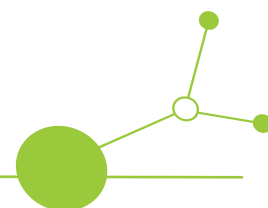


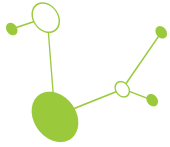
CROSS-BORDER RECOMMENDATIONS FOR CARPATHIAN BORDER REGIONS



Final version

November 2025





CROSS-BORDER RECOMMENDATIONS FOR CARPATHIAN BORDER REGIONS

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Suggested citation: Duľa M., Zwijacz-Kozica T., Sütő D., Kubala J. 2025: Cross-border recommendations for Carpathian border regions. Project Interreg Central Europe LECA “Supporting the coexistence and conservation of Carpathian Large Carnivores”. 21 p.

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1. Introduction

Large carnivores represent one of the most ecologically significant, yet socially challenging components of Central European biodiversity. Their conservation and management require coordinated, long-term, and evidence-based approaches that transcend administrative and national borders. The Carpathian region, shared by Czechia, Slovakia, Poland, Hungary, Ukraine, Romania and Serbia plays a key role in maintaining viable populations of wolves, lynx and bears across Central Europe. However, differences in national legislation, monitoring standards, data-sharing procedures, and stakeholder engagement often hinder the efficiency of conservation actions. The LECA project was therefore designed to improve cross-border coherence, harmonise monitoring efforts, strengthen collaboration with local communities and enhance the capacity of institutions responsible for conflict prevention and law enforcement.

This document summarises the final strategies developed within four pilot areas: Beskydy-Kysuce, Tatras, Slovak Karst - North Hungarian Mountains, and the Eastern Carpathians. These areas reflect the ecological connectivity and socio-political complexity of the Carpathian borderlands, and they were selected to test practical solutions in real, diverse conditions. Each chapter provides (i) a synthesis of achievements and challenges encountered during project implementation, (ii) an overview of factors that influenced the success of cross-border cooperation, and (iii) specific recommendations for the continuation and expansion of harmonised monitoring, conflict mitigation, and poaching prevention.

The strategies presented here are intended not only for protected area administrations and conservation organisations, but also for hunters, farmers, local authorities, police forces, and other stakeholders whose collaboration is essential for the long-term stability of large carnivore populations. By integrating ecological data with practical field experience, stakeholder engagement and targeted capacity-building, this document offers a coherent framework for strengthening cross-border wildlife management in the Carpathians and serves as a basis for replication in other European border regions.



2. Beskydy-Kysuce

Achieved and Unachieved Results During Project Implementation

This chapter summarises the main outcomes achieved during the implementation of pilot activities in the Beskydy-Kysuce area, as well as key challenges and tasks that could not be fully accomplished within the project timeframe. It highlights how the cross-border collaboration between Czech and Slovak partners contributed to meeting the project's objectives and where further improvements are still needed.

Key achievements:

- **Harmonised cross-border monitoring system** combining camera trapping, telemetry, genetics and SCALP validation
- **Over 5,000 wolf records** collected across the Beskydy-Kysuce region
- **42 unique wolf individuals identified** through intensive winter genetic sampling
- **6 GPS collared individuals**; telemetry revealed cross-border territories, reproduction, long distance dispersals
- **Preventive measures (fladry, electric fencing, livestock guarding dogs, audio-visual deterrents) successfully implemented** with zero further attacks on pilot farms.
- **First regional testing** of smart tools: **proximity units** and **virtual fences**
- **Cross-border anti-poaching seminar strengthened cooperation** among police, customs and conservation authorities
- Creation of a **shared cross-border database** enabling long-term integrated monitoring

Unachieved results / challenges:

- The **common data-sharing platform between Czech and Slovak partners** was not fully functional; data exchange was mainly manual (via email or file-sharing)
- **Limited stakeholder cooperation on the Slovak side**, especially among hunters and livestock breeders, reduced potential for broader conflict mitigation
- **Successful capture of wolves on the Slovak side was not achieved** due limited trapping sessions due to administrative and technical constraints
- **Population size estimation using advanced capture-recapture models was not completed** within the project timeframe but remains planned for continuation

Recommendations and Future Improvements for the Cross-Border Area

This section provides specific, forward-looking recommendations to strengthen ongoing activities in monitoring, conflict mitigation, and law enforcement. The recommendations aim to consolidate achievements of the Beskydy-Kysuce pilot area and to guide the next phase of transboundary cooperation.

Monitoring harmonisation:

- **Maintain the integrated monitoring approach** combining camera trapping, non-invasive genetics, telemetry and data validation based on SCALP methodology..
- **Strengthen cooperation with hunting and forestry sectors**, involving hunters into large carnivore monitoring.
- **Ensure regular cross-border coordination meetings** for harmonised planning of monitoring campaigns and analyses.



Conflict prevention:

- **Compilation of all damage incidents caused by large carnivores into a database in accordance with FAIR principles, by documenting as many details as possible including the type of prevention measure(s) used at the time of attack.**
- **Continue systematic mapping of damage hot spots and target preventive measures accordingly.**
- **Expand the implementation of tested preventive tools (fladry, livestock guarding dogs, high electric fences) in risk areas, supported by national subsidy schemes.**
- **Develop financial and advisory support mechanisms for Slovak livestock breeders to reach parity with existing Czech schemes.** Livestock breeders in the Czech republic need to maintain the existing financial schemes containing support of preventive measures, payments of extra-work related to these measures and compensation of damages. However, the Czech system would benefit from setting a minimum standard for preventive measures and providing advisory support for small farmers.
- **Maintain the multi-stakeholder platform** involving conservationists, farmers, hunters, and local authorities to foster trust, share knowledge, and coordinate preventive actions.



Figure 1: One of the most challenging tasks in the Beskydy-Kysuce region is reducing wolf-human conflict by improving preventive measures and ensuring their effectiveness. Most pastures remain insufficiently protected and do not meet recommended standards, which significantly increases vulnerability to wolf attacks. (Photo: Michal Bojda)

Poaching prevention:

- **Institutionalise cross-border cooperation between law enforcement agencies** through annual joint trainings and close collaboration on cases of illegally killed large carnivores in trans-boundary areas. **Promote the use of forensic genetic analyses, telemetry data and the lynx database of coat patterns** as a standard method for identifying illegally killed individuals and tracking wildlife crime networks.



- **Strengthen cooperation between scientific institutions and police authorities**, enabling faster data exchange and evidence interpretation.
- Agreed protocol on cadaver collection and autopsy in all cases where illegal killing cannot be excluded.
- Establish independent police teams dealing exclusively with wildlife crime, including prevention actions such as vehicle checks in the field.



3. Tatras

Achieved and Unachieved Results During Project Implementation

This chapter summarises the main outcomes achieved during the implementation of pilot activities in the Tatra pilot area, as well as key challenges and tasks that could not be fully accomplished within the project timeframe. It highlights how the cross-border collaboration between Polish and Slovak partners contributed to meeting the project's objectives and where further improvements are still needed.

Key achievements:

- GPS telemetry on **25+ brown bears** provided detailed data on seasonal movements, denning, habitat use, and cross-border connectivity between Poland and Slovakia.
- First-ever use of **video collars in the Western Carpathians** produced 2,600+ recordings documenting natural behaviour, foraging, denning and family interactions.
- Integrated analyses (genetics, diet metabarcoding, hormones) revealed **lower dietary diversity and higher human-food intake** in settlement-visiting bears, along with **lower cortisol levels** indicating habituation.
- Electric fencing and bear-proof containers effectively reduced conflicts at key hotspots on both sides of the border.
- Telemetry identified **illegal attractants** and high-risk zones, guiding targeted interventions.
- A binational seminar improved **anti-poaching cooperation** among police, customs and conservation authorities.
- Harmonised PL-SK data integration strengthened SCALP-based monitoring and long-term coordination

Unachieved results / challenges:

- Technical limitations of **video collars** prevented recording of planned night-time deterrence events.
- A **lower number of human-bear conflicts (Poland) and different bear intervention and management regime (Slovakia)** during the project **reduced opportunities for aversive conditioning experiments and collection samples for hormonal and diet analyses**
- One probable **poaching case was not formally reported**, highlighting the need for clearer and stricter enforcement procedures.
- **Methodological differences between Polish and Slovak institutions** occasionally hindered **full harmonisation of monitoring protocols**

Recommendations and Future Improvements for the Cross-Border Area



This chapter presents specific, forward-looking recommendations to reinforce ongoing efforts in monitoring, conflict mitigation, and law enforcement. The proposed measures aim to consolidate the achievements of the Tatras pilot area and guide the next phase of transboundary cooperation.

Monitoring harmonisation:

- **Establish a unified Tatras monitoring framework** between TPN and TANAP integrating telemetry, genetic, and camera-trap data.
- **Develop a shared database for real-time data exchange** among protected area authorities
- **Standardise data collection protocols**, ensuring comparability of results across borders
- **Continue testing video telemetry technologies** with improved night-vision capacity and remote activation
- **Increase non-invasive monitoring efforts to complement telemetry** through genetic and visual identification.

Conflict prevention:

- **Introduce mandatory bear-proof waste management systems** in tourist zones and settlements within the Tatra region.
- **Implement a coordinated transboundary protocol for rapid response to human-bear incidents**
- **Strengthen collaboration with local communities**, farmers, and tourism operators through education and technical support.
- **Maintain continuous monitoring of bear diet and behaviour to assess long-term trends** in conflict occurrence.
- **Integrate awareness campaigns using educational materials** derived from video and telemetry data.

Poaching prevention:

- **Institutionalise regular cross-border training sessions** for law enforcement authorities, prosecutors, and conservation staff.
- **Develop a Tatra Wildlife Crime Network** to facilitate rapid exchange of intelligence and case data.
- **Encourage the systematic use of forensic genetics and telemetry evidence** in court proceedings.
- **Establish clear protocols requiring mandatory reporting** of all suspected poaching incidents.
- **Promote community awareness initiatives** to discourage tolerance for illegal killings and trade.



Figure 2: Bear feeding at an unprotected trash container - one of the main challenges in Tatra Mts. (photo T. Zwijacz-Kozica)

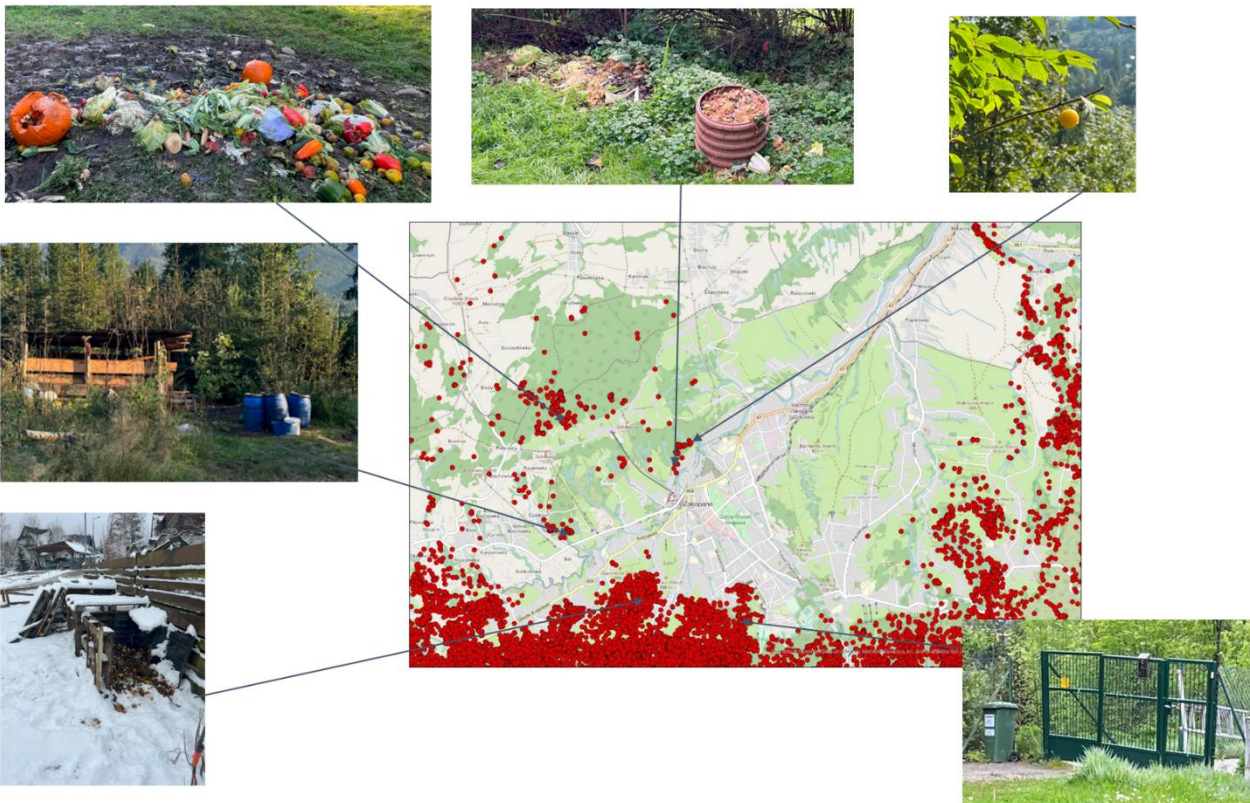


Figure 3: GPS data from bears around Zakopane highlight the presence of several key attractants. Eliminating these additional attractants now represents the next major challenge for reducing human-bear conflicts in TPN (Source/photo: T. Zwijacz-Kozica)



LECA

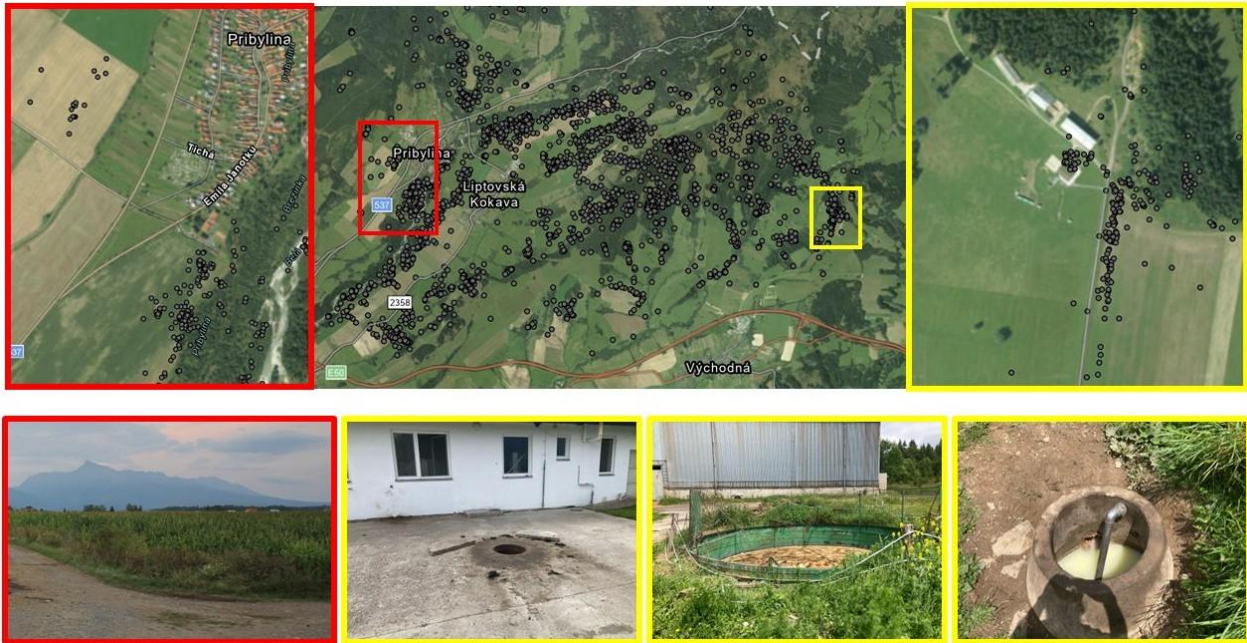


Figure 4: GPS locations of monitored bears clearly highlighted key attractants in TANAP, including unprotected corn fields and freely accessible whey from cheese production. These attractants represent a major driver of bears repeatedly approaching settlements and farms. Addressing the availability of such food sources is one of the next critical challenges for reducing human-bear conflict in Tatra Mts. (Source/Photo: M. Dula & M. Hančín)



4. Slovak Karst - North HU Mts.

Achieved and Unachieved Results During Project Implementation

The chapter summarises the main outcomes achieved during the implementation of pilot activities in the Slovak Karst - North Hungarian Mountains area, as well as key challenges and tasks that could not be fully accomplished within the project timeframe. It highlights how the cross-border collaboration between Slovak and Hungarian partners contributed to meeting the project's objectives and where further improvements are still needed.

Key achievements:

- **Establishment of a harmonised Eurasian lynx monitoring framework using non-invasive camera trapping and genetic sampling**, applied consistently on both sides of the border in line with the SCALP methodology.
- **Collection of 33 lynx presence records with the harmonized monitoring methods.** During deterministic monitoring two distinct adult lynx individuals were identified. **The lynx population** in for the northern part of the pilot area, the lynx population was statistically **estimated at 3.03 ± 1.05 individuals within 2,934.8 km² of suitable habitat**, corresponding to a **density of 0.1 ± 0.03 lynx per 100 km².**
- **Collection of over 2500 wolf and 500 bear presence records** with the harmonized monitoring methods and field mapping during the project.
- **Implementation and successful testing of preventive measures** - including multiwire predator proof electric fences, livestock guarding dogs and deterrents - at farms in cooperation with local livestock breeders.
- **Strengthened cross-sectoral collaboration** through the active involvement of hunters, foresters and other stakeholders into the monitoring efforts.
- **Organised multiple cross-border stakeholder platform meetings.**
- **Participation in 2 cross-border seminars on poaching prevention for police and customs authorities**, improving inter-agency cooperation and integrating forensic genetics into investigations (in-person seminars took place in the Czech republic and Poland only, as per PA, with active participation of WWF SK and Associated Partner Ministry of Interior of the Slovak Republic, particularly Slovak Environmental Police with national competency).
- **Realisation of online survey** (questionnaires) among the police force to find about the attitudes on poaching.
- **Realisation of joint online international seminar to replicate best practices** from regional to international level with participation of 104 representatives from among the police force, customs, prosecution, ministries, state organisations of nature protection and conservation NGOs from Slovakia, the Czech Republic, Hungary, Ukraine and Poland.

Unachieved results / challenges:

- **No evidence of lynx activity was detected on the Hungarian side** of the pilot area.
- Camera traps revealed **high levels of stray dog activity** in the Slovak side of the pilot area. Their presence likely contributes to the struggling lynx population, as stray dogs represent both direct competitors and a direct or indirect threat to successful reproduction.



- Camera traps revealed injured wolves, their injuries indicated **elevated poaching pressure**, which could influence the lynx population as well.
- Camera trap monitoring was divided into two approaches: opportunistic and deterministic. Due to the absence of lynx activity in Hungary, **deterministic monitoring was implemented exclusively in the northern part of the pilot area** covering the Slovak Karst and Aggtelek National Park, while the southern part relied solely on opportunistic methods. As a result, full harmonization of the monitoring was not achieved for the entire pilot area in practice.
- **Stakeholder cooperation remained limited**; although meetings were held regularly, deeper formalisation of the platform could not be fully achieved.

Recommendations and Future Improvements for the Cross-Border Area

This chapter provides specific, forward-looking recommendations to strengthen ongoing activities in monitoring, conflict mitigation, and law enforcement. The recommendations aim to consolidate achievements of the Slovak Karst - North Hungarian Mountains pilot area and to guide the next phase of transboundary cooperation.

Cross-border collaboration:

- The results indicate that the condition of the lynx population in the area may be critical. We recommend increasing the intensity of cross-border collaboration by **establishing a Lynx Survival Working Group** with regular meetings to develop a feasible strategy to address the identified issues, coordinate conservation actions in the transboundary area, and ensure continuous mutual exchange of results and findings. The **WG should be inclusive** and open for hunters, foresters and all stakeholder willing to collaborate to improve status of the population.

Monitoring harmonisation:

- **Maintain and expand the harmonized monitoring approach beyond the borders of the pilot area**, with particular focus on transboundary wildlife corridors along the border and their surroundings.
- **Establish a shared data platform** to improve the efficiency of the data exchange.
- **Further strengthen cooperation with hunting and forestry sectors**, by integrating their data into the large carnivore monitoring network and regularly sharing monitoring results with them.

Conflict prevention:

- **Develop and ensure continuous financial support for the installation, renewal and modernisation of protective equipment** against LC damages in livestock, including access to funding schemes under the Common Agricultural Policy (CAP) or other national or EU-level mechanisms.
- **Provide ongoing technical support for the livestock breeders** focusing on the correct installation, maintenance, and combined use of preventive tools such as electric fencing, livestock guarding dogs, and improved herd management practices.
- **Establish a systematic monitoring and evaluation framework to assess the effectiveness of implemented preventive measures** and gather data on predator activity, livestock losses, and best practices.
- **Maintain multi-stakeholder platforms by strengthening cooperation among breeders, environmental organizations, and protected area administrations**, fostering the shared platform for knowledge exchange and rapid response to conflict situations, coordination preventive actions.



- **Encourage research and innovation in the field of non-lethal livestock protection methods** and their adaptation to local ecological and socio-economic conditions.
- **Promote multidisciplinary, social science research** to better understand the needs of livestock keepers and the reasons behind reluctance to adopt proven preventive techniques.

Poaching prevention:

- **Place special emphasis on preventing illegal LC killings through stakeholder involvement, data sharing, and targeted education.**
- **Incentivise game managers and hunters to share large-carnivore-related data** and to actively contribute to the conservation of local populations.
- **Review the current legal framework governing the use of traps in Hungary that are presently permitted for hunters**, such as conibear and other body-gripping canid selective type of devices. At the moment, any licensed hunter can legally deploy these traps without additional training or license. In addition, traps may be set without any form of identification plate or number, making it impossible to determine who placed a given device.
- **Institutionalise cross-border cooperation between law enforcement agencies** through annual joint trainings and shared databases on detected cases.
- **Promote the use of forensic genetic analyses** as a standard method for identifying illegally killed individuals and tracking wildlife crime networks.
- **Strengthen cooperation between scientific institutions and police authorities**, enabling faster data exchange and evidence interpretation



Figure 5: One of the most challenging tasks in Slovak Karst-North HU Mts. is reducing wolf-human conflict by improving preventive measures and ensuring their effectiveness. Many pastures remain with insufficient protection against large carnivores attacks in Hungary. (Photo Bükk NPD)



Figure 6: One of the most challenging tasks in Slovak Karst-North HU Mts. is reducing wolf-human conflict by improving preventive measures and ensuring their effectiveness. Many pastures remain with insufficient protection against large carnivores attacks in Hungary. (Photo Bükk NPD)



Figure 7: High presence of stray dogs during monitoring in the Slovak Karst National Park as one of possible effect of low population density of lynx in area due to kleptoparasitism on lynx prey (Photo WWF SK)



5. East Carpathians

Achieved and Unachieved Results During Project Implementation

This chapter provides a synthesis of the main outcomes achieved through the implementation of pilot activities in the Eastern Carpathians, along with key challenges and tasks that could not be fully completed within the project's duration. It outlines how cross-border collaboration among Polish, Slovak, and Ukrainian partners contributed to achieving the project's objectives and identifies areas where additional efforts and improvements are required to ensure long-term effectiveness and continuity of the implemented actions.

Key achievements:

- **Establishment of a harmonised, stratified, and systematic monitoring framework** that integrates camera trapping, non-invasive genetic sampling, and field tracking, applied consistently across all three transboundary sites using the SCALP methodology.
- **Collection of more than 400 lynx photo and video records** and the **identification of 17-21 independent individuals** based on camera-trap data.
- **Systematic monitoring of lynx—combining opportunistic and deterministic camera trapping—generated detailed data on population density and abundance**, spatial behaviour, dispersal, reproduction, and mortality, and confirmed extensive cross-border movements.
- **Implementation and successful field testing of conflict-prevention measures at farms and in public areas within the Polish part of the pilot region**—where the majority of damage and wildlife-human incidents occur—conducted in close cooperation with local livestock breeders and the Bieszczady National Park administration.
- **Participation in cross-border seminars on poaching prevention for police and customs authorities**, strengthening inter-agency cooperation and promoting the integration of forensic genetics into wildlife crime investigations.
- **Establishment of a joint cross-border database and data validation system**, providing a robust foundation for long-term, standardised population monitoring.
- **Strengthened cooperation in minimizing human-brown bear conflicts established with key stakeholders within the Polish part of the pilot area** including Bieszczady local governments, state and scientific institutions, livestock breeders and local NGOs. The discussions and meetings led to the establishment of working groups on communication activities and waste management.

Unachieved results / challenges:

- **The common data-sharing platform between partners did not become fully operational**, and data exchange relied largely on manual transfer (e.g., email or file-sharing).
- **Limited stakeholder cooperation on the Slovak and Ukrainian sides**—as well as reduced institutional engagement at the national level—due to socio-political changes and the ongoing war, constrained collaboration with key actors, including livestock breeders/owners, and national park administrations, thereby reducing the potential for broader conflict-mitigation efforts.
- **Full sharing of all recorded data was not achieved due to administrative and technical constraints.**



Recommendations and Future Improvements for the Cross-Border Area

This section presents specific, forward-looking recommendations to reinforce ongoing efforts in monitoring, conflict mitigation, and law enforcement. The proposed measures aim to consolidate the achievements of the Eastern Carpathians pilot area and guide the next phase of transboundary cooperation.

At the final stage of project implementation, a new and highly significant challenge has emerged. Since the outbreak of the war in Ukraine in 2022, the enforcement of martial law has led to the construction of fortified border infrastructure along Ukraine's western frontier with the European Union. This system, consisting of extensive razor-wire fencing, was established for national security purposes but now represents a major barrier to wildlife movement. As a result, previously connected subpopulations of lynx, other large carnivores, and wildlife more broadly in both the Eastern and Western Carpathians are becoming increasingly fragmented and isolated. This development poses a serious threat to the integrity of ecological corridors that are essential for dispersal, gene flow, and the long-term viability of wildlife populations across the Carpathians.

Applying the findings and outputs from the Eastern Carpathians pilot area and the LECA project to support the IUCN Red List and Green List assessments of the Eurasian lynx, and to contribute to the development of a comprehensive Conservation Strategy for the Carpathian lynx population.

Monitoring harmonisation:

- Given the situation described above and the emerging conservation risks, it is **crucial to sustain the integrated systematic monitoring approach—combining camera trapping, genetic analyses, and telemetry**—implemented under the SCALP framework.
- **Establish a shared, cross-border data management system with clearly defined responsibilities for data collection, validation, archiving, and access.** Such a system should ensure consistent data standards, facilitate secure long-term storage, and enable timely exchange of verified information among all partners.
- **Strengthen cooperation with relevant authorities—particularly national park administrations—and key stakeholders, including hunters, foresters, and livestock breeders/owners,** and ensure that their data are systematically integrated into the large carnivore monitoring network.
- **Institutionalise regular cross-border coordination meetings to jointly plan monitoring campaigns,** align analytical approaches, and ensure timely exchange of methods and findings.

Conflict prevention:

- **Continue systematic identification and mapping of damage/incidents hot spots and use these results to strategically target preventive measures in the most affected areas.**
- **Strengthen the exchange of experience between authorities and stakeholders** and broaden the use of proven preventive measures—including improved waste management, fladry, livestock-guarding dogs, and high-voltage electric fencing—in high-risk areas, supported where possible by national subsidy schemes.
- **Develop financial, advisory, and compensation mechanisms for Ukrainian livestock breeders to ensure parity with existing support schemes in Slovakia and Poland.**



- Maintain and further strengthen the multi-stakeholder platform involving conservationists, farmers, hunters, and local authorities to build trust, facilitate knowledge exchange, and coordinate the planning and implementation of preventive measures.

Poaching prevention:

- Institutionalise cross-border cooperation among law enforcement agencies through annual joint training exercises and shared databases on detected wildlife crime cases.
- Promote the routine application of forensic genetic analyses as a standard tool for identifying illegally killed individuals and uncovering wildlife crime networks.
- Enhance collaboration between scientific institutions and police authorities to enable faster data exchange, more accurate interpretation of forensic evidence, and more effective case resolution.



Figure 8: A resident male lynx recorded on the Slovak side of the Eastern Carpathians pilot area in Poloniny National Park, close to the Ukrainian border. This individual was documented across both national parks within the transboundary study area. These observations clearly demonstrate that the lynx population within the pilot area operates as a single, interconnected unit across national borders (Photo: TUZVO)

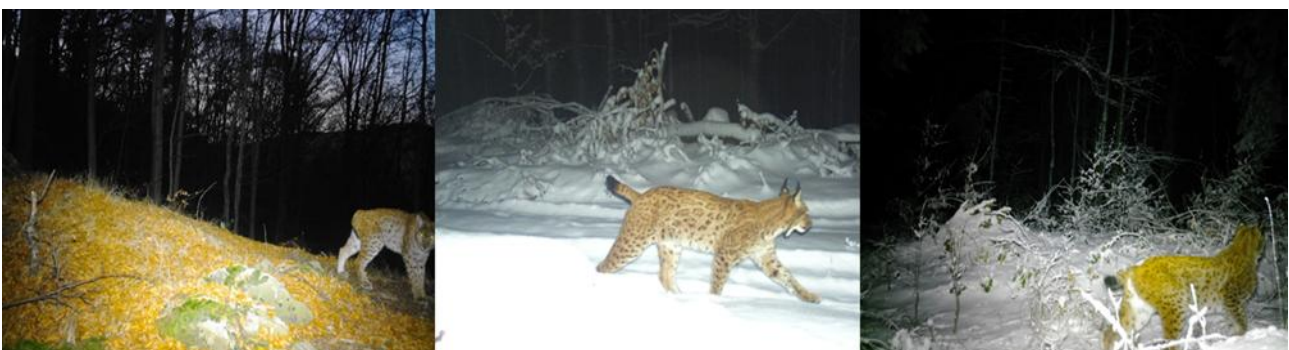


Figure 9: Identification of the same male lynx recorded across Bieszczadzki NP in Poland, Poloniny NP in Slovakia, and Uzhanskyi NNP in Ukraine (Photo: WWF PL, TUZVO, WWF UA)



Figure 10: A section of the border security fence system along Ukraine’s western frontier with the European Union. This structure, consisting of extensive razor-wire fencing, was built for national security purposes, however constitutes a major barrier to wildlife movement (Source: <https://dpsu.gov.ua/en>).



Figure 11: Bear-proof container purchased within the LECA project (left) and The LECA project enabled the creation of a cooperation platform in the field of minimizing human conflicts with brown bears, engaging local stakeholders (right; photo WWF PL).



6. Recommendations for Other Cross-Border Regions

This chapter synthesises the key lessons and transferable practices that emerged across all pilot areas, structured along three thematic pillars: monitoring harmonisation, conflict prevention and poaching prevention. The aim is to highlight methodologies, partnerships and innovations that demonstrated effectiveness and can be replicated in other Carpathian border regions.

Monitoring harmonisation

Bear

Telemetry results clearly demonstrate that large carnivore populations, such as bears, cannot be reliably assessed from only one side of the border. Accurate population estimates require joint, cross-border monitoring, harmonised methodologies and data sharing. Isolated national estimates risk misinterpretation and undermine effective management. Telemetry, however, cannot be the only method used in bear monitoring. It can, however, significantly support other methods, especially non-invasive genetic monitoring, which is conducted cyclically on the Polish side of the Tatras every 6 years. We also do not recommend the use of camera collars, and in Tatra conditions GSM collars have proven to be more effective than Iridium collars.

Wolf

The Beskydy-Kysuce model provides a strong example of integrative, multi-method monitoring, combining non-invasive genetic sampling, camera trapping, snow tracking and other complementary methods. This harmonised approach produces high-quality, comparable data on wolf distribution and population size across the transboundary range. A transferable framework is provided by the CarniTrack system, integrating a shared application and database for large carnivore occurrences and camera-trapping data. This model enables evidence-based conservation and management, particularly in regions with differing management regimes (e.g. strict protection vs. hunting/culling).

Lynx

For lynx, insufficient scientific grounding in population reporting and data interpretation contributes to conflicts between conservation and human interests and may ultimately facilitate illegal killing. Because illegal killing interacts synergistically with habitat fragmentation, there is a pressing need for accurate, evidence-based information supported by a standardised, spatially explicit monitoring system. Such a system should be harmonised across all Carpathian cross-border regions, implemented by national wildlife authorities and developed in close cooperation with hunters' and foresters' organisations. The example of harmonised, deterministic lynx monitoring, supported by strong partner cooperation and active stakeholder involvement from the East Carpathians and the Slovak Karst-North Hungarian Mountains can be replicated in other cross-border regions with permanent or recovering lynx populations.

Conflict prevention

Bear

Wherever bears occur, mandatory bear-proof waste management must be implemented. Providing anthropogenic food to wildlife, whether through unsecured waste, agricultural products (corn, fruit, vegetables) or by-products such as freely accessible whey at cheese farms, is unacceptable. Eliminating these attractants is essential to reducing bear-human conflicts. The application of preventive measures and the reduction of attractants, together with dietary and hormonal analyses aimed at better understanding



bear habituation to anthropogenic food sources and related behaviour, provide valuable tools for resolving and mitigating conflicts. The use of telemetry makes it possible to precisely identify attractants and sources of conflict, and thus eliminate them more effectively. These approaches are fully replicable from Tatra pilot area to other regions hosting transboundary bear populations, such as the Eastern Carpathians.

Wolf

Projects demonstrated that combining preventive measures (electric fencing, livestock-guarding dogs, fladry, audio-visual deterrents) with close cooperation with local farmers significantly increases tolerance and reduces conflicts. The positive experiences from the Kysuce-Beskydy pilot area and the Slovak Karst-North Hungarian Mountains are particularly relevant for replication across other Carpathian border regions with strong or recovering wolf population.

Lynx

Effective conflict mitigation for lynx requires strengthening baseline knowledge on population status, ecology and local human attitudes throughout cross-border regions of the Carpathians. Promoting the economic benefits of lynx presence, such as opportunities for nature-based tourism, can further enhance local acceptance. These steps should be supported by adaptive, evidence-based measures addressing key threats and by improved cooperation with stakeholders across the species' distribution range.

All Species

A priority for the entire region is the development of a shared data-collection protocol, based on pre-defined electronic forms linked to a common database. Such a system would harmonise the collection of information on damages and attacks, contextual factors, and associated compensation costs, enabling timely and well-informed decision-making.

Poaching prevention

The cross-border seminars for police investigators model should be replicated as an example of effective linking large carnivore monitoring and research research with investigation process which help to improve sharing best practises and improve investigation process in cross-border areas



7. Conclusion

The pilot activities implemented across the four Carpathian border regions demonstrated that effective conservation and management of large carnivores is possible only through coordinated, long-term and well-structured cross-border collaboration. The project successfully harmonised monitoring methodologies introduced advanced techniques such as telemetry, hormonal analyses, DNA metabarcoding and strengthened cooperation among scientific institutions, protected areas, law-enforcement authorities and local communities. These achievements represent a solid foundation for future work. At the same time, several challenges, including incomplete data-sharing systems, limited stakeholder engagement in some regions, different regimes in management and conservation of large carnivores and emerging geopolitical barriers such as the fortified Ukrainian border, highlight the need for continued attention, resource allocation and institutional commitment.

The recommendations formulated in this document provide a roadmap for consolidating and expanding the progress made within the pilot areas. A unified monitoring framework, better integration of preventive measures, systematic capacity-building for law-enforcement and strengthened cooperation with farmers, hunters and forestry sectors are essential steps toward ensuring the long-term viability of large carnivore populations in the Carpathians. Furthermore, the approaches developed here have clear potential for replication in other European cross-border mountain regions facing similar challenges.

Sustaining the ecological connectivity of the Carpathians and fostering coexistence between humans and large carnivores will require not only technical solutions, but also continuous dialogue, mutual trust, and strong political will. The outcomes of the LECA project demonstrate that such integrated efforts can bring tangible results and create a resilient, cooperative framework capable of addressing current and future conservation challenges.