without stopping the transit traffic;
- At present there are conflicting views on the efficiency of mitigation measures. Further scientific data is needed to confirm one of the two opposing views;
- Ensuring protection of species and habitats in the Kresna gorge is the focus of the Bern Convention and Recommendation no.212 (2021), and the process can benefit from IENE experience and best practices.

The participants call for the:

- Implementation of possible defragmentation measures on the existing road regardless of further developments;
- Avoidance as much as possible of the destruction of currently unaffected landscapes with new infrastructure developments;
- Avoidance of fragmentation caused by the construction of new infrastructure to bio-corridors of *Canis lupus* and *Ursus arctos*;
- Provision of sufficient measures to ensure the restoration of populations and habitats connectivity of *Testudo graeca*, *Testudo hermanni*, *Elaphe quatorlineata*, *Elaphe situla* and guarantee daily movements of individuals, and draw attention to the following best practices, approaches and methods to be utilised in similar cases in the planning, implementation and maintenance of transport infrastructure:
- In planning and design, combine green and grey infrastructure and plan measures that satisfy the needs of different species as well as people. Whenever unaffected landscapes are concerned, maintain high permeability of new infrastructure with respect of the known routes of wild animals, biology of the species and habitat characteristics. Consider the combined effect of natural and man-made barriers.
- Promote a culture of learning and constructive cooperation between different stakeholders as well as between environmentalists and technicians that focuses on solutions for the sustainable coexistence of ecological and transport corridors, while effectively sharing data, experience and know-how between multilevel and multidisciplinary entities.
- Zero solution is the worst solution especially when there is a known pressure exerted on wildlife by existing infrastructure and a clear need to construct new infrastructure. It is therefore not in the public interest to stall development until all data is gathered (it can never be complete because the situation constantly changes) and decisions based on the best available scientific knowledge are justified.
- Test actions/measures (design of facilities, location, etc.) and make the results widely available. Agree with stakeholders on the success indicators and possible contingency measures.
- The degree of efficiency of defragmentation measures can only be established based on scientifically verified data. Otherwise claims that they work or do not work are unsupported. Expert opinions and hypothesis need to be backed by data, which can inform decisions to make changes to initially planned designs.

- Establish environmental supervision and monitoring of the effectiveness of transport infrastructure features on wildlife permeability in all phases of planning, designing, construction, utilisation and maintenance of investment. Use robust study designs that evaluate effects of infrastructure and measures and ensure evidence-based decision-making for further developments. Focus on a small number of key aspects and study them well, rather than a superficial interpretation of scattered data.
- Guarantee long-term maintenance of facilities by integrating the necessary expenditures and performance indicators in the maintenance contracts. Use automated methods to monitor integrity and usage of facilities. Ensure control of the monitoring activities and the functioning of the facilities by the competent authorities.
- Consider the allocation of funding for research and innovation, monitoring and evaluation of the effects of transport infrastructure on wildlife and the way to reduce the negative impact.
- In order to ensure sustainability and the resilience of infrastructure and address fragmentation of habitats in the development of transport strategies and plans, integrate green infrastructure priorities based on available data for distribution and threats to species, in particular large carnivores. Do a robust cost-benefit analysis of such measures to demonstrate feasibility and relevance.

Annex II: Draft Action Plan

Note: This draft Work Plan has been shaped during the Workshop as a living document to be further used by Bulgarian parties in order to define objectives and actions per each challenge identified by the Government and the NGOs at the opening session of the Workshop.

Draft Action Plan

Challenges / Objectives	Problems/issues/ gaps/needs	Actions	Priority/ urgency (1-3)	Expected (URGENT) results	Who?	Notes / Observations
Re REPTILES						
Restoration of reptiles' populations in the gorge	Lack of final data on the current **status of populations** Need to set parameters for **viability of populations** Need to **define restoration** (abundance, range, conditions vs baseline) in the gorge Lack of data from all relevant areas Lack of data on movements Lack of genetic data/studies	**Define concrete objectives** and **expected results** + **timeframe** **Assess the current status** vs favourable status + **viability of populations** (could be calculated) *(SSCOs define some indicators)* **Set the baseline conditions** **Assess viability of populations** (could be calculated - minimum size, effective (meta) population size in genetic terms) Monitoring the **use of home-ranges** Set-up a **restoration plan for habitat connectivity**				Populations exists Precautionary approach to be used Similar experiences on reference populations in BG could be used for umbrella species (Testudo sp.) Between vs within populations Labour intensive

Implement sufficient and effective defragmentation measures in the gorge	Need to have **baseline / control data** Need to **define success / efficiency indicators!** Monitoring before and after	Agree on the **concrete needs/aims of defragmentation** Recommendations exist but need to be **adapted to local conditions** Set-up a **pilot defragmentation plan** **Implement the pilot-measures & monitor their functionality** (monitoring before and after + control areas) **Conclusions and set-up the main defragmentation plan**	**1**			**<u>It is the most important objective of the road project!</u>** **Doing nothing is the worst option.**
Reduce/eliminate WVC (Wildlife-Vehicle Collisions)	**Fences** paired with insufficient and/or sub-optimal (in terms of design/construction/integration in the landscape/maintenance) **may lead to extra fragmentation** for target species (adults or juveniles) and/or for other species.	**Assess road-kill black sectors** (Data & dynamics on roadkill exists - not enough, not comparable, but useful) **Assess habitat restoration needs/opportunities** to "bypass" hard-to-mitigate sectors **Assess option for non-fencing-sectors** where WVC could be accepted? Assess the **traffic-safety impact of non-fencing-sectors**				Sufficient passageways need to be paired with fencing in order for the system to be functional. Roadkill data needs to be interpreted on the context of population dynamics, structural and functional fragmentation (traffic volume, avoidance, monitoring frequency, …)

Allow daily movements of individuals	The most difficult, therefore the mitigations needs to be adapted to this! The daily movement distances are not known Complicated to be implemented under traffic Fencing longer than the daily movement distances could create barriers!	**Map priority areas for daily movements** **Adjust the pilot defragmentation plan for these areas accordingly** **Implement the pilot-measures & monitor their functionality** (monitoring before and after + control areas) **Conclusions and set-up the main defragmentation plan**				Scientific info exists in literature re Testudo Mitigation solutions are being proposed for an average frequency of 80m The quality needs to be discussed in relation with each local particular conditions
Systematic continuous monitoring of key species and the effect of traffic on their conservation status	No common database Different protocols? Different objectives? Standard procedures agreed? Scientific-based decisions Scientific council/working group? BAS Who will work on the common database	**Set-up the common database** **Identify and address gaps** **Define practical objectives** 3 types: population **numbers** & **trends** , daily / seasonal **movements**, **abundance** around the road (could be combined with genetic) **Include genetic monitoring** (for numbers and isolation) **Agree on protocols**	**1**	Common database Scientific working groups for monitoring		Data exists - Put the data together, assess them! – what you could use, where the gaps are Focus on the 4 species

		Set up a preliminary monitoring plan connected with the pilot defragmentation plan Agree on **measurable targets, efficiency indicators and contingency measures** Use the pilot-project to test the efficiency – before and after (monitoring started in 2020, it will continue until 3 years after…)				
Re LARGE CARNIVORES						
Effectively planned defragmentation facilities	Lack of LC studies / monitoring carried-out in relation with the road/motorway (RE - There is no specific task to conduct LC monitoring before fencing / facilities are in place.) Permeability target for LC to be agreed based on the importance of the area and the regional context (minimum 25% permeability TBD) - Regional connectivity of populations (BG – North Macedonia), in-line with the European action plans	**Address LC as key-species for studies/ monitoring!** **Permeability mapping to understand the key points/sectors/area** **Connectivity assessments (genetic / telemetry is possible)** Improvement plan for the Eastern route should be targeted (i.e. avoid pipes for water drainages and use larger structures (min 2x2m) built as multifunctional solutions		Mapping of existing permeability Future-proofed solutions & multi-targeted / versatile structures!		Not only to reduce mortality but to ensure genetic connectivity Habitat is good… but no data on poaching? Kresna road is a barrier even for the traffic itself Hun. A. - Stable wolf pop in the area Hun. A. -On the East, topography will support permeability

	Improvement possible on some sectors of the Eastern route (i.e. large embankments + cost for improvements vs extended viaducts for the Eastern route) Construction details are needed and important for assessment Special fencing (bear-proof, see Egnatia model) + maintenance Implementing new solutions for connectivity in the Gorge is problematic Similar problems – Trakia motorway is a barrier					Hun. A. -The gorge may not the MAJOR crossing route for wolves Hun. A. -No stable population of bears BWS - there is connectivity, but no data on the efficiency of existing features Permeability solutions are better on the Eastern route Full motorway outside is to be considered Is a decision already taken? What we are discussing? RE: Decision re EIA 2017, the need for a new EIA? Dynamic of territories (climate change) will generate issues where historically they were present. RE - We haven't

						have a case of bear spotted near the Gorge road. There are no official info on wolf roadkill – they will be included in the assessments if provided.
Effectively managed defragmentation facilities	There is no monitoring in the gorge (tunnels and bridges) so there is no data re their efficiency	14 larger structures exist in the gorge (for medium mammals) proposed to be improved – to be monitored (before & after)				
Effective fencing	Mandatory for the passageways to be effective	Special fencing (bear-proof, see Egnatia model) + maintenance plan				
Ensure migration in the gorge	Cumulative effect to be considered For the one direction in the Gorge, it needs to be fully fenced and to add special measures for LC – the existing tunnels are not enough (at least two new structures are needed)	Set-up a defragmentation & reconstruction plan for the area Cross-sectoral and multi-disciplinary stakeholder engagement is needed				

Ensured protection of feeding and hunting habitats outside the gorge	Impact is not known, but there are engineering solutions to minimise the impact					**BWS – connectivity for LC is more important vs habitat**
Safety and HWC	Accidents with large mammals = a serious problem to be taken into account Take into account also ungulates and other medium-size mammals!	To be included into the action plan				
Proactive Planning	Future problems are to be expected (dynamic of factors – see Egnatia for example)	**Contingency plan** to build the second half of the motorway outside the Gorge, if road will not prove efficient		**Set up scientific working groups but be practical = scientific/data based-decisions!**		**But slicing the zone with several parallel linear infrastructure should be avoided**
OTHER						
Ensure the protection of other species in the protected areas: birds, bats, habitats etc.	G20 – will significantly impact 4 N2000 habitats + 4 species + 5 bird species (EIA 2017) New LC overpasses in the gorge will impact the habitats of herpetofauna, but if the case, they will be the subject of subsequent EIA	Define the key-species for the area and the critical habitats (i.e. the Gorge for reptiles) For G20 – check if the impact is caused by the large embankments and assess alternative planning/design/constructive options (ie viaducts and				

		reconstruction/compensatory measures = creating new habitats)				
Human presence dynamic in the gorge	To be evaluated re functionality of structures					
Time pressure!	Delay of the finalisation of the motorway is also a local problem!					Timeframe to be agreed **Delays are costing the most!** Mitigations are not that costly actually (within the unexpected costs margin)
Impact on humans	Cultural values impacted Living standard impacted Road accidents A properly-built motorway is important for the economy	Include the standards for modern transport infrastructure (safe, sustainable, …) as a major goal. Find a solution for local access!				
Other…						