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Guidelines & Strategies to sustain, restore & enhance Ecological Connectivity in the Carpathians

EURAC
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1 Introduction

The BioREGIO project was a very ambitious project aiming at studying and valorizing the biodiversity of the Carpathians countries and mountain range. In the activities of work package 5, a comprehensive analysis of connectivity and permeability has been performed to gain information both from the GIS analysis and especially from the site visits in specific locations as well as from literature review.

Particularly selected site visits have highlighted differences among Carpathian countries, in terms of both: connectivity and the co-existence between human society and wildlife. The site visits enabled the identification of the main barriers from a physical, legal and social point of view, providing necessary information for compiling ten major guidelines.

Due to the large extension of the Carpathians mountain range and to the national differences, it was intended to elaborate guidelines being applicable in all the Carpathian countries. From the practical point of view it is almost impossible to give the here derived guidelines the same priorities in each Carpathian country. It is in the nature of things that the same topic/problem is faced in different ways in different locations. That's evident due to historical reasons, the socio-economic environment, the national/local laws, the conformity of landscape, the species present causing conflicts with the human society and the personal relation of the people with local wildlife.

The ten guidelines do not want to be comprehensive. They are providing a general introduction and overview of the main barriers highlighted during the lifetime of the BioREGIO Carpathians project. The main aim of these recommendations was to look beyond the natural aspects of ecological networks and suitable areas for wildlife dispersal. Considering landscape maps is an almost straightforward strategy to define the most probable passage sites and core areas for each of the selected umbrella species. What work package on continuity and connectivity aimed at was to define the most impacting forces influencing ecological networks, in order to prevent future fragmentation or other conflicts related to ecological connectivity.

Humans and wildlife share the same environment. Only when the factors causing conflicts are understood and solved, biodiversity together with human life could gain a higher value. Hence it is fundamental to adapt the general guidelines to the needs of the seven Carpathian countries. Based on the results of the site visits, each partner was requested to define in a questionnaire priorities concerning the importance and impact of the single guidelines in their countries and to underline their choice with a short explanation. With these essential contributions, the WP5 partners were able to derive specific approaches and recommendations that could be integrated in any legal act/guideline of a Carpathian country to sustain its ecological network and the human/wildlife coexistence.

2 Guidelines: Ecological Continuum & Connectivity

The guidelines are providing a final assumption of topics touched during the project life time in BioREGIO concerning ecological connectivity. This brief overview should enable a compact knowledge transfer, in which problems, opportunities, threats and strengths in dealing with dispersal of wildlife are focused at, and in which the Carpathian particularities as well as natural assets playing herein a major role are underlined.

During the project life time these 10 guidelines derived here as recommendations were indicated as the most relevant ones. They all refer to the initial concept to separate the barriers/possibilities influencing ecological continuum and connectivity into a physical, legal and socio-economic part.

The first five recommendations refer to physical barriers/possibilities, while the trans-boundary aspect and the hunting law is more likely touching legal fields. Finally urban sprawl or ecological connectivity beyond protected area as well as compensating wildlife damages cover socio-economic topics. Consequently the guidelines developed in the context of connectivity are enlightening evident deficits concerning landscape fragmentation. And thus, the field around maintaining and restoring ecological corridors is touching task-areas from spatial and land use planning and their various legal directives regulating these aspects.

2.1 New infrastructure, roads & motorways

Countries in the Carpathians are experiencing a growth of infrastructures since the end of the communism. New motorways are foreseen in Romania, Czech Republic, Hungary and Slovakia that causes at different locations an expansion of human settlements (urban sprawl). The purpose of road developments is to ensure an effective connection of new-EU states with other EU countries through the Trans-European Transportation Network (TEN-T). In this unprecedented era of urban expansion and road building, the opportunity is given to revisit the design for connectivity, rather than discussing about fragmentation. The question is not focused on “whether to build a road”, but on adopting a different approach to transportation planning that focus on the enhancement, maintenance and re-establishment of ecological connectivity.

The data collected during the BioREGIO project have highlighted that the current road network in the Carpathians do not act as unsurmountable barriers for wildlife. Rather there is the need to reconcile the notion of mobility in order to (re)imagine the road as a device for (re)connection between humans and wildlife, culture and nature. The foreseen motorways need to be developed

following the guidelines for the new TEN-T corridors of the European Union. The guidelines propose a multidisciplinary approach to analyze the impact of the trans-European transport network, posing great emphasis on the safety and environmental friendliness of transport infrastructure by promoting innovative technological developments. In addition to the Habitats and Bird Directives, the EU issued a directive (97/11/EC)¹ that calls for a strategic environmental assessment (SEA)² and, for major infrastructure projects, an environmental impact assessment (EIA)³ to foresee potential environmental problems from plans and projects. Specific guidance for transportation planning is being developed under the COST 341⁴. The goal of BioREGIO analysis on wildlife connectivity is to assist transportation managers to consider the protection of wildlife connectivity in their strategic decisions, when designing new and expanded road projects.

In case of generated discussions on possible alignments (e.g. Deva – Lugoj Motorway in Romania; M2 motorway in Hungary, new motorways in Czech Republic and Slovakia), it is essential to:

- Perform a systematic analysis of wildlife presence and dispersal through GIS and field work.
- Develop a framework to identify the ecologically strategic locations for enhancing wildlife connectivity.
- Provide planning level mapping tool highlighting the strategic locations.
- Invite local communities, NGOs and experts for public debating.
- Provide mitigation and monitoring recommendations for areas interested.

¹ Council Directive 97/11/EC of 3 March 1997 amending Directive 85/337/EEC on the assessment of the effects of certain public and private projects on environment; OFFICIAL JOURNAL NO. L 073, 14/03/1997. URL: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31997L0011>

² Strategic Environmental Assessment - SEA, Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on environment. URL: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32001L0042>

³ Environmental Impact Assessment - EIA, Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on environment, URL: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32011L0092>

⁴ COST 341: Iuell, B., Bekker, G.J., Cuperus, R., Dufek, J., Fry, G., Hicks, C., Hlavác, V., Keller, V., B., Rosell, C., Sangwine, T., Tørsløv, N., Wandall, B. le Maire, (Eds.) 2003. *Wildlife and Traffic: A European Handbook for Identifying Conflicts and Designing Solutions*, URL: http://www.iene.info/wp-content/uploads/COST341_Handbook.pdf

Examples:

Lugoj-Deva Motorway (Romania)

Lugoj-Deva Motorway sector is part of the Pan-European Transportation Corridor no IV (Europe Aid 122273/D/SER/RO ISPA 2004/RO/16/P/PA/002/01; part of TEN-T Corridor IV)⁵. The proposed alignment would intersect the last ecologic corridor for large carnivores between Western and Southern Carpathians in Romania, isolating the Apuseni Mountains (Western Carpathians) from the rest of Carpathian Range in Romania (see Figure 1).

Large carnivores have been detected in the interested area, although bears are present only during seasonal movements, lynx and wolf are residential. The IENE Network (www.iene.info), the greatest European network for ecological connectivity and transportation, organized a workshop in May 2013⁶ about this motorway inviting local stakeholders, road administration and European experts to find mitigation strategies for the maintenance of connectivity.

The main conservation goal is to assure long-term functional connectivity between the Western and Southern Carpathians populations, protecting the main populations at a healthy level, and to allow natural expansion in favorable ranges and safeguard movement/dispersal routes.

From a social and legal point of view, there is the additional need to overcome a series of barriers going from the management and coordination between the various stakeholders, the lack of public awareness, law enforcement and damage/conflict prevention and compensations. The major barriers remaining are the physical ones. For the new planned infrastructures in that area, they are pointed out in the map as yellow arrows. The ecoducts or underpasses planned here, need to be well designed that wildlife considers these ecological reconstructions also for dispersal.

⁵ *EuropeAid/122273/D/SER/RO: B-Brussels: ISPA — technical assistance for the preparation of road project pipeline for the Cohesion Fund, in Romania — contract No 1, detailed design and tender documents, URL:*

<http://www.dgmarket.com/tenders/np-notice.do?noticeId=1790865>

⁶ *IENE 2013, Scientific and Technical Workshop, 23-25 May 2013, Lugoj, Romania, URL:*
<http://iene2013romania.wordpress.com>

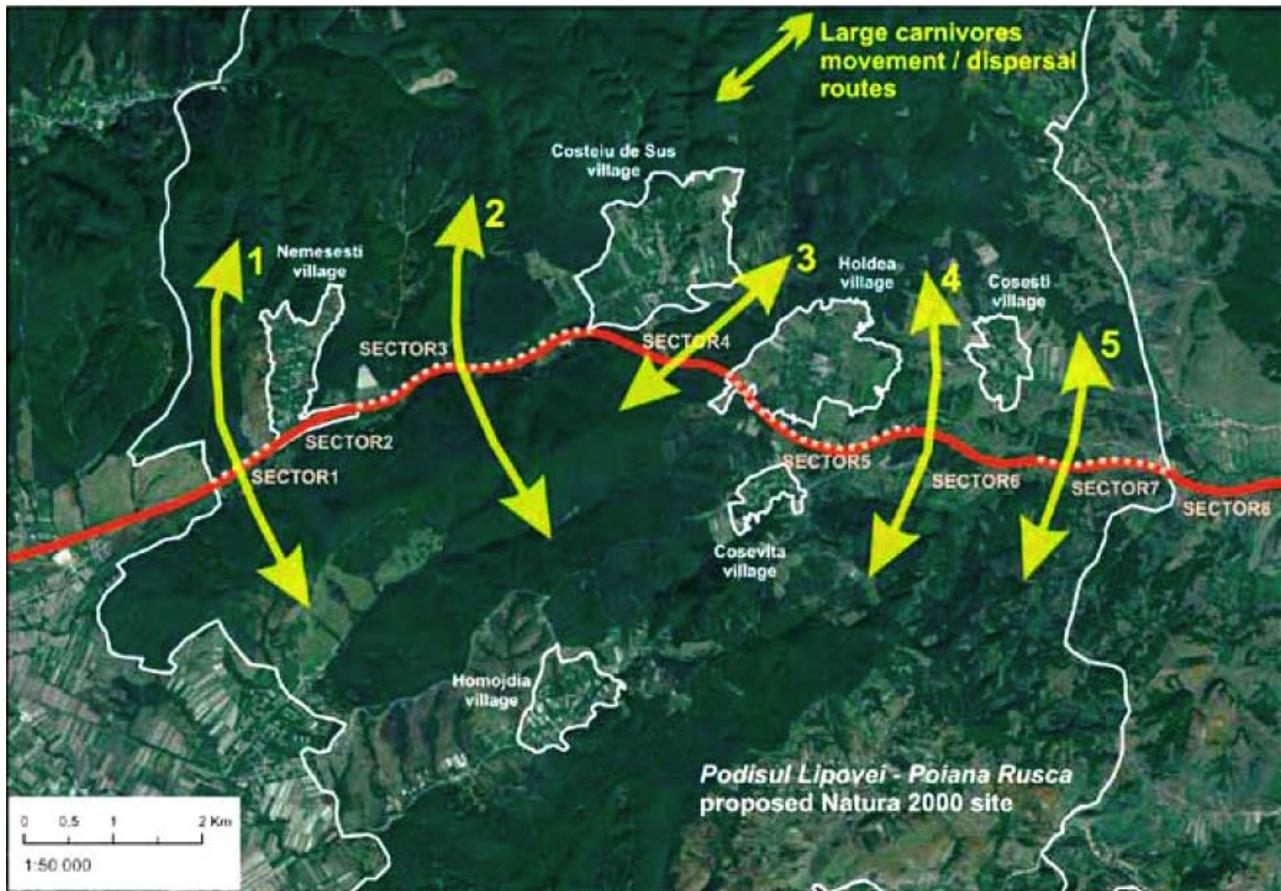


Figure 1: The Deva-Lugoj alignment and the intersection with a NATURA 2000 site and wildlife dispersal routes (Fauna and Flora International, WWF Danube-Carpathian Program, Greenlight Services, Romanian National Environment Guard, Romanian Forest Research and Management Institute, Faculty of Silviculture and Forest Engineering Brasov, Carpathian Wildlife Foundation, The European Nature Trust).

Planned highway D1 from Turany – Hubová, passing Malá and Veľká Fatra (Slovakia)

The construction work into this very sensitive area – a small valley with unique Natura 2000 sites and a high relevance for ecological connectivity – has already started before Slovakia entered in the European Union (EU). Since Slovakia is now a member of the EU, the continuation of building this highway is interrupted. The EU requested a Strategic Environmental Assessment (SEA) and to tunnel these ecologically sensitive area.

Planned Highway M2 from Budapest to the Hungarian/Slovak Border (Hungary)

The project aim is to build a new express-way that will cross the Slovakian border at Balassagyarmat, much more east from the present alignment versions (this alignment would cross the Natura 2000 part of the Ipoly river at the border that it is not so rich (valuable) than near Borzsony mountain at Dregelypalank). Another realistic reason is that the road from the settlement Retsag to Balassagyarmat (today the road number 22) is much busier than the road from Retsag to the border on the old (current) road number 2. The only problem is with this eastern alignment-version, that in Slovakia there is still no planned express-road-connection that would go to the north, but at the "Dregelypalank-versions" there is already an express road in Slovakia, so the EU says that would be better for a TEN-T road (and it is wanted to be a TEN-T road).

Final considerations

In order to analyze correctly the different alignments of a foreseen motorway concerning ecological connectivity, it is fundamental to provide:

- Site location and site plan: locations, types and sizes of ecological connections close to the foreseen infrastructure;
- A list of the wildlife species identified;
- The location of the main core areas and most probable passage sites;
- Strategic Environmental Assessment (SEA) & Environmental Impact Assessment (EIA);
- According to the species present in the location, the kind of ecological infrastructures/connections that may be required;
- A list with location of new dedicated connections for wildlife (bridges, culverts, fences);
- 3D rendering of the project with the dedicated crossing structures for public debating.

A multidisciplinary study considering the environmental, social and legal issue should join the engineering to detect all the potential and future barriers for connectivity and to identify new and dedicated wildlife crossing structures and protective fencing if needed.

In current roads, existing culverts and fencing structures that may be in-kind, retrofit, or structurally deficient, damaged, obsolete, insufficiently sized, or otherwise inadequate should be replaced.

Public debating becomes continually more important. Local people, living in locations interested by the new roads construction, need to be advised and want to give their contribution to the choice of

the alignment. Public debates concerning the construction of new motorway can fulfil additional aims. It may be used to spread the concept of connectivity and the need of re-thinking our vision of movements and transportation. Public debates can stimulate people to see their environment in a different way, or can mature the need for sharing spaces with wildlife in order to gain concrete benefits from a healthy ecosystem.

Specific recommendations formulated together with local stakeholders and NGO to highlight the impact of new infrastructures can be presented to the national government. There is, anyhow, a gap between the formulation of recommendations and their presentation to the governments. Many international projects do not include so far the presentation of recommendations to national governments in order to gain and “official approval”. Also the provision of recommendations to highway planners and administrators remain only a suggestion and has no legal value. In the Carpathians, this process usually takes a lot of time, mainly after the lifetime of the project ended.

- A solution for that could be to include already in the writing phase, the presentation of recommendations to national government and their implementation on the ground.
- New projects concerning the evaluation of the impact of new infrastructures should include the training of people not directly connected with Nature Protection.
- Different stakeholders in the fields of spatial planning and administrations can fill the gap in dialogue between Nature Agencies and national government.
- Raising awareness among responsible authorities for the environmental loss and the meaningfulness of protected and Natura 2000 areas, when designing and implementing new motorways is very important for the Carpathian countries.

In terms of recommendations, the information gained during the life time of the project are pointing to the following issues:

- Adoption of the prudence principle – it has to be considered already in the planning phase that the negative impact to wildlife is reduced to a minimum.
- The EU guidelines force investors and constructing companies to collaborate and to find a deal with all interested groups to prohibit potential conflicts and problems preventively.
- What is herein negative are the short periods for announcing any critics what requires to be organised quite well to open the opportunity to all stakeholders to state their opinion.
- Analysis of the potential conflicts with wildlife has to be done in advance through monitoring of their movements and indicating their core areas:
 - This could concern analysis of the current and potential future conflicts due to the presence of hydropower plants for the otter or
 - The analysis of the conflicts between migratory birds and overhead power lines or
 - The increase of awareness for ecological connectivity among local population
- Establish a public consultation to enable local people to express their concerns about:

- Analysis of the financial and technical barriers
- Requirement of alternative alignments
- The challenge is to create technical solutions that are economically affordable and ecologically as well as practically reasonable. This requires to find acceptable compromises within the stakeholder consultation process.
- It should become obligatory to integrate the ecological corridor approach in landscape and spatial planning in form of a background document like in Slovakia, which is called “The territorial system of ecological stability”

2.2 Animal-Vehicle Collision (AVC)

The phenomenon of Animal Vehicle Collision (AVC) is interesting for those European countries, which are struggling with increasing road kills due to a natural return of many wildlife species (ungulates but also carnivores) at locations from where they were almost disappeared.

The AVC phenomenon interests also the Carpathians countries. Many animals are routinely captured and killed by vehicles during their basic quest for “survival”. Since few years, many institutions and research centers have started to monitor data on involved species, on costs (for biodiversity, for economy and human health) and on locations at higher collision risk to get a clear picture of AVC in their countries and to provide solutions for mitigation.

Road kill is a concrete result of the conflict between the needs of humans and animals. The humans’ need to travel safe and quick to any location, is a basic expectation of modern society. Yet wild animals need connected landscapes: they must cross roads to search for food, mates, and shelter. Furthermore a connected landscape is able to provide apart from ecological corridors, additional other ecosystem services in favor for human society. The road kills issue, as for the construction of new motorways, can be used to raise awareness to broaden the idea of connectivity and the threats related to fragmentation among the citizens mainly those living close to high-risk areas.

The road kill problem is not only related to wilderness, but it is a problem affecting everyone. Growing numbers of animal-vehicle collisions are leading to higher levels of personal injury and property damage, and with this, rising insurance premiums. Many countries miss a compensation program to refund the damages caused by AVC. While human deaths are not high compared with other accidents, AVC have increased significantly. This represents a significant danger to human safety and to wildlife populations. Animal-vehicle collisions are also increasing relatively in relation to the total roads’ accidents. Even if not physically hurt or economically affected by a collision, many people report that they feel traumatized after hitting an animal. Besides, these obvious concerns for motorist safety have serious implications on wildlife. Road mortality is documented as one of the major threats to the survival of many species listed threatened or endangered. On a much larger scale, conventional road building results in significant losses of habitat for game species. Road networks fragment the landscapes into ever-smaller, disconnected patches in which

wildlife must live and move, faced with declining genetic fitness as populations become separated and isolated. Road kill is not simply “bad luck” or an unfortunate consequence of driving; it is an avoidable cost and a preventable loss. AVC is not only a matter of physical road effects but also of the driving behavior. An increase in the ecological awareness is fundamental to allow the mitigation structures to work properly. Thus there is the need to rethink our dominant model of mobility and our awareness to understand that both humans and wildlife share a common need to move. Based on these premises, the opportunity is to redesign the roads to provide safe passage for all.

During the BioREGIO project, EURAC collected data concerning AVC from Romania, Hungary, Slovakia and Czech Republic in order to identify an additional impact of road infrastructures on wildlife connectivity. Currently road kills is still not considered, as a meaningful threat for Carpathians’ ecological connectivity. However, the foreseen expansion of roads, motorways, and interchanges that is interesting all the Carpathians’ countries creates the conditions for a higher impact of this phenomenon, both on wildlife and on humans. In general terms, all the Carpathians countries do not have a proper system of road kill monitoring yet and, although local people know which the most risky places are, much has still to be done to improve the situation.

Example: AVC in Serbia

Location: road 25-1. The road 25-1 runs along the Danube River at the northern border of Djerdap National Park (see Figure 2). In many locations (red dots), the road cuts the access to water for wild animals in an environment rich in wildlife species and individuals. The road is a 2-lanes national road, narrow and very curvy. The speed limit is 80 km/h. The road is used also by many bike tourists but there are no specific bike routes. The normal attitude in Serbia and Romania is to drive quite fast.

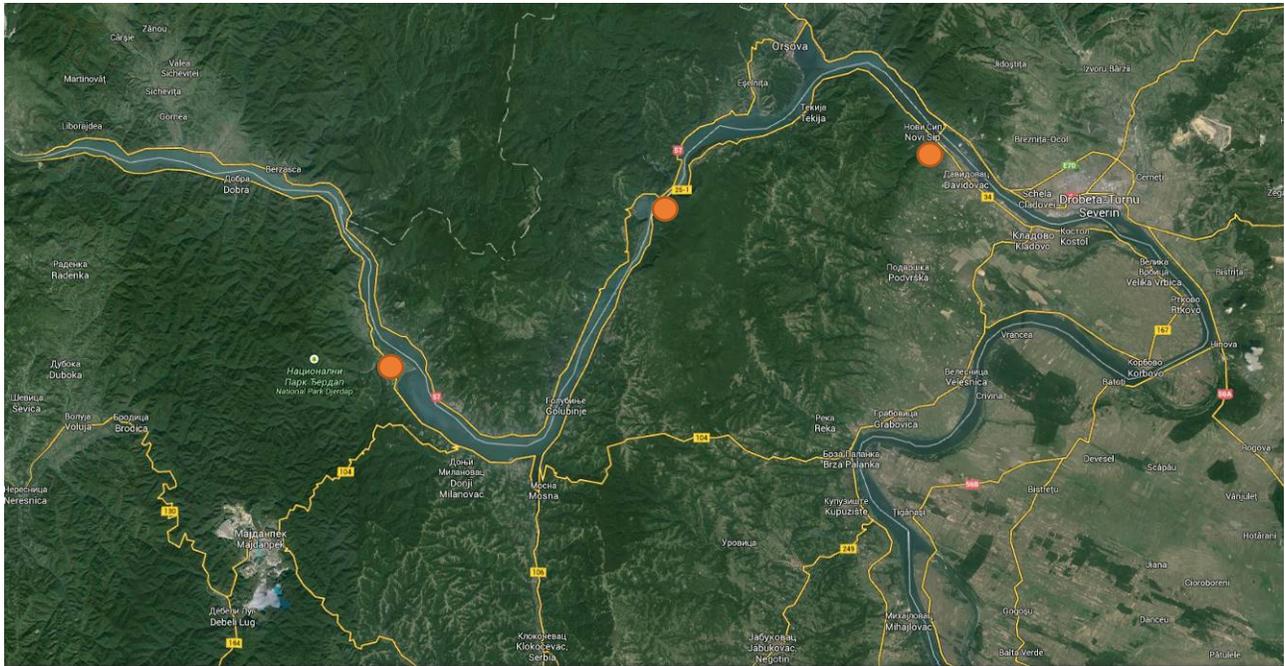


Figure 2: Road 25-1 in Djerdap National Park (Serbia) and locations of road kills hotspots (Google Maps).

The major problem is represented by the cumulative effects given by the high speed of the cars, by the scarce visibility, the low awareness of drivers on this issue and the absence of fences, signals and mitigation structures. The main locations of wildlife crossing, identified by direct observation or by wildlife cadavers, occur at positions with a limited visibility situation, e.g., just after a big curve. There is no detection system to identify the road killers and no information are available concerning the real numbers associated with this phenomenon. The driving behavior and the absence of remote speed control are probably the main obstacles for reducing this phenomenon.

Location: road E-761: The same situation happens in the road E-761 between Boljevac and Paracin (see Figure 3). This road is highly frequented, with a speed limit of 70 km/h. The road cuts a forested area surrounded by agricultural fields. Also at this location, official data on wildlife road kills are not recorded, although leftovers and direct observations indicate clearly the evidence.

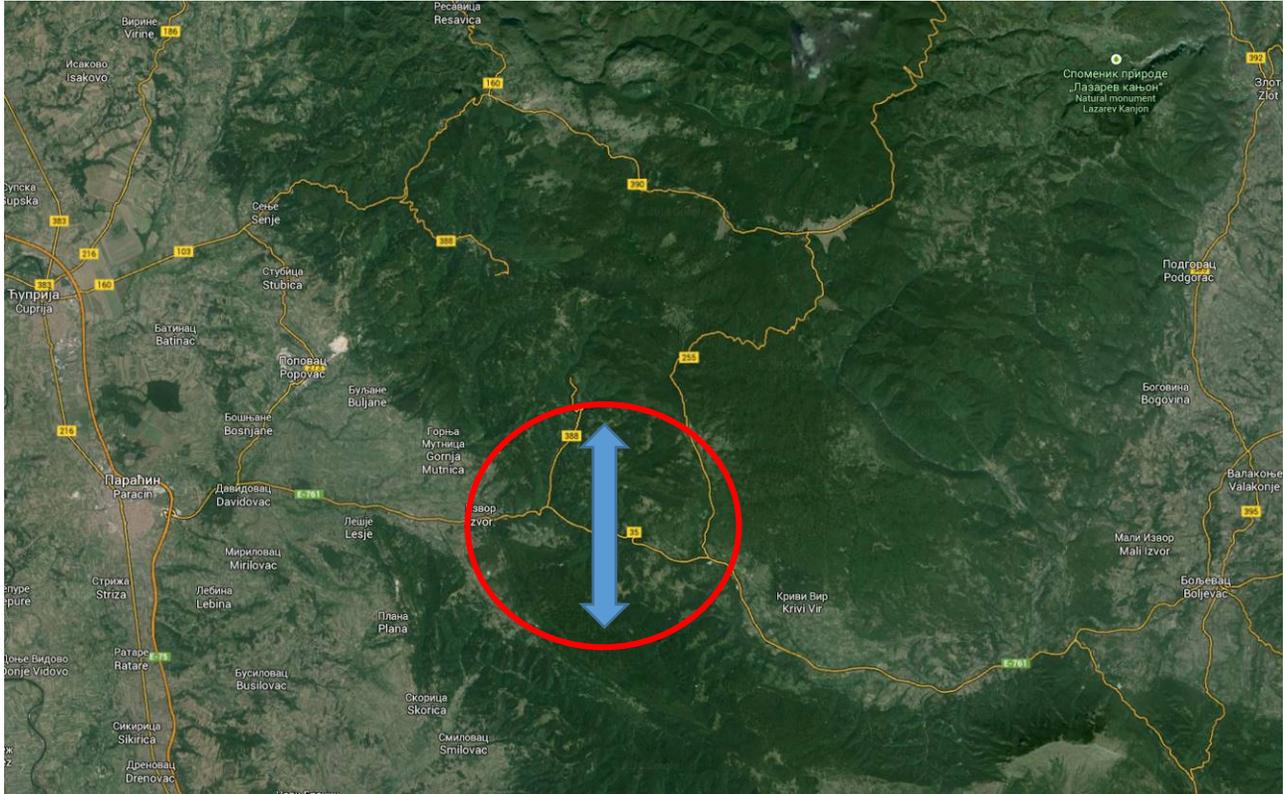


Figure 3: Road E-761 between Boljevac and Paracin (Serbia) (Google Maps).

The area has been detected by the BioREGIO GIS analysis as a probable passage sites for wildlife, connecting the Danube part of Serbia with the Balkans in Bulgaria. Direct observation by local people and researchers have confirmed this hypothesis. The presence of forest, agriculture and of edge habitats provide an ecological diversification what is attractive to many different wildlife species and individuals.

Unfortunately, this national road has a total absence of mitigation / prevention infrastructures and no signals inform the drivers that they are inside of a highly frequented wildlife area with a high risk of crossing wildlife. Also along this road, due to the absence of remote speed control, drivers are used to drive over the speed limits. Many accidents happen between cars and wildlife but still no decisions has been taken to mitigate this situation.

Fences are present in some parts of the road (see Figure 4 – left) but their height, size and length does not represent a barrier for all the wildlife crossing.

Just as a comparison: the fences in the right picture of Figure 4 are those used in Hungary on the Motorways to avoid car-wildlife accidents.



Figure 4: Fences along the road E-761 in Serbia (left); and fences along a Hungarian motorway (right) (photos by Filippo Favilli and Elisa Ravazzoli)

Final considerations

The situation briefly described for Serbia finds analogies in many other locations of the Carpathian countries (Romania, Hungary, Slovakia, and Czech Republic). That makes the need evident, to find new solutions to wildlife crossing infrastructures, for reducing the costs and to tailor each type of crossing to the specific needs of species in various landscape contexts. In this new modernization era of Carpathians' infrastructures, there is an increasing need to repair existing and often crumbling transportation infrastructure. There may be opportunities to reuse adaptively some structures for wildlife crossing purposes, whereas new structures may test alternative and emerging sustainable materials at lower lifecycle costs. New solutions to the construction approach and material of crossing structures must also be considered in the context of long-term ecosystem change. The new structures should be adaptable to changing wildlife movement patterns due to changes in habitats, climate, or other factors that become apparent over time. This implies a continuous monitoring of the wildlife species present in a certain area interested by the AVC phenomenon. It is important to emphasize that this is not a new idea. Providing crossing infrastructure at key points along transportation corridors has been shown to improve safety, reconnect habitats, and restore wildlife movement. Throughout Europe, Asia, Australia, and North America, hundreds of crossing structures, or "ecoducts," have already been implemented successfully. That includes underpasses and overpasses covering the whole variety-range of size and design. Although wildlife underpasses are generally less costly to build and commonly more used by a wider range of species, wildlife overpasses are preferred by certain wide-roaming and iconic species-at-risk, such as lynx, bears, and wolves, for example. These structures should be joined by a large campaign of environmental awareness to underline that the best prevention system is always a correct driving behavior.

To avoid AVC conflicts and reducing risks, for both humans and wildlife, the BioREGIO project partners agreed on the following recommendations:

- Analyse the socio-economic impact of road kills
- Establish a monitoring system of the most risky road sections
- Develop national databases on AVC
- Share local and international experiences to know the available instruments for reducing the risks
- Railway kills have to be considered, too. It is assumed that railways can be controlled easier and are reducing significantly the risk of AVC in contrary to car traffic.
- Individual traffic like car traffic are most meaningfully affected. Reasons are:
 - Lacking facilities like information-signs to avoid road kills
 - Driving behaviors, lacking awareness and education

Strategies to avoid road kills:

- Special devices along the corridors to control the migration paths of the umbrella species spatially
- Herbivores are affected usually more from road kills – thus imitated “wolf eyes” enlightened form car-lights, should stimulate herbivores to flee.

2.3 Hunting procedures

The Carpathian landscape is dominated by forest and game species (mainly ungulates but also bears, lynxes and wolves). The forest offers an important link for connecting landscape patterns and has a high significance as a habitat. Forest workers, mainly hunters and foresters, may act as promoters of its importance, and contribute actively to the establishment of an ecological network. They can theoretically contribute to the promotion of a sustainable use of the forest resources and contribute to the awareness raising among the population.

Appropriate hunting measures are extremely important for ecological connectivity, as it helps to preserve a near-natural forest and to create ideal conditions for sustaining a wide spectrum of possible species. Areas with no or limited hunting activities are used as core zones or stepping stone biotopes by more sensitive species and habitat restoration measures could support that.

The information gathered during BioREGIO site visits have highlighted several regional differences concerning the impact of hunters for promoting and restoring ecological connectivity.

In some Carpathian countries, hunting is a large business. The protection of landscape to sustain or to restore an ecological corridor has to face with all the related economic interests. Nature protection is less economically attractive than forestry and hunting.

The high numbers and densities of game species attract many foreign hunters. Hunters may pay up to 7000 € for shooting a bear in Romania. The economic income gained from the trophies is much higher than the one coming from conservation. Thus hunters may find the carnivores as their competitors (e.g., Hungary), because they reduce the number of game individuals. The idea of competition and that carnivore species are “a pest” for game management, stimulates the “protection” of game species to assure the economic income. Nevertheless even protected carnivores are killed by hunters and mainly poachers. The high presence of hunters and their negative relation with carnivores, in some countries, may push carnivores to other locations that are not enough suitable due to their habitat requirements and are not allocated close enough to any ecological corridor to enhance connectivity.

To summarize, hunters and game managers on one hand are considering mainly the economic benefits of applying their hunting rights and are thus avoiding the promotion of a strategy to stimulate cooperation among different actors and interests. On the other hand, hunters from other countries feel the presence of big carnivores (especially Lynx) as an ally in keeping game population under control.

The big challenge comes from the harmonization of the different and often contradictory interests among hunters, ecologists, gamekeepers and the local populations.

In some locations, due to an (estimated) oversize of game populations, farmers and foresters complain about the damages they create. In these cases the organization that manages the hunting area, where the damage occurred, is usually responsible to compensate damages. In some cases they may be extremely high, what consequently leads to a high conflict-potential.

The establishment of feeding points is a highly used technique to steer game species out of the forest to provide the “paying hunters” (mainly foreigners) a safe shoot. The presence of feeding point is helpful for the hunters, because it generates “easy preys”; it rises the economic income and keep game species away from causing economic damages in forestry or agriculture.

Big carnivores are themselves attracted by feeding points, too. The provision of prey at less suitable territories, can change their behavior. If they get used to the availability of prey and remain permanent at these marginal areas, they are more exposed to hunting and poaching.

Besides, it has to be considered that at many locations, carnivores and ungulates’ species have started to spread in territories where local people are not used to their presence. A higher wildlife presence creates fear among local people justifying the intervention of hunters for their safety. Elsewhere, where rural people are used to co-exist with wildlife, hunting has not that economic weight and the presence and damages by carnivores and ungulates are more accepted. As for other issues, the low awareness and education concerning the benefits coming from a restored ecological connectivity pose a serious barrier.

The core areas and least-cost paths identified in BioREGIO could be used, to identify the stripes of land necessary for the establishment or maintenance of ecological corridors. On the contrary, the information, where these species tend to pass, could be misused from poachers and hunters. Hence the proposal to dedicate stripes of forestland for the establishment of an ecological network has to be coordinated with the economic interests of the game management authorities.

Hunters may take a very important role in the preservation of ecological connectivity. They could help to identify the currently used least cost paths and to reduce the hunting pressure at local level.

Example: Feeding points in Romania

The presence of feeding point supports hunting. This attracts on the opposite also bears and thus they attend areas they normally don't use. This changes their behavior. They start choosing less attractive dispersal paths as they get used to the food provided by humans (see Figure 6).



Figure 6: An observation/hunting structure close to a feeding point (Brasov area, photo by Filippo Favilli).

Poaching in many locations in Romania is under control by the game managers and hunters try not to shoot bears because the sector is benefitting from the “paying hunters” coming from abroad.

Connectivity is considered to determine the occurrence of hunting species (also bears) and to share the information among different hunting units. Bears’ shooting quotes can be shared among those hunting organizations. Hunters analyze the area and identify the crossing sites for wildlife. There are no studies on connectivity in many areas but locally they are known due to observations. In the area close to the city of Sibiu, hunters monitor NATURA 2000 sites, because hunting is allowed in these areas and to prevent poaching. An estimation of bear individuals is done every year, at the same time in two neighboring hunting units using the feeding points and signals of presence. Some studies on the genetics of bear populations gave contradictory results, without revealing whether the bears living at both sides of the valley belong to the same population.

In areas attractive for planning new motorways, local hunters should be motivated to collect data on wildlife crossing sites and to cooperate with road agencies to evaluate the real impact coming from the planned infrastructure. Hunters may then help in the identification of hunting ban areas, game protection and quiet zones and of game reserves. This would contribute meaningfully to steer various different interests.

Final considerations

The role of hunters in relation to ecological connectivity has to be derived from the social attitude towards big mammals' species: in countries where hunting has a high economic weight, the concept of ecological connectivity needs more time to be accepted. The preservation of ecological corridors from hunting and forest works can be obtained only through a long process of awareness raising among the local populations, highlighting the benefits coming from a maintained ecological network.

The information gained have highlighted the need for the following recommendations:

- Increase of cooperation among different hunting units: state owned hunting areas, private and fenced hunting clubs or private land owners should have the permission to hunt.
- Definitive hunting quotes should be allocated every year to each game species. Forest or national park rangers should be responsible that this quotes are achieved or not exceed. They have to count each shot game-animal.
- In Slovakia particular agricultural sites are fenced to avoid potential damages from wildlife.

2.4 Forest

Forest Management and ecological connectivity: Adaptation of forest management measures in silviculture and harvesting practices can improve the habitat quality for particular umbrella species and thus the appropriateness for ecological connectivity. Particular linear afforestation strips could connect large forested areas or improve the heterogeneity of landscape. This enhances the dispersal options for wildlife. Awareness for measures like that to promote the maintenance of ecological connectivity are among foresters still low. Thus initiatives would be required mainly at the local level. Hereby the local knowledge of protected areas are playing a major role, although their territorial contribution to connectivity is usually only of minor relevance.

To enhance connectivity at locally, foresters and forest managers have to focus on their joint-up thinking to which they are used in terms of silvicultural treatments at different forest stands concerning the different functions a forest site has to fulfill. Nevertheless they have to include also the demands and requirements of other “users” like people seeking for recreation as well as hunters and game managers. Partly the contradictory interests are sometimes causing a conflicting situation. If e.g. agricultural land is affected from game damages or afforestation, conflicts are programmed as this reduces their income. Besides, through an applied knowledge transfer, these economically driven conflicts are more likely solved with politically granted subsidies. They are capable to compensate the territorial loss and to initiate a rethinking of farmers. Regulations and guidelines for sustainable forest management should particularly be considered for maintaining protected areas but also beyond protected and forested territories.

Due to the numerous initiatives in the past, the state owned forest association Romsilva in Romania and different other forest associations are considering rules of sustainable forest management – mainly regarding harvesting techniques and silvicultural programs. For instance in the case typical and site adopted tree species like autochthone broad leaved tree species are replaced by coniferous tree species. The ecosystem of fir (douglas fir) or spruce is much different. These secondary coniferous forests planted for economic reasons have usually not any soil-vegetation. Concerning ecological connectivity this remarks a reasonable barrier for animals used to structured broad leaved forests with different tree species and a heterogeneous vegetation.

Nature conservation versus economic interest in forest areas: To raise awareness and to maintain the population of large carnivores, the two-annual reports to the EU on NATURA 2000 species is an instrument to put pressure on the hunting and forest management sector. Contradicting to that is the common responsibility of the ministries that are sometimes sharing nature conservation, forestry and hunting. As particularly in the Carpathians the majority of forest areas are state owned, the economic interests of forestry and hunting are traditionally on a higher priority. This economic purpose corresponds with the opinion of the rural society. People are convinced that only forestry creates jobs and income for the rural area, while nature conservation is from their view not able to. Hereby it is a disadvantage that only a low percentage of protected

areas have management plans but not enough money to implement them, although the EU provides subsidies to enhance nature conservation and biodiversity.

Low income and poverty in rural Carpathian areas may be one of the main reasons of the persistency of illegal hunting and logging. Additionally, it is well known that legal prosecution to uncover the offenders is nearly impossible.

In contrast city-people are strongly supporting the conservation approach and have herein a strong voice to claim for conservation measures and management plans to maintain the ecological continuum and biodiversity. Maintaining ecological structures is a main purpose in the Carpathians, whereas in Western European countries and the Alps the restoration of ecological corridors to reduce landscape fragmentation is of greater importance.

Forest versus game management: Due to economic interests we have to face here contradictory interests among hunters and gamekeepers versus forest and protected areas managers. Particularly game-keeping in forested areas requires to protect animals with fences from predators or on the other hand forest stands foreseen for economic use are fenced to protect them from game species. Both realities may interrupt dispersal paths and thus connectivity. On the opposite restrictions of legal acts are sometimes harming economic interests in harvesting trees, particularly when they protect large carnivores. Here forest management can become a main threat for these animals, when the legal act states that only forest stands can be harvested, if large carnivores are thereof not impacted. Thus forest managers remove them usually from forest stands foreseen for being harvested. In that case foresters are collaborating successfully with the hunting community, as also they still see the predators like “pests” for game species. And in general the results of the corridor model applied in BioREGIO plays here a contradictory role, as the most probable pathways delineated for carnivores makes their detection and hunting easier.

Prevention from road & railway kills: Along infrastructures like roads and railways the task of forest management is to prevent the animals from crossing roads or railways. Therefore it is required to create intelligent guidance systems with natural and artificial fodder-grounds that guarantee a safe landscape dispersal. On the other side forest management has to take responsibility to share or to cover the costs for installing and maintaining fences along roads and railways touching forested areas to protect animals from getting killed. Fences at the edge of forest areas or along hedges are leading the animals to green infrastructures like eco-ducts or subways to cross roads or railway tracks safely.

Recommendations regarding forest management in order to make it a positive contribution to the development of ecological connectivity can be summarized as follows:

- Awareness-raising among foresters and farmers regarding ecological connectivity and their contribution to the establishment of an ecological network: These ideas and concepts should become self-evident for sustainable forest management. This has to be agreed with several stakeholders to be in line with Natura 2000 areas, the Environmental Impact Assessment (EIA) as well as with the certification conditions of the Forest Stewardship Council or the Pan-European Forest Certification (PEFC).

- Management plans should include forest/agricultural territories and NATURA 2000 sites. Ecological corridors and herein also stepping stones should be included as relevant ecological elements in forest planning.
- Forest plantations for gaining energy wood or Christmas trees should be fenced to protect them from any damages.

2.5 Agriculture

Farms and carnivores: The size of intensively used agricultural fields are for most species a barrier and even a dangerous trap for dispersal and ecological connectivity. Hence monoculture fields would require at least some landscape structures as stepping stones for covering and orienting. Besides, the application of technical harvesting machines as well as the application of herbicides and pesticides has to follow standardized rules to minimize the killings of dispersing animals. Such farm types are rather typical for the foothills and the fringes of the Carpathians, whereas in the Carpathians subsistence and semi-subsistence farming is more common. Concerning the presence of large mammals, the situation differs from place to place. In many cases farmers are used to them and to the damages they may cause and have accepted to live in this coexistence. Losses of breeding-animals or damages at bee-houses are avoided by holding dogs and the permission to shoot this animals if they attack human facilities. Farmers are advised to fence their territory preventively, as this is a precondition to claim compensation-payments for damages from carnivore attacks. Occasionally sheep in the mountains are killed by large carnivores and farmers have to face with a compensation system that is not everywhere regulated and transparent. In particular situations the authorities or the hunters associations are paying, but the whole process-cycle needs to be considered.

As farmers in rural areas are sometimes less experienced with legal restrictions and bureaucratic procedures, it is highly recommended to install an advisory-service centre to throw lights on policy measures and legal restrictions to enable those remote located farmers at least the possibility to access public funds to reimburse the created damages.

Farming and game-keeping: Usually this is not *per se* contradicting. Only in the case of game-keeping the overpopulation of game species for economic reasons causes damages in agriculture, what makes conflicts unpreventable. The operators and their hunting guest are often not residents or even from abroad and are thus less caretaking in nature conservation. Normally they are not interested in carnivores but rather on their prey-species (wild boar, red or roe deer) carrying hunting-trophies. Damages to farmers are compensated by those hunting clubs directly. As farmers are becoming even less tolerant to the damages their attitudes towards large mammals is not positively driven. To cope with these problems in the long run and gain trust among the farmers, two solution variants are discussed. Either these hunting clubs are restricted to fenced private land what is even negative to ecological connectivity. For the case hunting activities are applied on state owned territories, responsible authorities should introduce particular hunting

permissions that enables them to supervise hunting activities, to control the game species populations and thus to limit damages.

Wind-farms and flight paths of birds: Wind farms are obviously disturbing the flight paths of birds and are moreover impacting the habitat-attractiveness for large animals negatively. The allocation of these wind parks should thus concisely consider in an SEA or EIA the effects of the rotors and the produced noise on the fauna and biodiversity.

New planned infrastructures and farming: If the territory where new infrastructure facilities are planned is covering agricultural land, an agreement on selling prices has to be found, which usually varies between utilized agricultural area and industrial territory. For those cases the land is not intensively cultivated or the proprietors even don't have any relation to their agricultural land anymore, these (new) farmers are most likely interested in selling their land. On the other hand, those farmers economically addicted to agricultural production and who are often strongly integrated in the local network, are not willed to abandon the management of their agricultural land. This requires the development of alternative variants or other compromises. To sustain ecological connectivity, eco-ducts or subways along these new infrastructure facilities are installed as this is required in the SEA and EIA to offer save crossing-passages to wildlife and to avoid road kills. These infrastructures should be well integrated into existing ecological structures like stepping stones and linear corridors. As along this ecological networks agricultural damages cannot be avoided, legal regulations (contracts on nature conservation) have to be defined to reimburse the incidental damages through wild boar, red deer or carnivores from public funds.

Concerning agriculture, the main issue in the Carpathians is land abandonment, more than damages of wildlife. Especially young people move away from agricultural lands to main settlements.

To deal adequately with the theme of landscape fragmentation and ecological connectivity it would be best to include it as a measurement in the agro-environmental program of the rural development plan. In this case it would be required to estimate the costs, which may evolve for compensating the agricultural fields, allocated to ecological connectivity like wind shelters and comparable stepping stones.

For sustaining these stepping stones and to motivate farmers to support connectivity a contractual mechanism needs to be installed. Therein a kind of "Trust-Fond" could be appropriate to sustain a heterogeneous landscape structure and avoid landscape fragmentation. The planning procedures thereby should be conducted by the local authorities. Here the fear could be faced that the plans and measurements foreseen are good designed but unfortunately not adequately applied. Hence the donors "the Trust Fond" for instance should only agree on the distribution of subsidies if the process is prepared and implemented correctly.

Integrate measurements to foster ecological connectivity as an agro-environmental measure in the rural development plan (2014-2020) would be a preferred option to claim support from the European Union to find at least a compromise to solve the land-use conflict.

The agricultural sector in the Carpathians needs a new vision and forecast, in order to conserve existing structures, avoid land abandonment and enforce new measures.

2.6 Trans-boundary issues

Both strategic environmental impact assessments (SEA) and environmental impact assessments (EIA) of projects having a significant impact on environment, as well as assessments of the impact on Natura 2000 sites, can provide the comprehensive warranty for the protection of natural values. Both assessments take into consideration both the findings of environmental impact study and the results of consultation with specialized environmental authorities and the public, before authorizing a plan or a project. The environment and/or Natura 2000 impact study should, however, stress biodiversity and ecological connectivity-related issues, thus ensuring a sound implementation of Natura 2000 legislation and an effective national biodiversity and ecological connectivity protection; exemptions should be limited and granted on a stricter basis; public participation in the procedure should be enhanced especially in trans-boundary context.

Management plans are key management documents for protected areas. They provide the basis for ensuring ongoing management of protected areas or their buffer zones and for protected areas of international importance. Only a few protected areas approved valid management plans. Thus protected areas do not have clear and concrete rules on how to restructure and organize their territories. At the same time, protected areas apply simultaneously other plans or programs, which influence them – like: forest management plans or municipal and regional land-use plans. Thus, both at national and cross border levels, it is recommended to integrate all approved and applied management plans for each of the protected areas into one management plan to avoid their mutual competition and use protected areas in accordance with their original purpose. The main issue, in this case, is the differences in legal requirements and frameworks for spatial and landscape planning which prohibits the establishment of unique management plans for trans-boundary protected areas. Additionally, the identification of common interests and topics of protected areas (PA) operating in a trans-boundary surrounding would encourage to anchor guidelines on common trans-boundary aspects and decisions taken in a “Memorandum of Understanding (MoU)” which would be available to different PAs dealing with trans-boundary issues.

In different Carpathian countries, similar category names of protected areas are applied to sites that diverge in terms of the protection regime, thus a harmonization of definitions and related protection regime should be promoted especially in trans-boundary areas.

As for cross-border natural areas, besides bilateral/multilateral and international agreements, other instruments, such as the European Grouping of Territorial Cooperation (EGTCs) regulation, should be further developed and adopted by Member States (as foreseen by the EU-Commission), regional authorities, local authorities and/or bodies governed by public law to facilitate and promote specifically cross-border, trans-national and inter-regional cooperation in favour of ecological connectivity.

Cooperation, interfaces and coordination among trans-boundary protected areas and between EU/non-EU state should become more intensive. An open collaboration should be aimed and compromises for solving problems should be found. Herein the centralization of competences would be contradictive.

2.7 Hunting laws

Hunting Law Acts are commonly approved at state level, however they often contain (e.g. Poland) direct authorization to local organs to adopt sub-national acts, which may constitute a derogation from the national law and lead in fact to a diminished protection of some species. Thus, derogations should be limited and granted only under strict conditions: preventing that at local level species are not protected.

In some of the Carpathian countries, hunting laws are only in fragmentary compliance with the EU legislation, in particular with the EU Bird Directive. Some infringements procedures have been already initiated by the EU Commission against Carpathian countries, e.g. Infringement procedure against Slovakia – No. 2012/4003 – for inappropriate implementation of Art. 2, Art. 7.1, (3) and (4) and Art. 9. (1) and (2) point. b), c) and d) of Directive 2009/147/EC on the conservation of wild birds. The reason is the lack of protection of selected bird species and discrepancy in the Nature conservation regulations and the Hunting regulations, especially the fact of missing the so called ‘non-hunting zones’ in some Special Protected Areas. EU Court of Justice has already delivered Judgements against some of the Carpathian countries to this regard (e.g. European Commission vs. Republic of Poland, Case C-192/11, in which the Court declares that by not applying national conservation measures to all species of naturally occurring birds in the wild state in the European territory of the Member States, which are entitled to protection under Directive 2009/147/EC on the conservation of wild birds, and also by not correctly defining the conditions to be complied with in order to be able to derogate from the prohibitions laid down by that directive, the Republic of Poland has failed to fulfil its obligations under Articles 1, 5 and 9 (1) and (2) of that directive. Thus, national legislators shall integrate without delay (if not done yet) hunting laws with the Natura 2000 legal framework and authorities shall improve their enforcement both at national and local level.

In some Carpathian countries (e.g. Slovakia) sensitive species (e.g. *Canis Lupus L.*) are not protected, and can be hunted, previous a permission from the provincial government (NUTS2). Thus, legislation should grant protection to these species as they do not longer exist in most of the countries of the European Union.

Although wolves are protected in Romania, selective hunting is applied to control their population. It is in the competence of the provincial government (NUTS2) to provide license for wolf hunting.

2.8 Urban sprawl and settlement expansion

Not only the construction of big infrastructural projects, such as motorways, but also small intervention at local scale have an impact on ecological connectivity; this is the case of the expansion of settlements and urban sprawl. As in Figure 7, settlements that are continuously interested by the “visits” of bears, need to adopt strategies to limit their impact. The bears are attracted by garbage and, although they do not cause any harm to local population, their presence is a serious disturbance.



Figure 7: A “bear-safe” garbage-collection-place (Băile Tușnad, photo by Filippo Favilli).

Two contrasting factors have an impact on this issue. On the one hand, the rapid socio-economic transformation are resulting in the willingness of local communities to expand dwelling areas. In this context, there is often an underestimation that even minor changes in the local settlement expansion, such as the allocation of garbage collection place (see Figure 7), can have an effect on the behaviour of selected species (such as bears), especially in rural areas. Small intervention like the one in Figure 8 may prevent bears to make damages and stimulate them to find alternatives for their movements. Parallel to this process, urban sprawl and (illegal) settlement extension can be driven also by the expansion of specific sectors.



Figure 8: Example of urban sprawl in a peripheral zone in the Carpathians

One example is the tourism sector, where growth often underlines the subsequent expansion of the hospitality and leisure infrastructure. Legislation and planning procedures are the main instrument of intervention in order to discipline the phenomenon; nevertheless, especially at the

levels of small communities, the regulatory framework and the enforcement can have a low effectiveness. Moreover, shared approaches to spatial planning among different municipalities are still not widespread; this results in a fragmented planning also in small areas. Finally, the spatial planning regulation at local, regional, national and Carpathian level does not integrate the concept of ecological connectivity and ecological corridor.

Impacts are multifold: on the one hand, the penetration of urban features into the landscape can affect important areas for feeding or breeding; on the other hand, the expansion of settlement can change the behaviour and the movements of selected species due to fencing or disturbance. Finally, fragmented planning among municipalities or provinces can result in a loss of connectivity.

While the drivers of this expansion (such as the creation of new touristic attractions or new dwellings) are positive signals of economic diversification for local communities, there is the need to intervene in a planning phase in order to avoid negative impacts of the phenomenon.

Possible recommendations regarding this field of intervention should address the following points:

- Add the concept of ecological connectivity in local spatial planning, in order to adequately address land – use change phenomena.
- Enforce spatial planning regulation and the integration of different planning levels.
- Make a management plan obligatory for protected areas.
- Promote inter-municipal plans for municipalities from the same geographical area (for example, a valley), to share infrastructures commonly (like garbage disposal areas) and to be able to design ecological corridors at inter-municipal level.
- Elaborate a foresight-analysis concerning potential urban sprawl and uncontrolled settlement development due to the new motorways.
- To avoid urban sprawl and probable conflicting targets concerning landscape fragmentation, facilities to sustain connectivity should also be included in the agro-environmental program.

2.9 Ecological connectivity: beyond protected areas

One of the main obstacles that can be highlighted in the promotion of ecological connectivity is the diffused perception among different stakeholder groups that a protected area is needed in order to make an ecological corridor. As the site visits in the overall Carpathians have shown, this perception is widespread among different actors at local, regional and national level, even among actors that are responsible for protected areas and conservation.

While the legislative aspect remains essential for the establishment of protected areas and nature parks, which constitute the essential ecological structure whose connection ecological corridors must protect, the preservation of corridors can be achieved also through a combination of legislation and practices of sustainable integrated management.



Figure 9: Agriculture in mountain environments and its interaction with other relevant features regarding ecological connectivity (such as roads).

This is particularly relevant where economic activities, such as forestry and agriculture, are in place. Here corridor development strategies can be combined with adequate incentives to land owners for the sustainable maintenance of these zones according to connectivity criteria. One main advantage of such integrated management is that it could also be advantageously carried out at transnational level, where the presence of different legislations could be a main barrier.

Possible recommendations regarding this field of intervention should address the following points:

- It is essential to highlight the potential ecological corridors through reliable models, in order to show up the areas where a sustainable integrated management should be fostered.
- Abandoned lands should be integrated in the restoration of corridors.
- The relevancy to maintain or restore ecological corridors should become also part of landscape and spatial planning – e.g. in Slovakia this is already considered in the “territorial system on ecological stability”.
- Legislation should be combined with sustainable practices in agriculture or forestry.
- Adequate incentives should be allocated to private landowners and firms in order to promote an integrated management.
- Adequate prevention and compensation measures for damages should be developed.

2.10 Compensation of damages

An effective approach to ecological connectivity should address the different steps in which conflicts between human activities and wildlife can arise, starting from the planning, through implementation up to the management of possible conflicting events. In this framework, a reliable and clear system of compensation of damages caused by wildlife is essential, since it can

strengthen the trust of the local communities in the authorities responsible for nature preservation and wildlife management. This can also lead to a more positive attitude towards initiatives aiming at promoting ecological connectivity.

There are several factors that hinder an effective application of compensation mechanisms: one of these is the lack of transparency and clarity regarding compensation. Often, local stakeholders do not have a clear idea of who can benefit from compensation, what can be compensated and how to access the compensation scheme. Moreover, this situation is influenced by an uncertain governance of the management of damages caused by wildlife in specific case, for example those caused to cars in a road collision. In this case, the different authorities involved may not have regular structures of dialogue (e.g. regular meetings or exchange) and often there is a lack of coordination in the intervention after a damage occurs. This affects the recipients of compensations, especially in a case of a scarce coordination between the authorities that should evaluate the entity of the damage and the ones that should compensate the damage.

A situation of uncertainty could discourage the application for damages compensation and could foster a negative attitude towards measures for ecological connectivity and the coexistence between wildlife and economic activities. Moreover, a lower rate of report of damages by private citizen can also represent a negative aspect in the monitoring system of wildlife presence and associated damages, which could profit from precise and updated information.

Recommendation in this aspect should therefore address three main points:

- Improvement of governance of compensation mechanisms: a positive coordination among all the authorities responsible for an intervention in case of damage should be promoted, for example through regular exchanges and meetings.
- Improvement of transparency and promotion of compensation mechanisms: a clear communication to private citizens should be promoted, in order to clarify who can be the beneficiary of the compensation system, the amount, the conditions, and which are the steps in order to receive the compensation. Specific attention should be given by the local authorities to the information and promotion of forms of damages prevention and related schemes (e.g. insurances).
- A clear system of complaint management should be set up and fostered in order to increase the trust of citizen in the responsible local institutions.

3 Recommendations for National Strategies to promote ecological connectivity

The final guidelines produced at the end of the BioREGIO project wanted to give a general overview of the main barriers that, at current time, or in the future reduce the general permeability of the landscape. Due to the fact that each country has its own story, landscape structure, laws, socio-economic environment and relationship with the local wildlife species, the ten final guidelines did not want to be comprehensive for the whole Carpathians mountain range.

Ecological connectivity means working with communities to find solutions that are practical and that may provide mutual benefits for humans and wildlife. It has to be taken into consideration not only the perspective of science but also of residents, farmers and industry. In order to better plan future projects and local activities, each project partner was asked to rank each of the produced guidelines and to explain their choice. With these national evaluation the WP5 partners were able to produce specific strategies for each country to sustain the national ecological network and give an outlook on priorities the single countries should focus at when considering ecological connectivity in any national guideline or strategy they may develop.

3.1 Slovakia

Due to the close collaboration with the state nature conservancy, the organized site visits and the contribution of Slovakian experts at the workshops during the mid-term and final conference we received a quite broad view on the Slovakian situation. Generally spoken, the environmental awareness of both people and politicians in Slovakia appear to be still quite low. Particularly after joining the EU – where the priorities are put on Natura 2000 sites – responsible people felt insecure as they thought the new legal acts will be less practical than their former conservation approach from the socialist era.

Anyway Slovakia is suffering from the need to design a national plan on connectivity as new-infrastructure facilities are planned to foster the “economic connectivity” between Bratislava and Košice. This would require a proper coordination to apply the environmental impact assessment (EIA) and to give the society a proper time to announce their doubts to react on planning strategies. In this process Slovakia is benefitting from the already applied tool on “Territorial System of Ecological Stability” that fosters ecological connectivity, which unfortunately is still lacking in being implemented as designed. Due to its practical relevancy there is the idea to integrate this system at the EU level for maintaining and restoring ecological networks.

Concerning the installation of new road infrastructures to enforce the economic corridor between Bratislava and Košice, the EU membership foresees proper Environmental Impact Assessments (EIA) before constructing new motorways. Due to that, the D1 motorway planned to be built through the Malá and Veľká Fatra National Park was stopped. Nonetheless, studies on ecological connectivity have been done, but they remain at the “report level” without a proper application in real cases.

Besides it seems that the theme of Animal-Vehicle Collision does currently not have an optimistic prognosis. A national database or any mitigation measures foreseen to cope with this aspects have not been installed yet. And up to now, only two green bridges are connecting patches of virgin forests. To summarize the statements of various stakeholders, Slovakian politicians responsible for constructing infrastructures, don't have a sufficient awareness and sensitivity for questions on landscape fragmentation and ecological connectivity.

Although the Slovakian Territorial System of Ecological Stability lacks in implementation, it is foreseen that the measures are considered also in the spatial planning act. There are also foreseen migration corridors for big animals – but currently not "applied" on the ground. Thus there are no urban and landscape plans to control urban sprawl. Regulations are still mainly unapplied – leading to the loss of ecological connectivity. Thus stepping stones and ecological corridors should be included in the forest management plans as sustainable managed forests are either business orientated and support targets of biodiversity.

Regarding policies beyond ecological protected areas, Slovakia has a need to foster the economy. That creates pressure on the National and Nature Parks. Environment authorities lack the political power to enhance landscape permeability as capacities and money for nature conservation are continuously reduced. Herein the impact of the now usually designated IUCN-V areas have only a weak protection effect. This underlines that nature conservation is not a major topic in the Slovakian policy. This lack of interest can be seen also in water and river basin management, important to protect from floods, and is on the other side a relevant corridor element. The problem is that farmers do not want to give up their agricultural managed land and there is no strategy for compensation from the public authorities. Furthermore, hydropower plants are causing problems to connectivity along the river – for the otter and the fish.

Slovakia is in need to adopt a multi-layer and multi-sectorial approach in order to raise the general population awareness on environmental topics and put different actors and interests at the same table.

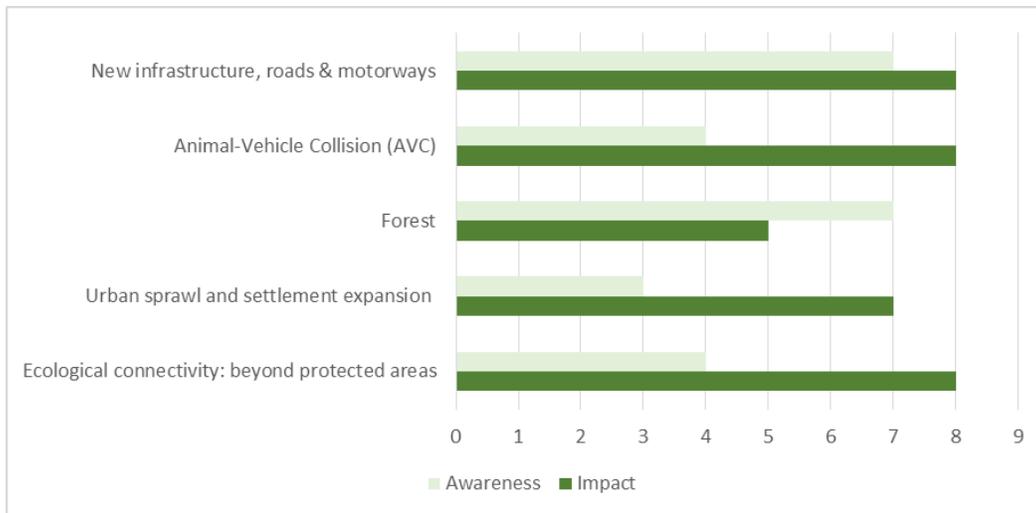


Figure 10: Essential Guidelines to sustain Ecological Connectivity in Slovakia concerning their relevancy and awareness (estimations derived from the explorative statements).

3.2 Czech Republic

No site visit was performed in Czech Republic. The information and recommendations were provided from the partners' view, which considers the common situation of ecological connectivity and continuum in the Czech Republic very generally.

Nonetheless of the organizational problems of the Czech partner in the SEE program, the Czech Republic is very active in identifying conflict areas. They particularly put emphasize on animal-vehicle collisions or on the adoption of the best mitigation strategies as they are aware of the barriers new foreseen motorways could pose for connectivity. Thus for these new infrastructures the road planners have foreseen at least some new overpasses (eco-ducts), underpasses and tunnels in an appropriate way. The problem is worse on old highways that weren't equipped well with these mitigation structures. The idea of adding eco-ducts or creating underpasses on existing roads is gaining concrete opposition at the political level and is registered as a loss of money.

As in Slovakia, the general environmental awareness is still quite low although Czech Republic is also running a Territorial System of Ecological Stability. Since the modernization and the construction of new infrastructures is seen as a priority that could gain growth for the state general economy, whereas environmental protection issues are considered as less important in the short time view.

Besides, Animal-Vehicle Collision (AVC) is causing main problems on roads of first category as well as at lower road categories. Information are taken from a database that records continuously in a monitoring system car accidents with animals.

As observed in other Carpathian's countries (e.g. Slovakia, Romania and Ukraine), additional threats for wildlife and nature conservation come from poaching and illegal urban sprawl. Hence in general, more focus should be paid to management plans and spatial planning procedures in relation to migration corridors and especially to their critical sections, where free animal movement is expected to be restricted.

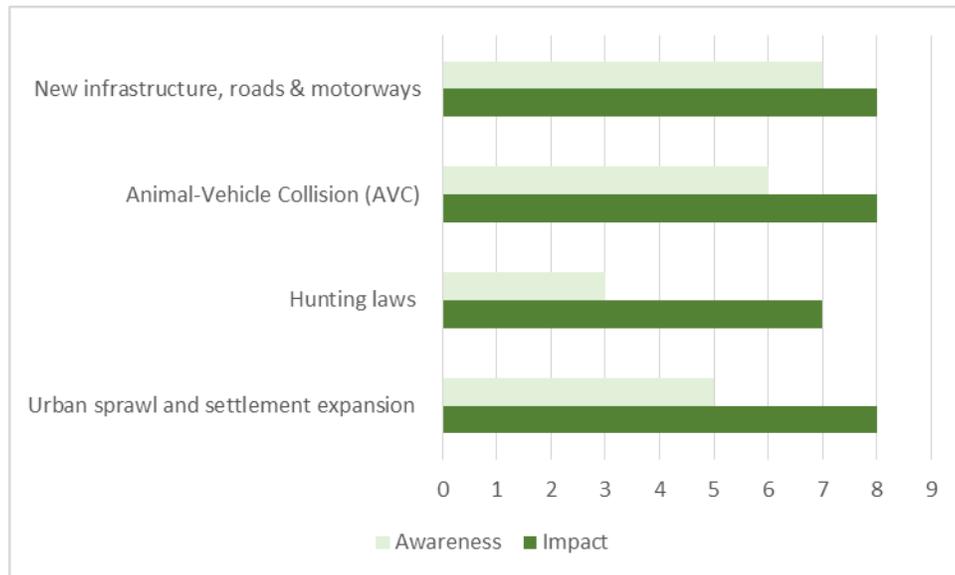


Figure 11: Essential Guidelines to sustain Ecological Connectivity in the Czech Republic concerning their relevancy and awareness (estimations derived from the explorative statements).

3.3 Hungary

In Hungary, the dominating aspect is economic income coming from the exploitation of nature. Nature conservation gains less money than hunting, forestry or agriculture. Hunters and foresters' lobbies have a great decisional power regarding the usage of natural resources, both inside and outside protected areas. National Parks, although striving for nature conservation and awareness raising, have a limited power even inside their own territories.

Forest management makes a great use of fenced areas, due to different reasons and interests: (1) protection against damages at forest trees from game species; (2) game farming for meat production (small areas); (3) hunting gardens (> 200 hectares). And secondly due to economic reasons native tree species are replaced by foreign species – like beech trees, which are in hilly territories sometimes substituted by spruce or silver fir, what is causing an obstacle to species dependent on beech forests.

Thus, the ecological corridor approach has to consider the habitat requirements and ecological habits of species: large-scale sustainable forest management does not necessarily correspond to the needs of species. Also those species which used to live on wide and open territories and avoid forests have to be considered. And awareness has to be put on the seasonal impact. During winter, when there is the tree-harvesting season, the workers are causing stress to the animals when they are in a recovering phase as fodder is rare and moving (fleeing) in the snow costs a lot of energy.

Besides, the hunting regulations are more likely to promote the economic interest than ecological requirements for nature protection. The hunting right is at the owner of the land, but only the state can give the permission to shoot the game. That's not unique to Hungary only. Romania applies the same regulation. Hunting gardens or hunting farms are renting these hunting rights from other land owners. It is their interest to gain these hunting rights to breed a high number of game species to guarantee attractive trophies for their customers. On the other side forest owners, from whom they have rented these rights - independent if state or private owned - are suffering from damages the game species are causing to trees and soil. Sustainable forest management procedure is here competing directly with intensive and economically driven hunting interests. As these hunting territories are usually fenced they become a 100% obstacle for ecological connectivity.

Concerning the social perception, there is a great difference in environmental awareness comparing people from the cities and people from the countryside. "City people" have an emotional approach to nature even beyond protected areas. They wish to have more "green areas", and to observe wildlife in their native environment, while rural people have a more materialistic view, suffering from the conflicts they have with wildlife and influenced from the target to gain as much economic income from nature as possible.

Thus Hungary needs to find the “middle-way” between economic interest and nature conservation, developing programs for environmental awareness and projects to study the benefits coming from a functional ecological network, both ecologically and economically.

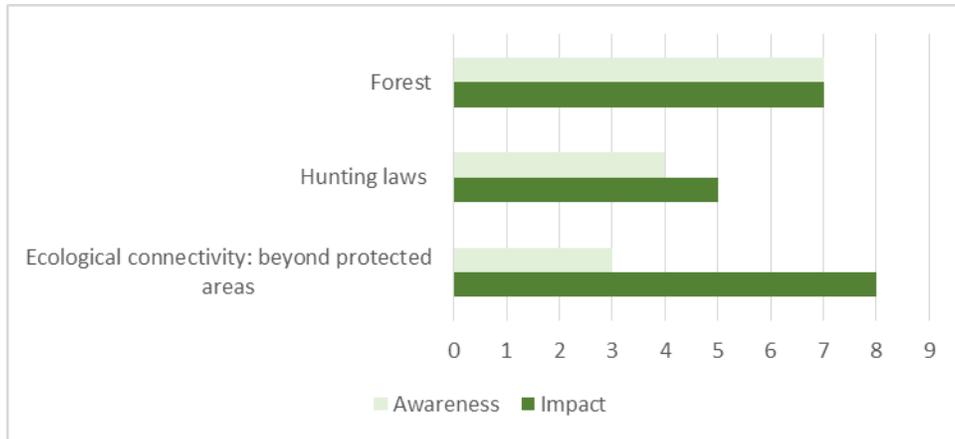


Figure 12: Essential Guidelines to sustain Ecological Connectivity in Hungary concerning their relevancy and awareness (estimations derived from the explorative statements).

3.4 Romania

Romania is subjected to big new motorways construction. Due to the EU regulations, studies on ecological corridors and recommendations for planners are available, although they are remaining at paper level. Nonetheless, negotiations with the highway administration are going on to decide the best motorways alignments providing less impact to nature.

Regarding forest management, in Romania, large fenced forest areas are not a big problem. Much more relevant would be particular harvesting strategies to maintain protected areas. Romsilva, the state owned company managing the Romanian state forests and other private forest associations and owners should follow a sustainable forest management strategies that consider also measurements to foster ecological connectivity. A feasible procedure to guarantee that could be the introduction of a permission fee for harvesting that is only provided to forest holders following a sustainable forest management strategy. Another comparable approach would be a certification procedure, in which measurements fostering ecological corridors are considered in the evaluation.

In none of the Carpathian countries agriculture was announced to have a meaningful impact to ecological connectivity. In Romania this seems to be different. The maintenance of the typical patterns of agriculture in the foothills of the Carpathians in south Romania is causing land use conflicts. Agro-environmental compensation payments were designed and foreseen but are practically not applied yet. Hence, this traditional agricultural landscape patterns are for that reason integrated into large intensively managed agricultural fields, where each square meter is used.

There is no space anymore for wind-shelters to avoid soil-erosion or diversified agriculture patterns for offering the species little options for coverage or orientation.

Intensive agriculture in the Carpathian Convention territory of Romania is usually not very common. Usual are subsistence and semi-subsistence farming. Normally the farm holders are fencing their agricultural land, which is not influencing connectivity a lot. This small-structured agriculture creates diversified landscape patterns, which is supporting the connectivity and ecological corridors. On the opposite, land abandonment can become an obstacle for some species adopted to agriculturally cultivated landscape structures, when the fields are gradually changing to forested structures.

Hunting in Romania is often practiced for economic reasons: private forest owners in Romania are not the owner of the animals, and hunting rights are distributed to districts by the ministry of environment. Usually the hunting permissions are given to large entities, in which private landowners can become a member to apply their hunting rights. Hence, the state and mainly the ministry of environment has the central coordination for hunting procedures. Thus the limits, restrictions and guidelines of the ministry for giving the permission, could also include measurements to sustain the population of large carnivores and their habitats. On the contrary hunting procedures like feeding point could cause a disliked situation, when some mobile species (wolf and bear) are changing their migration behaviour, as they are used to follow ungulates that are attracted by hunters to these feeding points. Mainly bears could become more confident to human society, which may lead to conflicting situations even in densely populated areas.

Due to the large numbers of wildlife species and individuals, it is essential for Romania to develop a national strategy to combine and valorise human and wildlife needs, which may bring several benefits, from a health and socio-economic points of view.

Apart from this general recommendations for Romania, site visits have highlighted particularly the problem of urban sprawl which is almost impossible to detect and to stop, due to the remoteness of locations compared to the central government and to the low updating of maps. Together with developing programs for environmental awareness, Romania should increase the presence of authorities to raise the state power in remote areas. If people feel protected from the state and involved in the decision processes, they may stop to use nature in an unsustainable and legally not acceptable way. A higher control could help solving several local problems and meanwhile a vision could be created enhancing the respect between nature and human society.

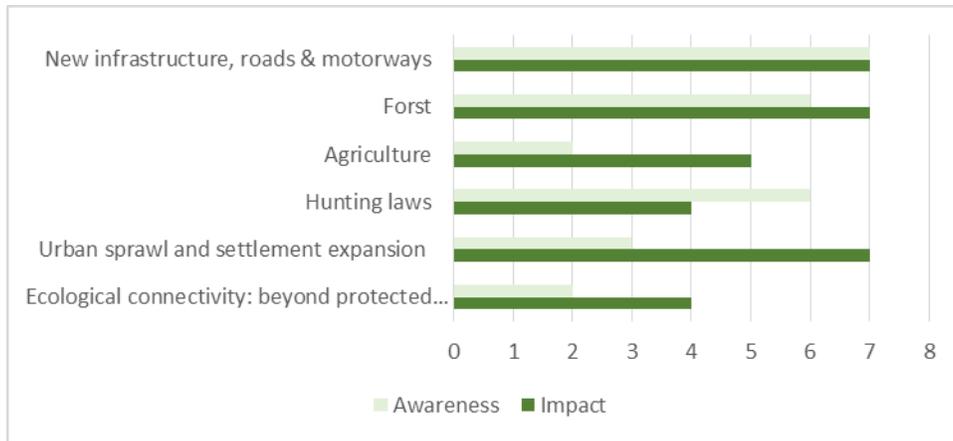


Figure 13: Essential Guidelines to sustain Ecological Connectivity in Romania concerning their relevancy and awareness (estimations derived from the explorative statements).

3.5 Serbia

The main problem highlighted during the explorative site visit is the total absence of a road kill recording and monitoring system. Road kills are frequent on national roads but no mitigation strategies are applied yet nor in development. The general awareness of drivers is low and there is no concern related to the impact of wildlife-car accidents on human health and wildlife populations.

Serbia should develop more programs for raising drivers' awareness on this topic and start to identify road sections of higher risk for collision and to install there mitigation structures.

This problem does not affect only wildlife and human health, but has several repercussions also in the touristic attraction of the country. National roads running along the border of National parks, protected areas, wetlands or riverbanks, are usually highly frequented by bike tourists. The absence of bike routes and mitigation structures for avoiding wildlife-car accidents, together with the general habit of very fast speed driving, may discourage tourists to visit this sites.

A national/local strategy to combine touristic opportunities with a higher nature protection and valorisation of cultural sites, may bring several benefits to the protected areas themselves and to the general image of the country. Hence it is highly recommended to apply more studies to connectivity and adopt a comprehensive strategy on road kill mitigation and prevention. Moreover this helps to get prepared for attaining EU standard and rules.

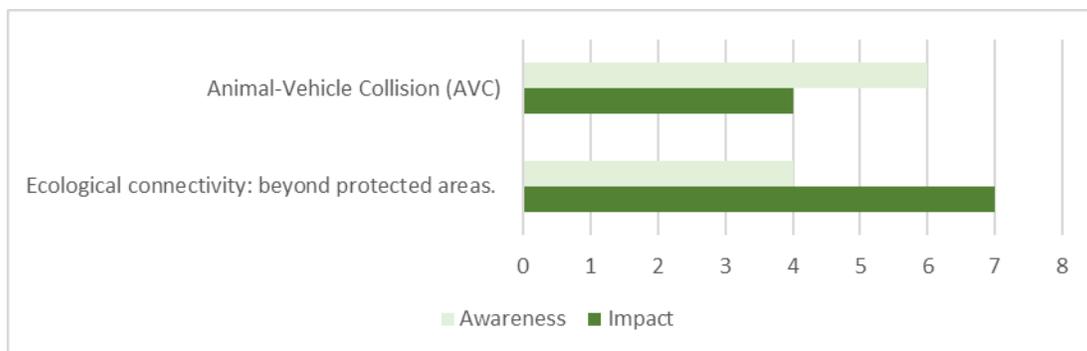


Figure 14: Essential Guidelines to sustain Ecological Connectivity in Serbia concerning their relevancy and awareness (estimations derived from the explorative statements).

3.6 Ukraine

The initiatives on ecological connectivity in the Carpathian part of the country is quite good. According to the local partners and administrators, the country does not suffer from the impact of the human society on the natural environment. The procedure to hold the ungulates populations are at an optimum level and to accept predators as part of the environment with the same needs of humans to live and move, should be continued.

During the site visit it was stated that no new roads or main extensions of settlements are currently foreseen. At the moment is thus no need for predicting their impact. As soon the situation is changing ecological measurements sustaining ecological corridors and avoiding landscape fragmentation have to be considered already during the planning phase.

More attention was paid at the visit to another main problem – the high presence of poaching, which is seen as a sort of “family tradition”. Due to that tradition and the corporate acceptance this phenomenon is extremely difficult to change. Surprisingly it turned out that according to the experts’ view poaching does not have a meaningful impact on nature protection and connectivity. The wildlife species, which suffers more for that, is the Capercaillie (*tetrao urogallus*), but specific studies, both on its population dynamic and impact of poaching are missing.

Specifically it is recommended for the Ukraine to continue the transnational cooperation and the creation of studies on connectivity with Romania and Slovakia to allocate the dispersal routes of the most important (umbrella) species analysed in the BioREGIO Carpathian project.

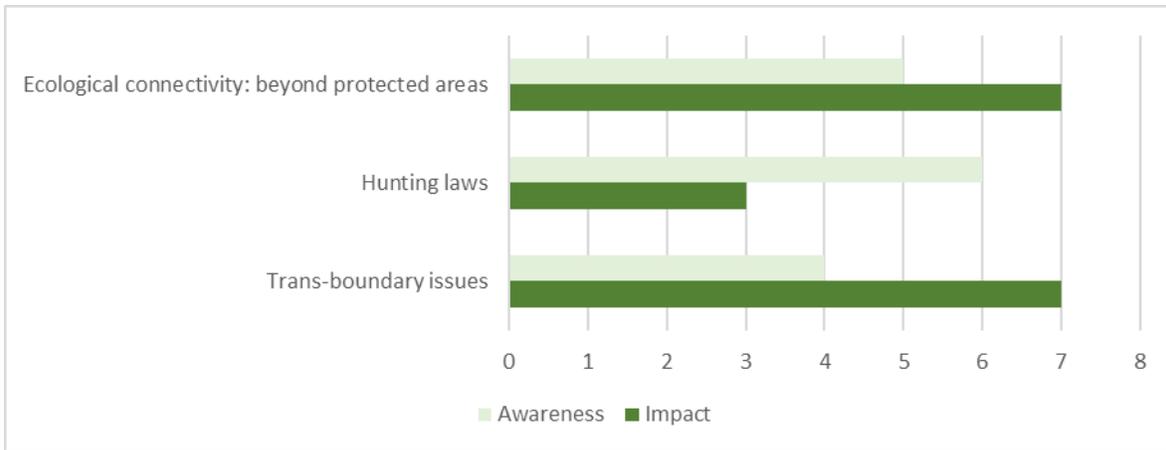


Figure 15: Essential Guidelines to sustain Ecological Connectivity in Ukraine concerning their relevancy and awareness (estimations derived from the explorative statements).

3.7 Poland

In the past years Poland has been quite active in the protection and valorisation of the national ecological network and its trans-boundary integration to the Carpathians' wide corridors. Currently this network of migration corridors in Poland is seriously threatened with disruption by the building of several new motorways and express roads protected with a fence on both sides. Since 2004, researchers, planners and investors have thus started to develop the handbook "Animals and roads: methods of mitigating the negative impact of roads on wildlife" to prevent the Polish ecological network from further landscape fragmentation in the future. The handbook has been revised in 2006 and 2009 (English version) and the recommended mitigation measures and recommendations have been updated to the current situation. Polish researchers on ecological connectivity are continuously lobbying at the Polish Government, to include regulations for migration corridors into the following documents: Nature Conservation Law, Environmental Law, Forest Management Law, Spatial Planning Law, and other regulations concerning preparing the Environmental Impact Assessment. Additional negotiations are ongoing for the conservation and restitution of migration corridors in several operational programs. As a result of these new operational programs on Environment and Transport Infrastructure as well as Development of Rural Areas some resources are guaranteed for wildlife corridors restoration and resolving conflict with the transportation infrastructure. These strategies to foster afforestation of private lands and pro-ecological management of private forests and to install eco-ducts or subways, where wildlife is crossings existing roads should be continued.

The main barriers and endangerments for the Polish ecological network identified in the literature and in discussions with local stakeholders are concentrated on: (1) current and foreseen linear Infrastructures; (2) deforestation of vast areas and low forest cove; (3) compact housing/urban sprawl in rural areas within important wildlife corridors; (4) the extension of industrial zones and (5) the installation and extension of ski-resorts. Mainly these recommended advice to deal reasonable with high sensitive natural sites should be applied also to the ecological corridors, crossing the Polish Carpathians too.

Although active in the identification of the locations for placing mitigation measures (e.g. over/underpasses), the amounts of conflicts due to linear infrastructures are still very high. Sometimes this is occurring, as wildlife crossings have been positioned in the wrong location and not sufficiently used by game species. To continue and support the process already started in Poland the so far developed recommendations from the BioREGIO Carpathians project are ready to be adopted to the Polish situation. They are corresponding to various demands from Polish study authors to put the focus on sustaining the ecological network by promoting a positive coexistence between humans and wildlife.

Concerning the main threats coming from infrastructure facilities, the authors are thus preferring to identify current wildlife passages through GIS analysis and field work, to design and build wildlife crossings' / underpasses in coherence to methodical recommendations, with the main objective, to minimize its interference with Natura 2000 sites.

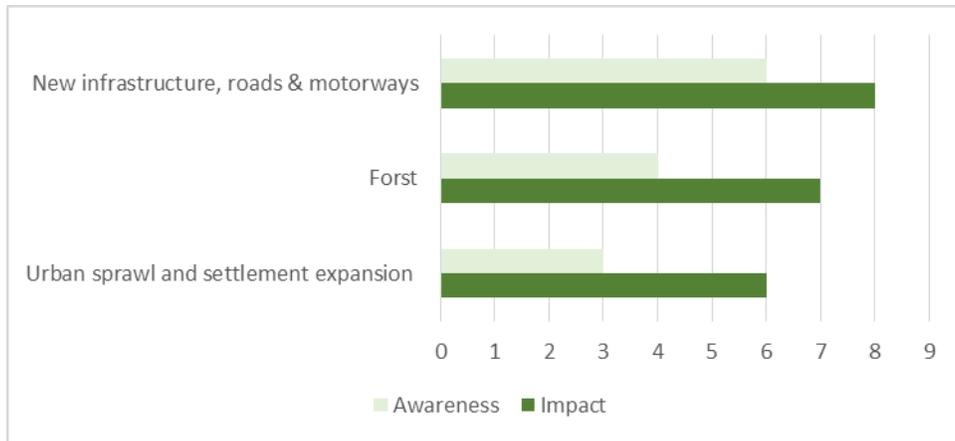


Figure 16: Essential Guidelines to sustain Ecological Connectivity in Poland concerning their relevancy and awareness (estimations derived from the explorative statements).