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PILOT ACTION IMPLEMENTED IN THE EAST CARPATHIANS ON THE MONITORING, POACHING PREVENTION AND CONFLICT PREVENTION OF LYNXES

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PILOT ACTION IMPLEMENTED IN THE EAST CARPATHIANS ON THE MONITORING, POACHING PREVENTION AND CONFLICT PREVENTION OF LYNXES

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Content

1. Introduction to the pilot area

Due to the direct and indirect impacts of human activities in Europe, populations of large carnivores (LC's), including the Eurasian lynx (*Lynx lynx*), have undergone dramatic declines (Chapron et al. 2014; Wilson 2018). By the late 18th century, lynx populations remained widespread only in the Alps, Balkans, Carpathians, Eastern Europe, the Baltic region, Finland, and Scandinavia (Breitenmoser & Breitenmoser-Würsten 2008). A broader wave of population extinctions followed in the early 19th century, leading to the species' complete disappearance from most parts of Europe (Wilson 2018). During the mid-20th century, lynx population expansion was minimal (Kratochvíl 1968a, b), and only four autochthonous populations—Balkan, Baltic, Carpathian, and Scandinavian—persisted. Even these remnant populations continued to decline (Breitenmoser & Breitenmoser-Würsten 1990, 2008; von Arx et al. 2009).

Information on lynx occurrence during the medieval period is lacking; however, 18th–19th century records indicate two small subpopulations—one in the Western Carpathians and another along the northwestern edge of the Eastern Carpathians (Windisch 1780; Rochel 1821; Kornhuber 1857; Paszlavsky 1918). At that time, lynx numbers were severely constrained by extensive deforestation, habitat loss and fragmentation, depletion of prey populations, and direct persecution. In the mid-19th century, a large-scale strychnine poisoning campaign across the Kingdom of Hungary caused further dramatic declines in large carnivores, including the lynx (Jamnický 1997). Consequently, in the Western Carpathians the species likely persisted only in very low numbers, with its survival largely dependent on immigration from the Eastern Carpathians. Following the Second World War, lynx gradually expanded westward as forest habitats regenerated and prey populations recovered, restoring ecological connectivity between previously isolated subpopulations and strengthening the species' long-term viability in the region.

The Western Carpathians are widely assumed to support a large and significant Eurasian lynx population (Breitenmoser et al. 2000; von Arx et al. 2004; Hell et al. 2004). Until recently, this assumption lacked empirical support due to the absence of systematic monitoring and reliable scientific data (Breitenmoser et al. 2000; von Arx et al. 2004; Kubala et al. 2019; Duľa et al. 2021). This data deficiency led to vague or misleading assessments of population status and trends. Moreover, inadequate scientific foundations for reporting and interpreting large carnivore data have heightened conflicts between lynx conservation and human interests, contributing to situations where the species fails to achieve ecological carrying capacity in some areas (Kubala et al. 2021; 2023). Despite its critical role for the Western Carpathians, the conservation status and population trend of the Eastern Carpathian lynx remain insufficiently understood.

Effective conservation and management, including conflict prevention, of the lynx and other LC's, must be grounded in reliable information on their distribution, abundance, population trends, and, ideally, detailed demographic parameters such as survival probabilities and recruitment rates (Gaillard et al. 2003; Haydon & Fryxell 2004; Molinari-Jobin et al. 2012). The Carpathians mountains, and particularly the Eastern Carpathians range are highly diverse in their geographical, environmental, and socio-economic conditions, making it unlikely that a single management approach will be effective in all contexts. Instead, a range of potential solutions should be identified, and context-specific combinations of measures applied (Boitani et al. 2015). Lynx and other LC's populations require extensive habitats, and their conservation must be planned at large spatial scales that frequently cross national borders, as exemplified by the pilot areas of the LECA project. In such settings, conservation and management actions must be coordinated across jurisdictions. This coordination depends on a common, up-to-date understanding of the species' conservation status at both national and transboundary population levels, which provides the essential basis for effective cross-border collaboration (Kaczensky et al. 2013; 2023; Chapron et al. 2014).

2. Description of pilot area

The Eastern Carpathians pilot area comprises three national parks and adjacent territories (buffer zones): Bieszczadzki National Park (BNP) in Poland, Poloniny National Park (NP Poloniny) in Slovakia, and Uzhanskyi National Nature Park (Uzhanskyi NNP) in Ukraine (Fig. 1.). The pilot area is located in the Eastern Carpathian Biosphere Reserve, a transboundary protected area of global significance under UNESCO's Man and the Biosphere Programme, which exemplifies large-scale cross-border conservation by maintaining ecological connectivity and safeguarding the natural and cultural heritage of the Carpathians.

Bieszczadzki National Park protects the highest parts of the Polish Eastern Carpathians, with ridges rising eastward to 1,346 m a.s.l. Approximately 80% of the park is covered by natural deciduous and mixed forests dominated by beech (*Fagus sylvatica*), grey alder (*Alnus incana*), sycamore (*Acer pseudoplatanus*), spruce (*Picea abies*), and fir (*Abies alba*), with 15% classified as primeval stands. It harbours over 230 vertebrate species, including 58 mammals.

Poloniny National Park, the easternmost Slovak national park, with nearly 80% forest cover, contains some of Europe's largest remaining old-growth forest complexes dominated by beech, fir and sycamore and supports a high concentration of threatened species. Characteristic mountain pastures, locally known as "poloniny", occur along the Bukovské vrchy ridge, with a maximum elevation of 1,208 m a.s.l.

Uzhanskyi National Nature Park, located in Zakarpattia Oblast along the borders with Poland and Slovakia, the park includes Kinchyk Bukovskyi Mountain as its highest point reaching 1,251 m a.s.l.. The vegetation of the area spans four distinct altitudinal zones, ranging from beech and alder forests to medium-forest and highland meadows above 1,100 m a.s.l., and provides habitat for 65 mammal species, 34 of which are considered rare.

Alongside the lynx, the pilot area supports viable populations of other large mammals, including the brown bear (*Ursus arctos*), grey wolf (*Canis lupus*), and European bison (*Bison bonasus*), as well as various ungulate species. Across all three parks, stable large carnivore populations with confirmed long-term reproduction have been documented (e.g., Kubala et al. 2023). Traditional land-use practices, such as seasonal grazing and small-scale haymaking, have maintained semi-natural meadows of high conservation value, while low human population density has enabled the persistence of extensive, uninterrupted forest tracts.

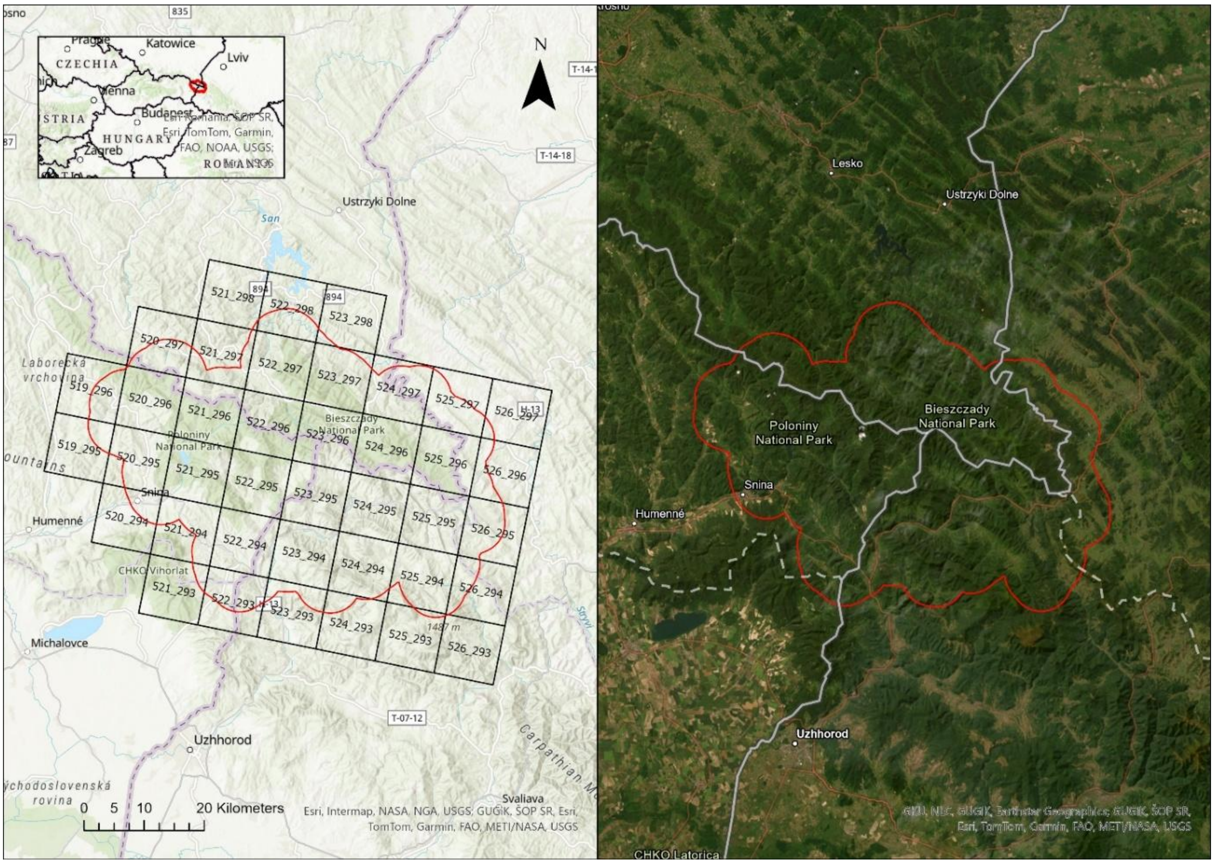

Figure 1. The Eastern Carpathians cross-border pilot area comprising three national parks and its buffer zones with 39 mapping grids (EEA 10×10 km): Bieszczadzki National Park (BNP) in Poland, Poloniny National Park (NP Poloniny) in Slovakia, and Uzhanskyi National Nature Park in Ukraine, with pre-defined pilot border (red line).

3. Pilot activities: Monitoring harmonisation

3.1. Camera-trapping and documentation of signs of occurrence (systematic monitoring)

A. Monitoring approach and data collection

The Technical University in Zvolen (TUZVO; PP9) was responsible for non-invasive systematic monitoring and data collection on lynx occurrence, in cooperation with project partners, the State Nature Conservancy of the Slovak Republic (SNC SK), World Wide Fund for Nature-Poland (WWF-Poland) and the administrations of Poloniny, Bieszczadzki, and Uzhanskyi National Parks. Collaboration actively engages key local stakeholders, including Ulíč Forest Enterprise (State Forests of the Slovak Republic), State Enterprise "Velykobereznianske Forestry" in Ukraine, local hunting and private forestry associations and representatives, as well as Foreign Police units operating within the Eastern Carpathians pilot area.

Throughout the project period (2023-2025), field mappers from project partners, national park administrations, and other key stakeholders conducted non-invasive systematic lynx monitoring. Activities focused in recording presence signs (e.g. tracks, marking sites and visual observations), snow tracking individuals when sufficient snow cover was present, collecting organic samples for genetic analysis (e.g. scats, hairs), and deploying a camera trap survey to document the occurrence of lynx and other large carnivores within the pilot area. The collected data were used to identify the most suitable locations for placing camera traps, with a high probability of recording lynx.

Training of partners and local collaborators in the project areas began in September 2023, according to the availability of technical equipment and camera traps. The use of automatically triggered remote cameras to photograph animals, known as camera trapping, has become a standard method for surveying elusive species. This technique is particularly effective for spotted felids, which can be individually identified from high-quality images (Karanth & Nichols 1998; Rovero & Zimmermann 2016). As a non-invasive method, it has proven valuable for a variety of species, including the lynx (Palmero et al. 2023). Lynx can be individually distinguished by their unique coat patterns, eliminating the need for physical marking (Fig. 2.; Kubala et al. 2019, Duľa et al. 2021). Recording these coat patterns is sufficient for individual identification. The principle of this method is to obtain as many photographs as possible of different individuals of the target species within the study area during a predefined period. The resulting data will then be used to estimate population size through capture–recapture statistical analysis (Pesenti & Zimmermann 2013; Zimmermann et al. 2013). The validity and statistical power of the results depend primarily on sample size, in this case, the number of photographs obtained from different individual lynx (Breitenmoser et al. 2006). Within our pilot area, systematic camera trapping survey was implemented through both opportunistic and deterministic approaches.

Figure 2. Identification and confirmation of the same lynx at two different camera trap locations, based on its unique coat pattern (photo © TUZVO).

3.2. Opportunistic camera trapping

A. Monitoring approach and data collection

To increase the probability of photographing and identifying lynx during capture–recapture surveys, deterministic (intensive) and opportunistic (extensive) camera trapping monitoring was carried out in each study area. The opportunistic approach does not permit capture–recapture analyses, and the statistical value of the data is therefore limited. Nevertheless, it allows for an pre-evaluation of the minimum number of lynx present in the area. In addition, it provides information on locations with identified individuals and enables the identification of new individuals, occasionally documents reproduction success, dispersal distances, and patterns of spatial use (Breitenmoser et al. 2006).

Opportunistic monitoring, primarily through camera trapping, was conducted throughout 2023-2024 in Bieszczadzki NP, while in Poloniny NP it began in late spring to early summer 2024. In Uzhanskyi NNP, Ukraine, a delay in the implementation of project activities occurred due to complications with customs clearance of technical equipment. Following the resolution of this issue, opportunistic camera trapping on the Ukrainian site was carried out between March and August 2025.

B. Data processing (data storing, validation, analyses)

It is particularly important that the identification of new individuals is realized with photographs of both body sides of the animal. Pre-identifying animals can substantially increase the validity of a deterministic camera trapping session. When applied extensively over several years, this approach also allows the documentation of individual histories, enabling certain inferences about survival rates and population trends. The value of opportunistic camera trapping extends beyond the lynx photographs themselves. It served as an important tool for training and communication, providing effective means of integrating the monitoring network into the local community. The selection of study areas and camera-trapping design was guided with data collected by our monitoring network (including national park rangers and local registered hunters/foresters) on evidence of lynx presence in snow tracking surveys, direct sightings, tracks and prey remains. Various models of digital cameras were deployed year-round along forest roads, hiking trails, game paths, and mountain ridges, specially targeting at lynx marking sites and kill locations.

C. Results

A Total of 315 camera trap locations were used during the opportunistic monitoring. In Bieszczadzki NP, 291 camera traps were deployed within an area of 665 km² during 2023–2024 and 14 lynx individuals, including 8 adults, were recorded. In Poloniny NP, opportunistic monitoring covered an area of 95.4 km², where at 14 camera traps deployed, with the identifications of four individual lynx: two males, one female, and one individual which sex was not determined. In Uzhanskyi NNP, camera traps were deployed in 10 sites, covering an area of 62.5 km², with three male lynx identified, plus one individual whose sex could not be determined.

3.3. Deterministic camera trapping

A. Monitoring approach and data collection

The deterministic camera trapping is an intensive labour technique with camera traps distributed within a pre-defined structure. For lynx, which live solitarily in stable home ranges, distribution according to a grid is obvious. Therefore, the study area was systematically divided into a grid of 2.5 × 2.5 km squares, following previous studies (e.g. Zimmermann et al. 2013). Camera stations were installed in every second square containing suitable habitat, with each station equipped with two camera traps positioned in opposite directions. Individual lynx were identified through visual analysis of their unique coat patterns.

Deterministic camera trapping in the Eastern Carpathians was conducted over a 60-day period, from 26th November 2024 to 24th January 2025. We determined winter and early spring because it matches the pre and mating seasons of lynx, which are considered the optimal periods for systematic camera trapping due to biological factors (i.e. high lynx activity), logistical advantages (i.e. reduced human disturbance), and favourable environmental conditions.

B. Data processing (data storing, validation, analyses)

Each first photograph of a lynx was considered a “capture,” while subsequent photographs of the same individual were regarded as “recaptures.” However, identifying individuals by comparing images was challenging, and errors could significantly influence the results. As lynx are long-lived animals capable of dispersing over large distances, photographs had to be considered across a broad geographic area and over multiple years. It was therefore essential to establish a well-organized database maintained within https://l2y0n1x2.selmy.cz/en/ of all photographs and to maintain it with strict discipline.

Lynx population size was estimated using the Spatial Capture–Recapture (SCR) approach, following established methodologies (Kubala et al. 2019; Duľa et al. 2021). The interpretation of a capture-recapture statistic is straightforward. It provides a population estimation and a confidence interval, that is an upper and lower range. Only individuals older than one year (i.e., independent lynx) were included in the analysis. Lynx cubs were excluded because they are non-resident and, after separating from their mother, are typically forced to disperse by resident individuals. Dispersal is especially likely when local carrying capacity has been reached (Kubala et al. 2024).

Population density (abundance of independent individuals per 100 km² of suitable habitat) was estimated using the SCR method, which is a standard approach for determining population size in ecological studies (Rovero & Zimmermann 2016). The proportions of suitable and unsuitable habitat within the monitored area were derived from Landsat and LUCAS data (Plugmacher et al. 2018). Suitable habitat included all forest types (deciduous, coniferous, and mixed) as well as shrublands and pasture habitats, whereas human settlements and agriculture were classified as unsuitable habitat.

Reliable estimation of lynx population size requires a comprehensive approach and rigorous statistical analysis. Some resident individuals may not have been photographed during the survey, leading to underestimation, and their number must therefore be statistically inferred and added to the observed count. Conversely, lynx recorded only at the periphery of the monitored area, whose home ranges extend primarily outside it, could inflate the population estimate if not accounted for. To address this, a 10 km buffer was added to the monitored area, reflecting the spatial requirements of lynx based on average home-range size in the region (Kubala et al. 2024), thereby defining the state space for analysis (Fig. 3). The resulting state space (monitored area + buffer zone) covered 2,762.3 km² of suitable habitat (Fig. 3).

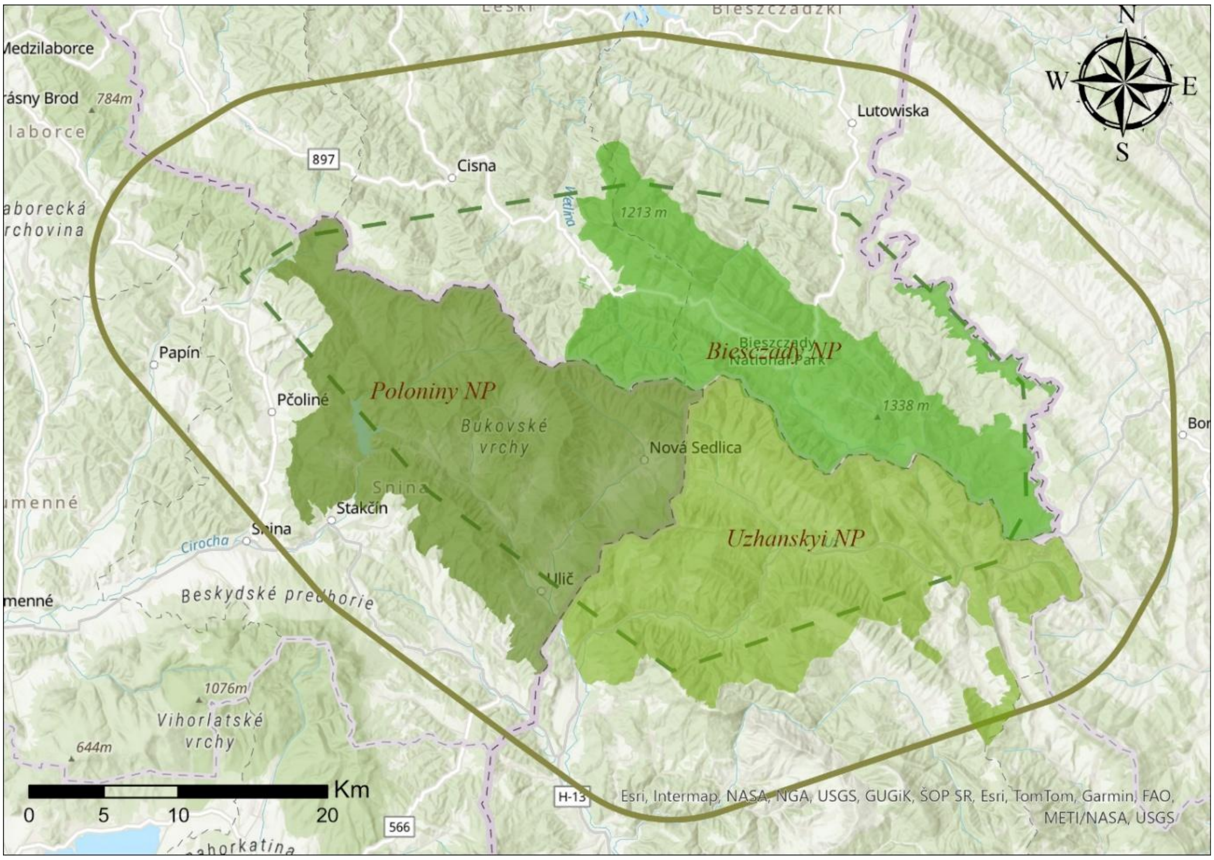

Figure 3. Schematic representation of the Eastern Carpathians pilot area, encompassing Bieszczadzki National Park (Poland), Poloniny National Park (Slovakia), and Uzhanskyi National Nature Park (Ukraine), with representations of the monitored area (dashed green line), and the state space (dark green line) comprising 2,762.3 km² of suitable habitat used for lynx density estimation monitored area + 10 km buffer). The buffer reflects the average lynx home-range size in the region (Kubala et al. 2024).

C. Results

During deterministic camera trapping in the Eastern Carpathians (26 November 2024–24 January 2025), 102 camera stations were active resulting in a total survey effort of 6,090 effective tap nights/days (number of monitoring days × number of active stations) across a monitored area of 1,116.5 km² (Fig. 3). One camera station was stolen during the survey period, but we normally used the collected photographs until the event.

In total 17 individual Lynx were detected and identified at 31 of the 102 camera stations surveyed (30.39%). The population in the Eastern Carpathians pilot area was statistically estimated at 33.2 ± 6.32 within 2,762.3 km² of suitable habitat, yielding a density of 1.12 ± 0.21 lynx per 100 km².

Our estimates are consistent with those reported for the Carpathian population (Kubala et al. 2021) and other European lynx populations assessed using comparable methods (e.g. Belarus, Ukraine, Macedonia, Czechia, Slovenia, Germany, Switzerland, and France; Palmero et al. 2021, 2023a; Fležar et al. 2023; Zimmermann et al. 2013). Lynx densities vary widely across Europe, being lowest in small or fragmented populations (e.g. Palatinate Forest, French Jura, Beskydy, Mavrovo) and highest in the Swiss Alps, Jura Mountains, and the autochthonous Carpathians (Pesenti & Zimmermann 2013; KORA 2022; Duľa et al. 2021; Iosif et al. 2022).

The population size within the Eastern Carpathians pilot area is largely shaped by the region's extensive, continuous forest cover which minimizes habitat fragmentation and maintains high landscape connectivity. This is substantiated by multiple records of individual lynx detected in transboundary locations. For instance, one adult male was recorded across all three national parks (Fig.4.), while another was observed in both Poloniny NP and Uzhanskyi NNP (Fig.5.). Additionally, two further lynx males were documented in both Bieszczadzki and Poloniny National Parks. These observations clearly demonstrate that the lynx population within the pilot area operates as a single, interconnected unit across national borders. Such cross-border connectivity is of strategic importance for maintaining dispersal pathways and ensuring genetic exchange between subpopulations along the western edge of the Eastern Carpathians and the broader corridor linking the Eastern and Western Carpathians. From a policy perspective, this underlines the necessity of coordinated transnational management measures and habitat protection efforts to safeguard the long-term viability and ecological functionality of the Eurasian lynx population in this region.

Figure 4. Photographs of one individual male lynx recorded in all three areas Bieszczadzki NP in Poland (left), Poloniny NP in Slovakia (centre), and Uzhanskyi NNP in Ukraine (right).

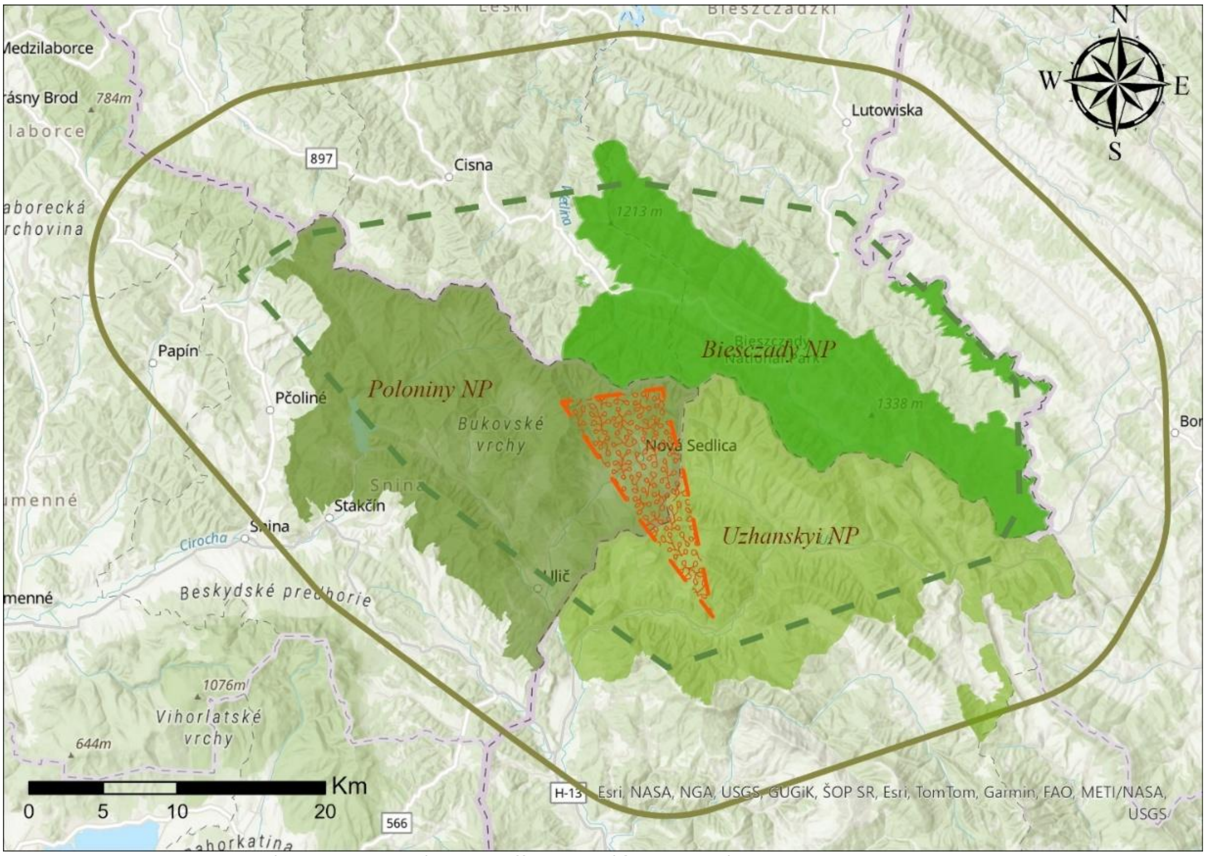

Figure 5. Monitored area (dashed green) and buffer area (Green line) with the spatial behaviour and habitat use of a resident adult male lynx (red doted area), documented through camera-trap detections during deterministic monitoring and visualised as a 100% Minimum Convex Polygon, confirm a well-defined home range extending across the transboundary area of Poloniny National Park and Uzhanskyi National Nature Park.

3.4. Synthesis of the main results

A. Monitoring approach and data collection

A standardized interpretation of locally collected data and information is essential for the calibration process and the presentation of large carnivore data at a large scale. This requires a common terminology and a shared agreement on how to classify the data (Breitenmoser et al. 2006). Our mapping approach follows the methodology developed by the Large Carnivore Initiative for Europe (LCIE; Chapron et al. 2014; Kaczensky et al. 2013, 2024) and the Status and Conservation of the Alpine Lynx Population (SCALP; Molinari-Jobin et al. 2003, 2012). It is based on compiling standardized information on the status of large carnivores during 2023–2025 within our pilot area and an additional 5 km buffer, using the most accurate and comprehensive data available from each country. The dataset is based primarily on data collected through our systematic monitoring, complemented by national and regional monitoring activities and official statistics. It also incorporates findings from ongoing research and conservation projects.

B. Data processing (data storing, validation, analyses)

The large carnivore (LC) data were mapped at a 10 × 10 km ETRS89-LAEA Europe grid scale. This grid system, widely used for Flora-Fauna-Habitat (FFH) reporting by the European Union, was downloaded from the European Environment Agency on June 9, 2023 (http://www.eea.europa.eu/data-and-maps/data/eea-reference-grids-2).

Data for each monitored grid cell (grid) were classified according to carnivore presence and frequency as follows:

- Confirmed presence
- Unconfirmed presence

When a grid covered more than one country and the countries presented different results, the higher presence value was assigned. To assess the quality, robustness, and reliability of the available data, we applied the SCALP criteria developed for the standardized monitoring of lynx in the Alps (Molinari-Jobin et al. 2003, 2012a; b):

- Category 1 (C1): "Hard facts" — verified and undisputed LC presence records (e.g. dead, injured, orphaned, captured or collared animals; verified camera-trap images; or genetic samples such as scat, urine, hair, or saliva confirmed through laboratory analyses).
- Category 2 (C2): Verified expert observations — LC presence signs (e.g. depredated livestock or wild prey, tracks, other field signs, scat, or documented LC calls) that have been checked and confirmed by an LC expert (e.g. a trained member of the monitoring network) and are supported by documentation.
- Category 3 (C3): Unconfirmed records — unconfirmed C2 LC presence signs, as well as all other presence signs such as sightings or calls that are undocumented and cannot be independently verified.

The collected data were shared among project partners, archived in a central database https://l2y0n1x2.selmy.cz/en, and validated in accordance with the SCALP methodology. Following validation, the dataset was employed to generate SCALP-based distribution and occurrence maps for Eurasian lynx, brown bear, and grey wolf. Distribution maps were produced using lynx and wolf monitoring years (WY), which run from 1st of May to 30th of April of the following year, specifically for 2023-2024 and 2024-2025. Bears monitoring period was produced in independent years 2023 and 2024.

3.4.1 Status & distribution/occurrence maps: Lynx

A. SCALP map

Lynx C1 evidence was confirmed in 15 mapping grids (38.5% of all grids) during the 2023/24 WY, based on camera-trap detections, telemetry data, or genetically confirmed samples (Fig. 6). In 2024/25, the number of grids with C1 evidence increased to 28 (71.8% of all grids). During 2023/24, C2 evidence on lynx presence was recorded in 10 grids (25.6%) and C3 evidence in 6 grids (15.4%). In the following monitoring year (2024/25), the number of C2 evidence grids decreased to 6 (15.4%), while C3 evidence grids decreased to 2 (5.1%).

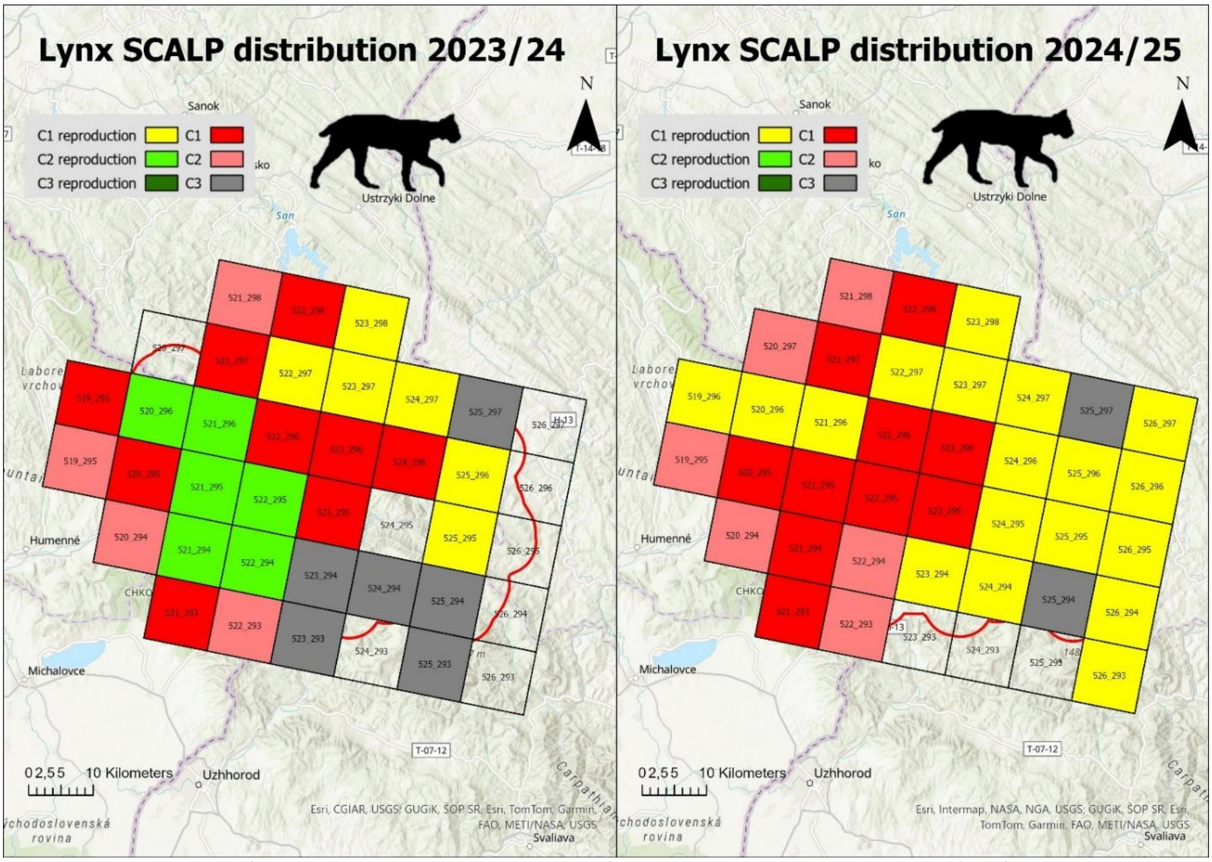

Figure 6. Distribution of the Eurasian lynx in the Eastern Carpathians pilot area, based on C1–C3 records validated according to the SCALP methodology, mapped at the EEA 10 × 10 km grid level for two consecutive lynx years (2023/24 left; 2024/25 right). Grid cells reflect SCALP evidence categories: C1 (yellow = reproduction, red = no reproduction), C2 (light green = reproduction, pink = no reproduction),), and C3 (dark green = reproduction, grey = no reproduction).

Reproduction was confirmed in both WY, with a total of five distinct breeding females identified (Fig. 6., 8.). In 2023/24, three breeding females were recorded in six grids (15.4%), while in 2024/25, five breeding females were recorded across 18 grids (46.2%).

B. Occurrence map

A standardized interpretation was applied for the calibration process and for the presentation of large carnivore data at a broader scale. Lynx occurrence was confirmed in 25 grids (64.1%) during the 2023/24 WY and in 34 mapping grids (87.2%) during the 2024/25 WY (Fig. 7.). Confirmed presence in these grids was based exclusively on C1 and C2 data (i.e., camera-trap records, telemetry locations, genetic analyses, or confirmed scats), following the methodology described by Kaczensky et al. (2024).

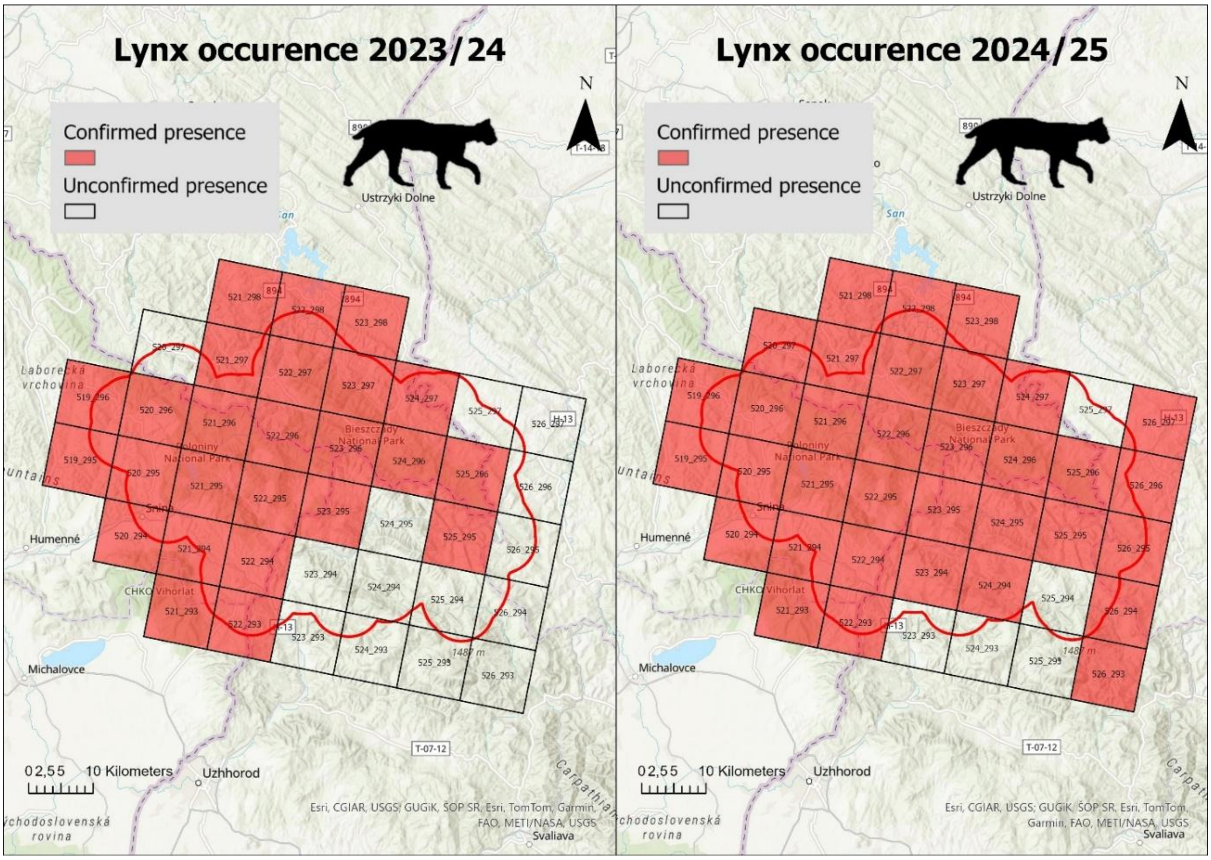

Figure 7. Confirmed lynx presence based on SCALP-validated data (C1 and C2) at the EEA 10×10 km grid level for 2023/24 and 2024/25, with pre-defined pilot border (red line).

Figure 8. A non-resident individual, presumed to be a male, recorded on the Slovak side of the pilot area (Poloniny National Park) during the final phase of deterministic monitoring, in association with the resident female Udava and one of her cubs.

3.4.2 Status & distribution/occurrence maps: Bear

A. SCALP map

Bear presence was confirmed by validated C1 evidence (camera-trap photographs or genetically confirmed samples), being recorded in 15 grids (38.5% of all grids) in 2023 and increasing to 19 grids (48.7%) in 2024 (Fig. 9.). In both years, C2 evidence of bears was recorded in three grids (7.7%). In 2023, C3 evidence on bear occurrence was confirmed in four grids (10.3%), declined to three grids (7.7%) in 2024.

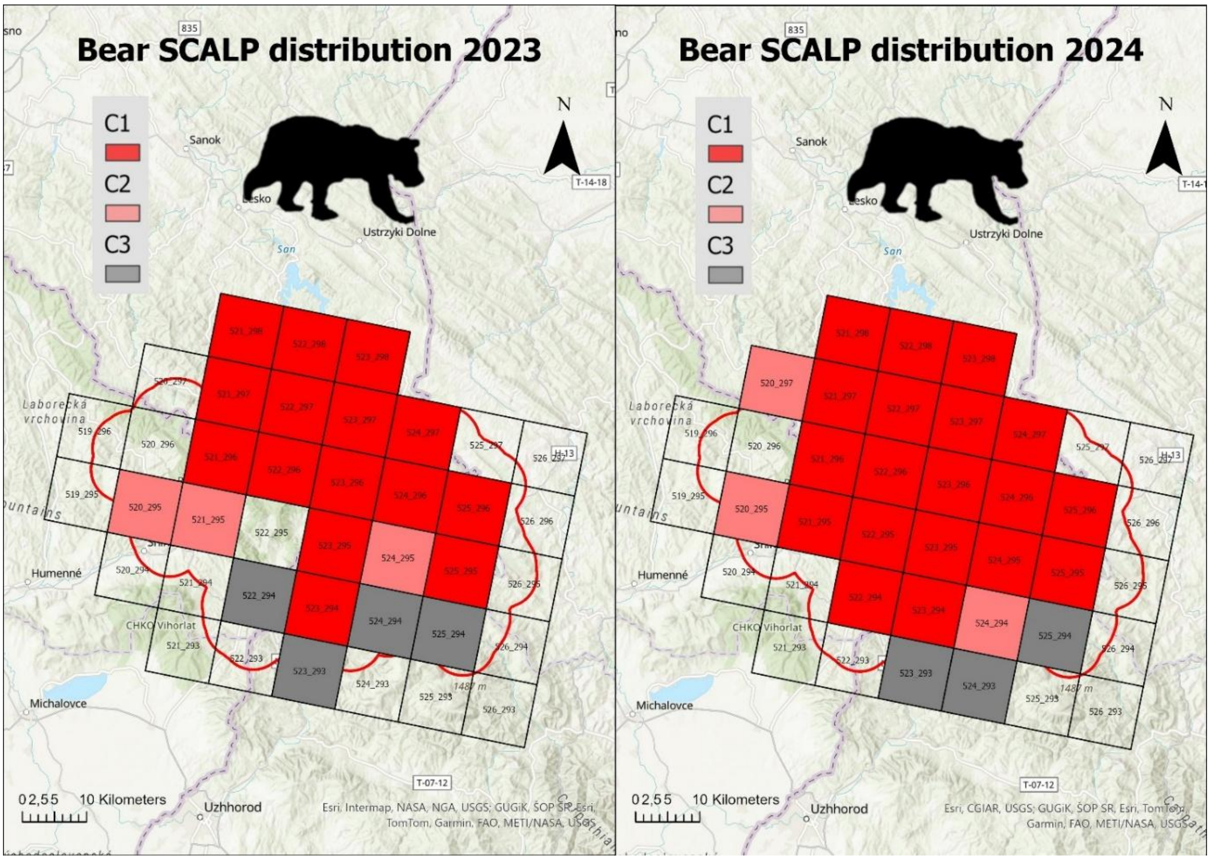

Figure 9. Bear distribution based on data (C1–C3) validated according to the SCALP methodology at the EEA 10×10 km grid level for 2023/2024, with pre-defined pilot border (red line).

B. Occurence map

Bear presence was confirmed in 18 grids (46.2%) in 2023 and in 22 grids (56.4%) in 2024 (Fig. 10, 11). Confirmations on bear presence were based exclusively on C1 and C2 evidence (i.e., camera-trap records, tracks, scats, and other signs of presence).

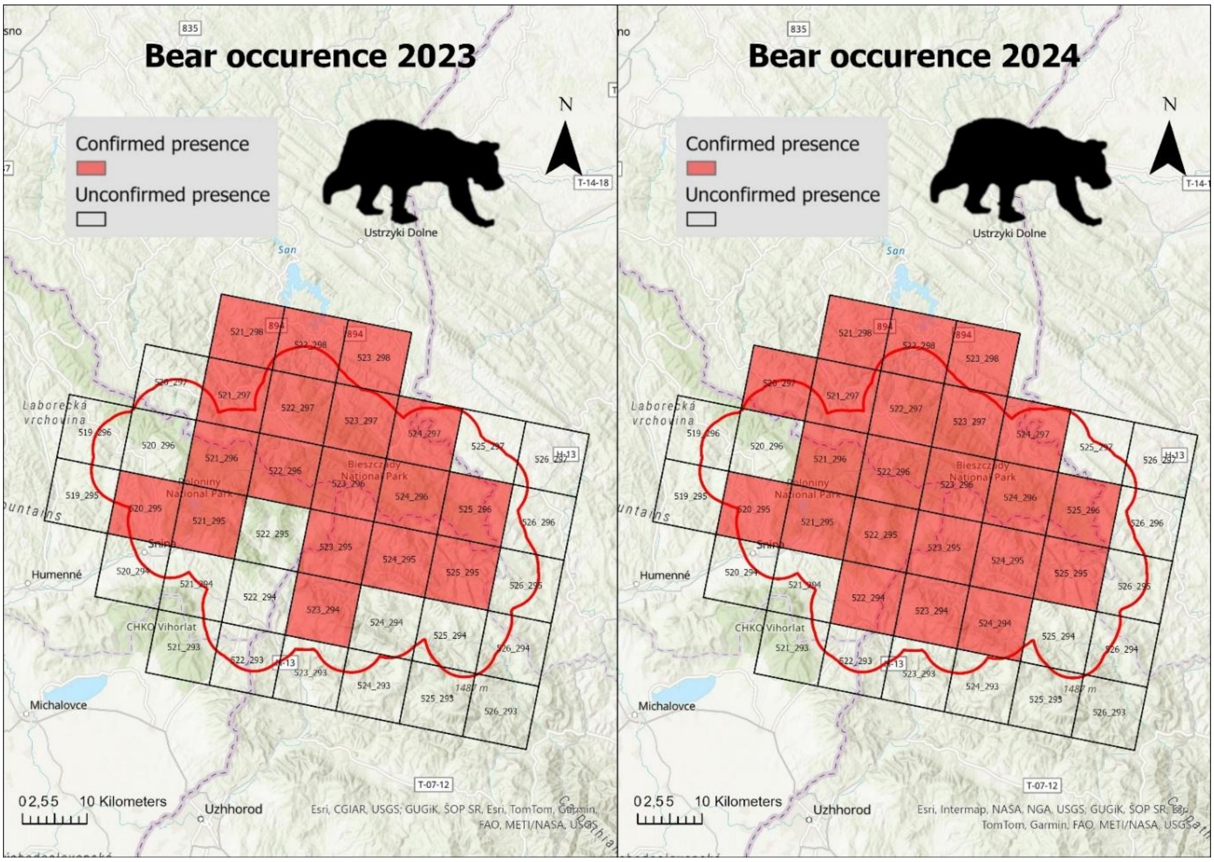

Figure 10. Confirmed bear presence (C1 & C2, SCALP methodology) at the EEA 10×10 km grid level for 2023/2024, with pre-defined pilot border (red line).

Figure 11. Records of bear individuals obtained from camera-trap monitoring in the Slovak part of the Eastern Carpathians pilot area (Poloniny National Park).

3.4.3 Status & distribution/occurrence maps: Wolf

A. SCALP map

Wolf presence, confirmed by validated C1 evidence records (camera-trap photographs), was documented in 19 grids (48.7%) in 2023 and in 23 grids (59.0%) in 2024 (Fig. 12.). During the 2023/24 WY, C2 evidence on wolf occurrence was confirmed in five grids (12.8%) while C3 evidence in six grids (15.4%). In the following WY (2024/25), the number of grids with C2 evidence decreased to four (10.3%), while C3 evidence was recorded in five grids (12.8%).

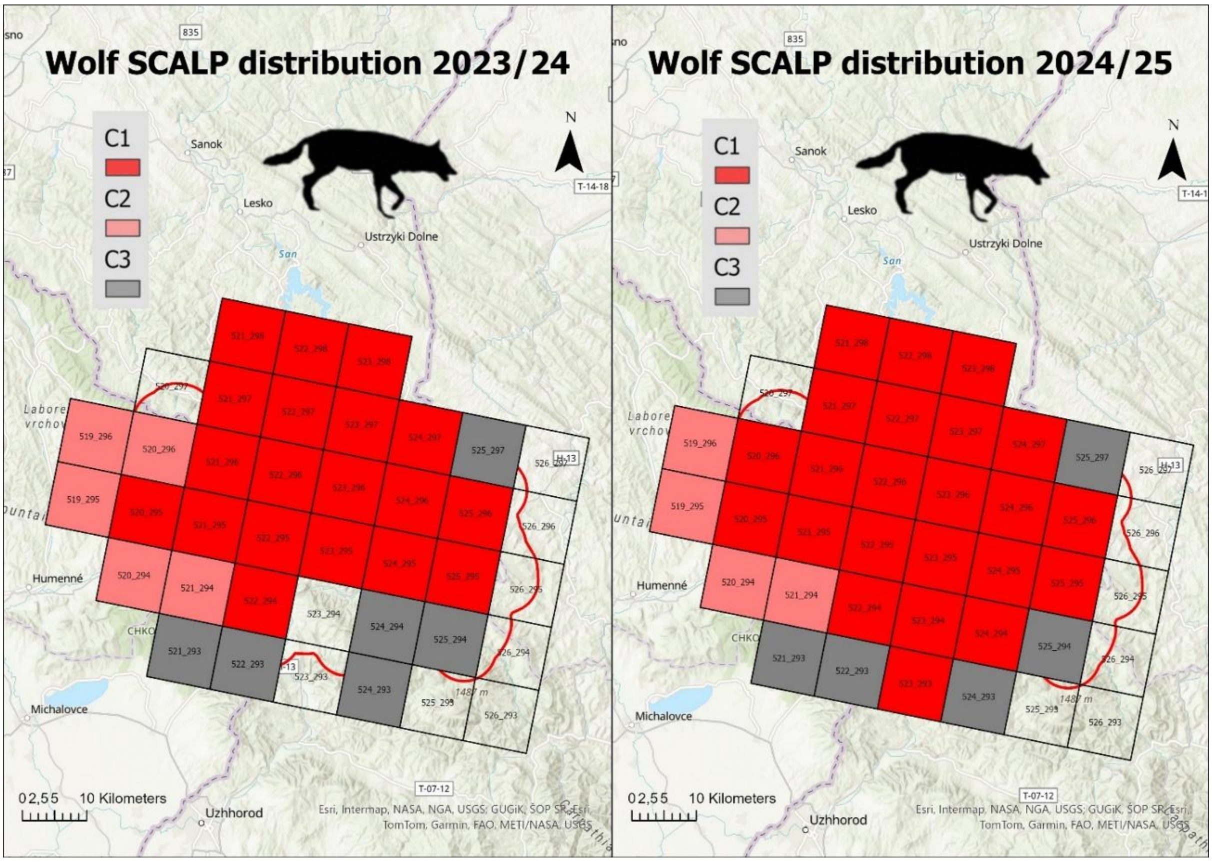

Figure 12. Wolf distribution based on data (C1–C3) validated according to the SCALP methodology at the EEA 10×10 km grid level in the two consecutive wolf years 2023/24 and 2024/25, with pre-defined pilot border (red line).

B. Occurrence map

Wolf occurrence was confirmed in 19 grids (48.7% of all grids) in 2023/24 WY and in 23 grids (59%) in the following WY (Fig. 13.,14.). Confirmed presence in these grids was based only on C1 and C2 data (i. e., camera trap records).

The establishment of standardized, science-based monitoring in the Eastern Carpathians has substantially increased the accuracy, consistency, and comparability of large carnivore distribution data across national borders. The use of SCALP categories has an harmonized criteria, strengthened data reliability and improved the interpretation of long-term population trends.

Lynx monitoring results show a clear expansion and consolidation of the species' range. Between 2012–2021, lynx presence increased from 31 to all 39 grids (79.5% → 100%), with the permanent range rising from 0% to 43.6% and the sporadic range from 10.3% to 17.9%. The decrease in C1 evidence (69.2% → 43.6%) reflects the adoption of more rigorous data validation rather than an actual population decrease. During 2023–2025, SCALP-based monitoring confirmed lynx in 87.2% of all grids, with C1 data increasing (38.5% → 71.8%) and C3 decreasing (15.4% → 5.1%), providing evidence of enhanced data quality and a stable, well-connected transboundary population (Fig. 6-7).

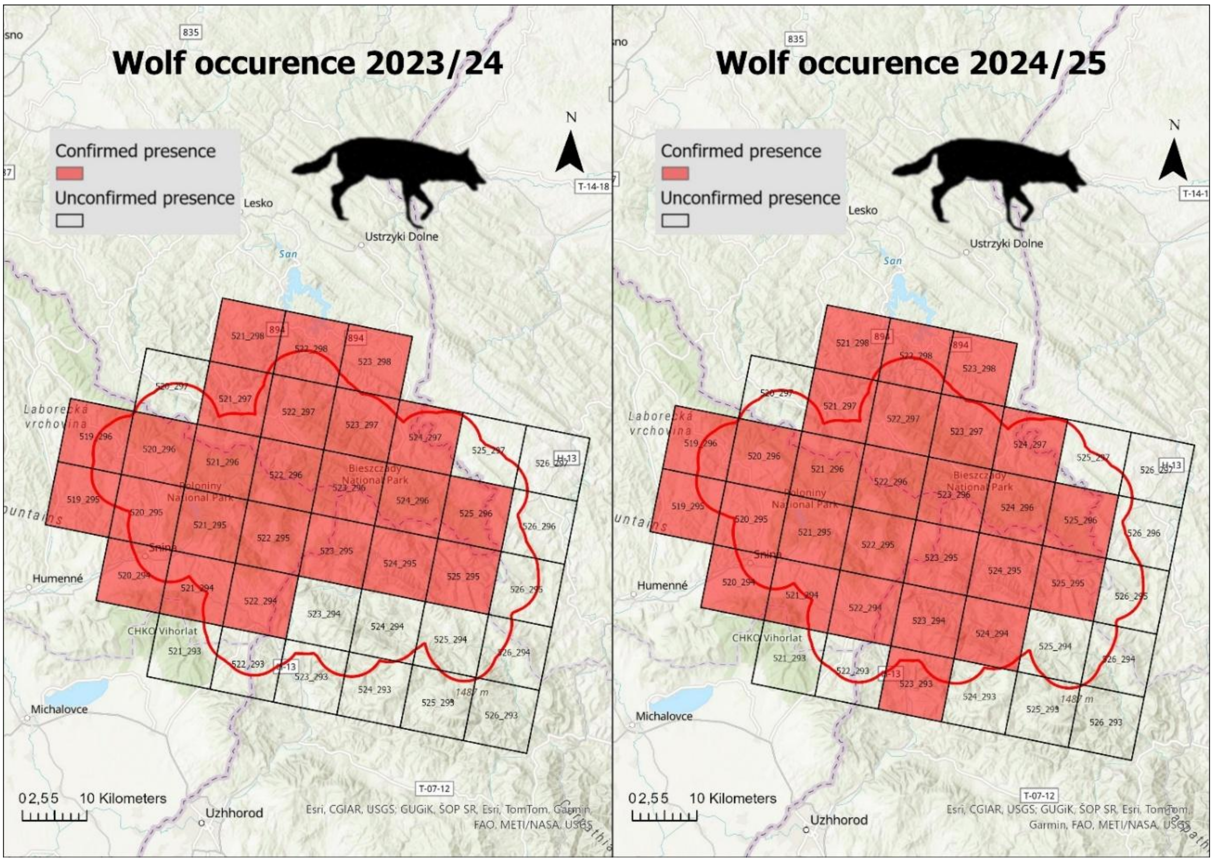

Figure 13. Confirmed wolf presence based on SCALP data (C1 & C2) at the EEA 10×10 km grid level in the wolf years 2023/24 and 2024/25, with pre-defined pilot border (red line).

Figure 14. Wolves recorded by camera traps in the Slovak part of the Eastern Carpathians pilot area (Poloniny NP).

Bear data indicate a similar pattern of consolidation and methodological refinement. Between 2012–2021, bear presence expanded from 79.5% to 100% of grids, and the permanent range increased from 52% to 69%, while sporadic and "Present" data declined to 2.6% and 7.7%, respectively. The C1 share decreased slightly (74.4% → 64%) as C2 and C3 rose modestly, reflecting more comprehensive evidence collection. In 2023–2025, bear presence was confirmed in 46.2% (2023) and 56.4% (2024) of grids, with C1 data increasing (38.5% → 48.7%) and C3 decreasing (10.3% → 7.7%; Fig. 9-10.). The smaller spatial extent results from stricter verification, not biological contraction, marking progress toward more consistent and policy-relevant monitoring.

Wolf monitoring results also demonstrate stable distribution and improved data validation. Between 2012–2021, the species' range expanded from 29 to all 39 grids (74.4% → 100%), with the permanent range growing from 46.2% to 74.4%. Although C1 evidence declined (71.8% → 56.4%), C2 and C3 increased (0% → 18% and 12.8%), indicating more systematic data verification. During 2023–2025, wolf presence remained stable (48.7–59% of grids), with C1 records increasing and C3 decreasing, confirming a well-documented and ecologically stable population (Fig. 13-13.).

Overall, these findings highlight a regional transition from opportunistic to systematic, evidence-based monitoring. The consistent increase in verified (C1–C2) data and decline in uncertain (C3) observations underline substantial methodological progress, providing a stronger scientific foundation for coordinated conservation and management of large carnivores in the Eastern Carpathians.

4. Pilot activities: Conflict prevention

4.1. Monitoring and identification of incidents and livestock damages

A. Methods and data collection

The coexistence of large carnivores with human activities, especially livestock production, presents significant challenges. Predation is one of the most visible and contentious forms of human–wildlife conflict in Europe, causing economic losses, animal welfare concerns, and social tensions in rural areas. Reliable monitoring and identification of livestock damages are essential for fair compensation and effective conflict mitigation. Accurate assessments not only ensure farmers are compensated but also reduce false claims and misconceptions about carnivores. Robust monitoring systems benefit all stakeholders: farmers gain clarity and support in managing risks, policymakers receive a sound basis for transparent programs, and conservationists foster coexistence by building trust. As Europe seeks to balance biodiversity protection with agricultural sustainability, improving methods for documenting livestock damages is key to reducing conflict.

The number of attacks, damages and hot spots was evaluated over two consecutive years 2023-2024 based on available data from the Regional Directorate for Environmental Protection in Rzeszów, the State Nature Conservancy of the Slovak republic, and the Uzhanskyi National Nature Park administration at the level of municipality units Czarna, Cisna, Komańcza, Lutowiska, Solina, within the pilot area in Poland, Snina in Slovakia and Dubrynychi-Malyi Bereznyi, Kostryna, Stavne, and Velykyi Bereznyi in Ukraine.

B. Results

Bear depredation and related damages

During the 2023 and 2024 monitoring years, a total of 135 bear-related depredation incidents were recorded within the Eastern Carpathians pilot area, affecting 421 livestock animals (Fig. 15-16.). The vast majority of incidents occurred on the Polish side of the pilot area, where most recorded cases of damage involved small livestock species, particularly poultry and lagomorphs. It is possible that most of the damages was caused by only a few habituated individuals present in the area. It was proven that only small percentage of bear population regularly causes damage. A declining in bear depredation was observed over the two-year period, with the number of affected livestock decreasing from 283 animals in 2023 to 138 in 2024. In addition, 110 cases of bear-related damage to apiaries (bee colonies and hives) were documented, showing a sharp decline from 92 cases in 2023 to 18 in 2024 (Fig. 15-16.). A similar reduction was noted in bear attacks on farmed game species, with 12 of 13 cases recorded in the first monitoring year and only one case in the second. Damage to apiaries occurred almost exclusively in Poland (99.1%), and all bear attacks on farmed game species were also confined to the Polish side.

The majority of all bear-related incidents originated from the municipality area of Solina, accounting for 76.5% of cases in 2023 and 30.3% in 2024 (Fig. 15-16.). On the Slovak side, only one bear-related incident was recorded during the monitoring period. According to official national statistics for 2023–2024, this situation remained unchanged even when considering adjacent districts encompassing an additional 1,181.5 km² of more human-dominated landscapes, where bear occurrence would be expected to be higher than within Poloniny NP and its surrounding buffer zone, which are characterized by extensive forest cover and mountain meadows.

In the Ukrainian part of the pilot area, only one bear-related incident was recorded in 2023. However, due to the absence of a formal damage compensation mechanism, the actual extent of bear-related damage remains uncertain. Limited incentives for reporting likely result in significant underestimation of conflict levels. This underscores the need for enhanced cross-border monitoring, improved reporting mechanisms, and harmonized compensation systems to ensure reliable data and effective management of human–bear coexistence in the Eastern Carpathians.

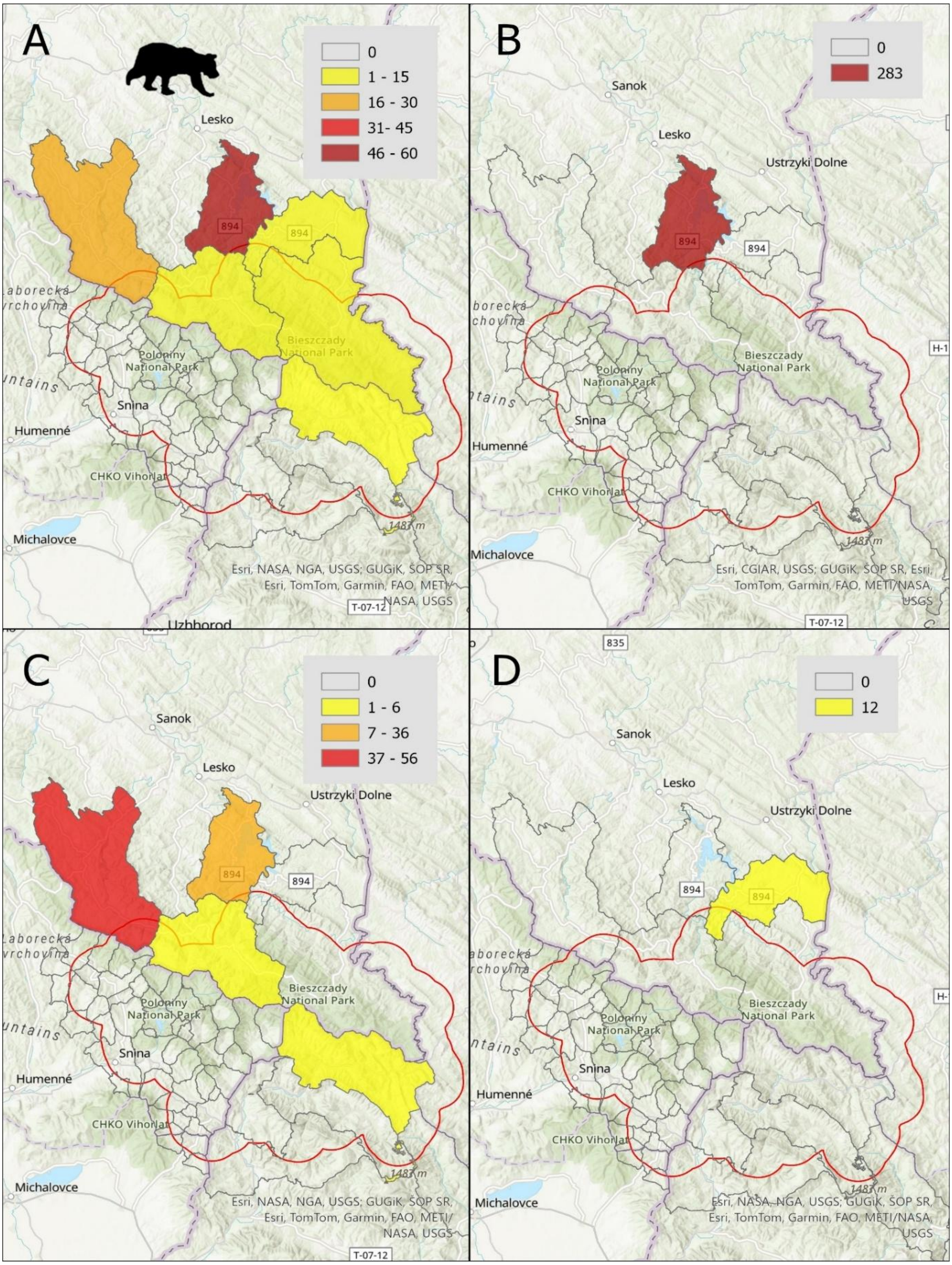

Figure 15. Distribution of bear-related damages in the Eastern Carpathians pilot area in 2023, including (A) total number of recorded incidents, (B) number of livestock killed, (C) number of damaged beehives, and (D) number of individuals killed in farms or game reserves, presented at the municipality unit level, with pre-defined pilot border (red line).

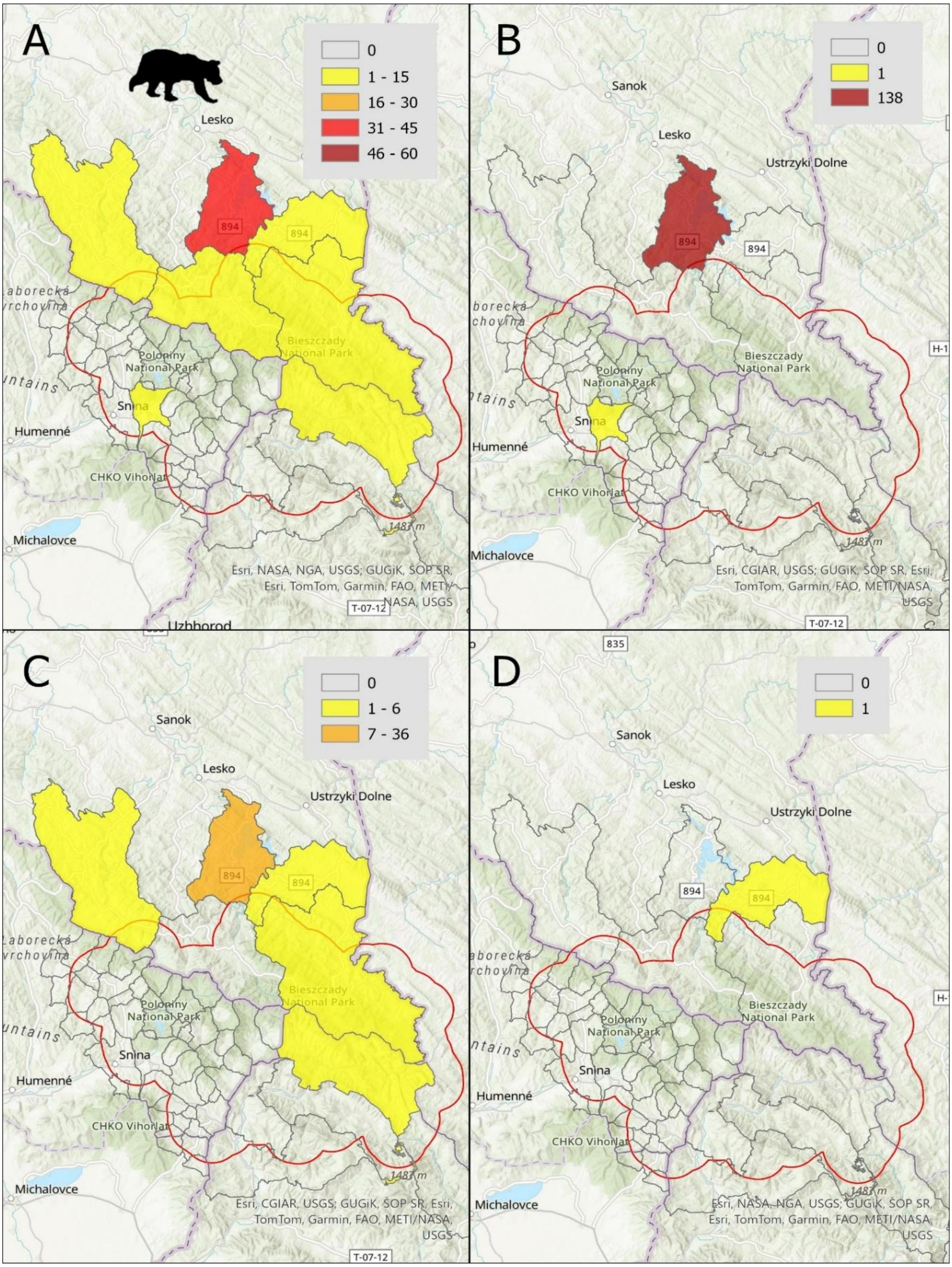

Figure 16. Distribution of bear-related damages in the Eastern Carpathians pilot area in 2024: (A) total incidents, (B) livestock killed, (C) damaged beehives, and (D) farm or game reserve animals killed, shown at the municipality unit level, with pre-defined pilot border (red line).

Wolf depredation

A total of 103 wolf-related depredation incidents were recorded in the Eastern Carpathians pilot area during the 2023 and 2024 monitoring years, affecting 231 livestock animals, majority of which occurred on the Polish side (Fig. 17). In contrast to the declining bear depredation, wolf related incidents slightly increased, rising from 103 affected livestock in 2023 to 128 in 2024. Wolf attacks on farmed game species remained stable across both monitoring years, with three animals affected annually. Similar to bear depredation, most wolf-related incidents were concentrated in the Solina municipality area.

Within the Slovak part of the pilot area, no wolf-related incidents were recorded during the monitoring period. However, when the analysis is extended to include the adjacent districts surrounding Poloniny NP —representing a more human-dominated landscape with a higher potential for depredation and conflict—the number of incidents increases notably: 10 cases involving 23 livestock losses were documented in 2023, and 14 cases involving 20 livestock in 2024. In the Ukrainian part of the pilot area, only one incident was recorded in 2024. The low frequency of wolf–livestock conflicts in this area is largely attributed to the absence of high-altitude pastoralism and livestock grazing on mid-forest and alpine meadows ("poloniny"). Across the Carpathians in Ukraine, most wolf-related conflicts are associated with attacks on livestock (primarily sheep and cattle) at such poloniny farms (Cherepanyn et al. 2024). These traditional farming practices are widespread mainly in the southeastern Carpathians, whereas in the northwestern part—particularly within the project area—they are almost entirely absent.

Nevertheless, as in the case of bear-related incidents, the seemingly low conflict rates in the Ukrainian pilot area may be influenced by the lack of a formal damage compensation system and potentially underreported cases. This highlights the need for continued monitoring and further investigation to ensure an accurate assessment of human–wildlife interactions and to inform evidence-based conflict mitigation strategies across the transboundary region.

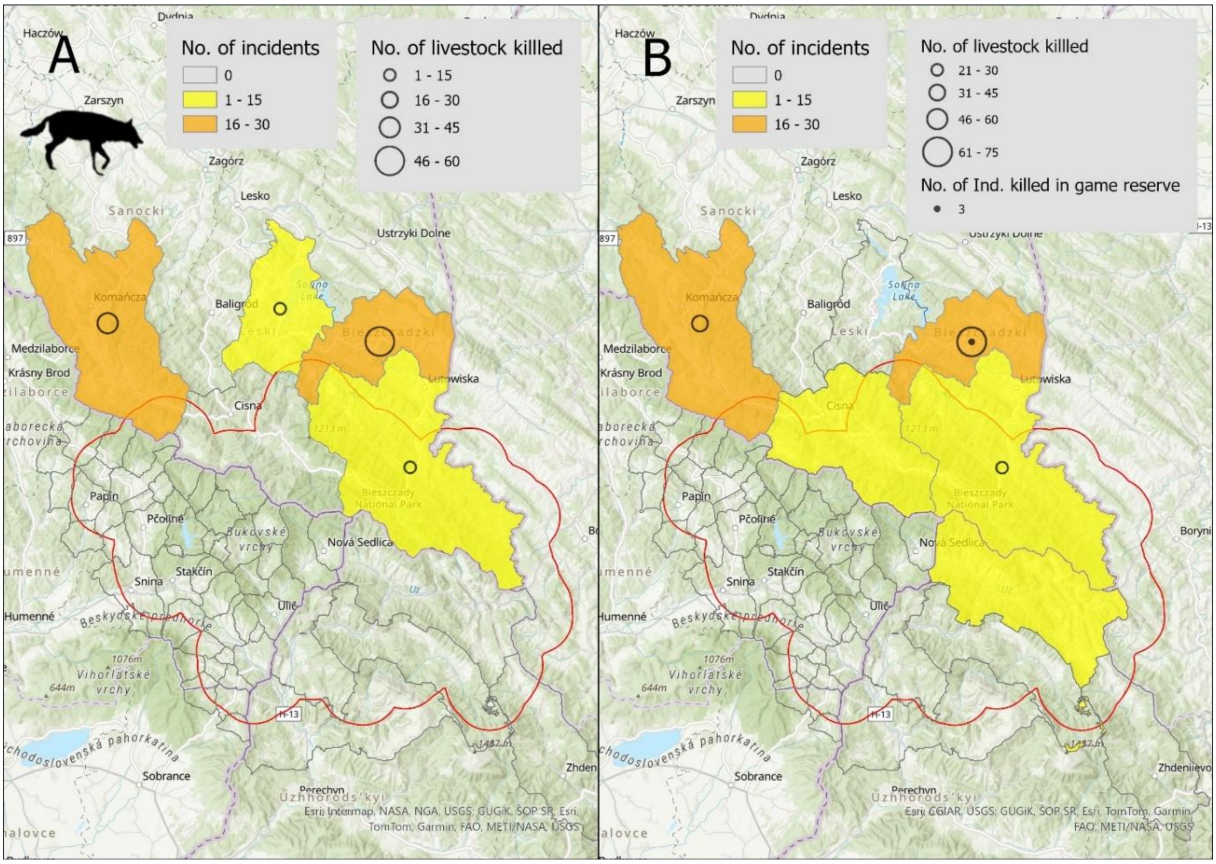

Figure 17. Distribution and number of wolf incidents and livestock killed in the Eastern Carpathian pilot area during the two consecutive wolf years, 2023/24 and 2024/25, scaled at the municipality unit's level, with pre-defined pilot border (red line).

4.2. Preventive measures

A. Methods and data collection

Conflict between humans and wildlife represents a major threat to the long-term persistence of some of the world's most iconic species (Gross et al. 2021). The IUCN SSC Guidelines on Human–Wildlife Conflict and Coexistence emphasize that effective HWC management requires sustained, collaborative, and process-oriented interventions. Such efforts should be grounded in interdisciplinary expertise—including local community leaders, peacebuilding specialists, animal-behaviour experts, biologists, and others—to ensure the development of integrated and sustainable strategies for addressing this global challenge (IUCN 2023). WWF has been working for many years to reduce human–wildlife conflict (Gross et al. 2025). Building on this experience and the Conflict to Coexistence framework, targeted efforts were initiated to mitigate conflicts with large carnivores in the pilot area. Central to this process was gathering information directly from local residents, who are the primary stakeholders affected by these conflicts, and whose active involvement is essential for developing effective and socially acceptable mitigation measures.

To identify key challenges and determine which conflicts could realistically be mitigated, a series of meetings was held in which a comprehensive survey was conducted. It quickly became apparent that the primary issue on the Polish side of the pilot area involved bears entering towns. These problems were concentrated in the most touristic parts of the

Bieszczady Mountains and were driven by human behaviour—both tourists and local residents—since most waste containers were not bear-proof. This readily available food source attracted bears into close proximity to human settlements. Reports were also received regarding damage caused by wolves and bears to livestock farms and, in the case of bears, to apiaries.

B. Results

Harmonious coexistence between humans and large carnivores is possible only if local communities accept their presence, which becomes far more likely when conflicts are reduced. Such conflicts can be mitigated, particularly through the use of effective preventive measures. Since 2013, WWF Poland has therefore purchased and distributed 419 electric-fence sets to livestock owners to protect animals from wolf depredation, and 181 electric-fence sets to protect apiaries from bears. In addition, 130 bear-proof waste containers have been provided to local municipalities. In 2025 alone, more than half of all electric fences supplied to livestock breeders in Poland were financed by WWF Poland. In the Polish part of the pilot area and adjacent regions, 33 electric-fence sets were purchased between 2023 and 2025 to protect apiaries from bear incursions, including 3 sets financed through the LECA project. Over the same period, 12 electric-fence sets were acquired to protect livestock from wolf depredation, of which 3 were funded under the LECA project. In addition, 41 bear-proof waste containers were procured, including 3 supplied through the LECA project (Fig. 18).

Figure 18. Container purchased under the LECA project at the place of use (Tarnawa Niżna, Lutowiska Municipality)

To evaluate the effectiveness of the preventive measures implemented, interviews were conducted with a livestock farmer and a beekeeper who had received prevention equipment procured through the LECA project. Both users reported a high degree of functionality and effectiveness of the installed measures in reducing the risk of bear-related damage. The interview materials were disseminated through WWF Poland's communication channels, including Facebook, to enhance outreach and public awareness. In addition, an instructional video was produced to demonstrate the correct use and maintenance of bear-proof waste containers, contributing to the standardisation of preventive practices (https://www.facebook.com/share/r/16qtQWRmTv/; https://www.facebook.com/share/r/17Kecpc9mf/; https://www.facebook.com/share/v/1WF8p5XJJo/).

Building on the Conflict to Coexistence framework, one of the most important contributions of the LECA project was the strengthening of cooperation between WWF Poland, local governments in the Bieszczadzki region, and academic partners (Institute of Nature Conservation, Polish Academy of Sciences) in mitigating human–brown bear conflicts. These discussions led to the establishment of dedicated working groups focusing on communication activities and waste management—two areas identified as crucial for reducing conflict risk.

As part of these collaborative efforts, a meeting dedicated to coexistence with large carnivores was held on 6 September 2024 at the Tourist Information and Education Center of Bieszczadzki National Park in Lutowiska. The event served as a platform for exchanging experiences among representatives of local government units, the State Forests, hunting associations, agricultural chambers and advisory services, police, and non-governmental organizations. Discussions centred on challenges arising from shared space with large carnivores. The strong engagement of local institutions resulted in numerous valuable insights and recommendations. The meeting was conducted in hybrid format, with participation from WWF Slovakia and WWF Ukraine; 36 participants attended on-site and 11 joined online. (Information link: *Effective nature protection must integrate the voices of local communities – Interreg Central Europe, LECA Project | WWF Poland*.)

Furthermore, on 30 September 2024, a representative of WWF Poland participated in the kick-off meeting for the Tatra pilot area, where issues related to mitigating bear–human conflicts were discussed—an issue that is also highly relevant to the Eastern Carpathians pilot area. During these meetings, participants agreed on the need for closer cooperation in developing measures to minimise human–large carnivore conflicts. In response, WWF Poland organised and led additional events, including a meeting on 12 February 2025 at the Tourist Information and Education Centre of Bieszczadzki National Park in Lutowiska. This hybrid event focused on conflict mitigation and was attended by representatives of local self-government units, agricultural industry associations, agricultural advisory services, relevant government institutions, nature conservation authorities, the State Forests, and non-governmental organizations, with 32 participants attending in person and 18 joining online.

Figure 19 the meeting on 12.02.2025 in Tourist Information and Education Centre of Bieszczadzki National Park in Lutowiska regarding minimizing human-large Carnivores conflicts

As mentioned, the meetings resulted in the establishment of working groups on communication and waste management. The communication group developed and implemented an information campaign for residents and tourists on how to protect their garbage from bears, how to avoid bear encounters, and how to react in the event of an encounter. The campaign was conducted in Bieszczady municipalities. The costs incurred were not covered by the LECA budget, but the LECA project undoubtedly contributed to the creation of a platform for knowledge exchange and collaboration. The campaign was based on graphics in the form of posters/boards/stickers installed in publicly accessible places in the Bieszczady communes (Fig. 20.). The campaign also included an article collecting the most important information *Jak unikać niedźwiedzi | WWF Polska*.

Figure 20 - Graphics used in the information campaign. Translation: top left - “Unsecured waste encourages bears to stop”; top right - “Leftovers cause uninvited company”; bottom left - abandoned garbage invite bears onto the trail; bottom right – “Easily accessible garbage means difficult encounters with bears”.

Within the waste-management cooperation group, work has begun on identifying bear conflict hotspots and on testing new as well as implementing existing preventive measures. By June 2026, at least 20 such hotspots are expected to be identified, with preventive interventions implemented accordingly. This activity is being carried out outside the LECA project.

Moreover, on the 24th of June 2025, the LECA Project Open Day for museum visitors was held at the Natural History Museum of Bieszczadzki National Park in Ustrzyki Dolne (LECA) (https://www.interreg-central.eu/news/leca-engages-with-public/). These meetings and the resulting network of contacts contributed to the establishment of a stakeholder platform, which has already stimulated new initiatives and plans to continue activities aimed at strengthening human–large carnivore coexistence in the region.

Figure 21 the LECA Project Open Day for held at the Natural History Museum of the Bieszczadzki National Park in Ustrzyki Dolne on the 24th ofJune 2025.

5. Pilot activities: Poaching prevention

5.1. Seminars for police investigators

Poaching prevention seminar in the Beskydy-Kysuce pilot area (CZ-SK)

On the 3rd and 4th September 2024, a specialized seminar was held at the Beskydy Hotel Portáš for representatives of the Police and Customs Administrations of the Czech Republic and the Police of the Slovak Republic. Across two days, participants attended nine expert lectures addressing topics such as species biology, genetic research, methods for investigating wildlife crime, national legal frameworks, and examples of successfully prosecuted cases. The 35 participants recognized the essential role of expert input in wildlife crime investigations and underscored the importance of ensuring that scientific findings are applicable in criminal proceedings, emphasizing the integration of scientific, forensic, and legal approaches.

The seminar also provided a valuable platform for networking and strengthening cross-border cooperation, aiming to enhance the investigation and prosecution of illegal killings of large carnivores within the pilot area.

Poaching prevention seminar in the Tatra Mountain pilot area (PL-SK)

On the 16th and 17th January 2025, a cross-border seminar for law enforcement authorities was held at the REWITA Center in Kościelisko, Poland. The event gathered 34 participants representing law enforcement agencies, nature conservation authorities, non-governmental organizations, and experts from Poland, Slovakia, and the Czech Republic. Throughout the two-day seminar, participants attended eight expert presentations addressing the challenges of protecting endangered species, with a special focus on poaching and wildlife crime. The program featured national overviews of illegal activities targeting protected species, analyses of large carnivore population dynamics in the Carpathians, and practical approaches to the investigation and prosecution of environmental offenses.

Experts from the participating countries shared case studies of wildlife crime investigations and presented innovative tools for detection and enforcement, including genetic methods and telemetry monitoring of large carnivores. The seminar concluded with a consensus on the need to strengthen cross-border information exchange, establish joint training initiatives, and enhance technical and institutional support for law enforcement agencies. The discussions underscored that the effective protection of large carnivores relies on coordinated international cooperation and the active engagement of local communities.

International webinar "Large Carnivore Poaching Investigation in the Carpathian Countries

Moreover, a joint international online seminar aimed at transferring and replicating best practices from the regional to the international level was organized on 4 November 2025. The event was jointly organised by the State Nature Conservancy of Slovakia, WWF Slovakia, MENDELU, and the Environmental Police of Slovakia. By the end of Reporting Period 5, a Save the Date announcement had been prepared and circulated to relevant partners and the Environmental Police.

The seminar convene representatives from all five participating countries Slovakia, the Czech Republic, Poland, Hungary, and Ukraine each of which present a successful case study highlighting key factors contributing to its success and transferability. Beyond the exchange of technical expertise, the event served as a networking platform to strengthen cross-border cooperation, promote knowledge transfer, and enhance the capacity of law enforcement and conservation authorities to prevent and investigate wildlife crime effectively.

5.2. Survey to assess current practices

A questionnaire survey was conducted among police officers in four pilot areas to assess their experience with and perceptions of poaching, with particular attention to cases involving large carnivores (bear, wolf, lynx). The survey instrument, developed based on experience from the LIFE SWiPE project and reviewed by the Environmental Police of Slovakia, aimed to improve understanding of wildlife crime and enforcement challenges across Slovakia, the Czech Republic, Poland, Hungary, and Ukraine. Between 12 August and 2 December 2025, a total of 118 completed responses were received—40 from the Slovak–Czech region, 5 from Hungary, 72 from Poland, and 1 from Ukraine. The survey remains open to allow additional participation and to improve the overall representativeness of the dataset.

In the Slovak-Czech sample, most respondents were police investigators (67.5%) with up to five years of service (57.5%). While 42.5% considered poaching a national problem, 30% viewed it as serious, and 20% regarded large carnivore poaching as a major concern. Hunting without a permit (90%) and the use of prohibited methods (65%) notably unauthorized firearms (55%) and trapping (45%) were the most frequent offenses. Lack of evidence (77.5%) and inadequate penalties (62.5%) were identified as the main barriers to prosecution. Respondents highlighted the need for consistent enforcement of damage compensation, stronger deterrent penalties, and improved media coverage. Nearly 88% expressed interest in additional training in forensic investigation, legislation, and species identification, emphasizing that cooperation with experts and peer learning are crucial for improving wildlife crime investigation and prevention.

Polish respondents were predominantly police investigators (36.1%) and police officers responsible for operational and search activities (19.4%). Most had been involved in investigating environmental crimes for up to five years (47.2%), although 30.6% reported experience ranging from six to fifteen years. A total of 65.3% of respondents perceived poaching as an issue in Poland, and 18.1% considered large carnivore poaching to be a major concern.

The most commonly targeted groups in poaching incidents were fish (62.5%) and game species (55.6%), whereas large carnivores accounted for only 11.1% of cases. Hunting without a permit (63.9%) and the unauthorised possession or transfer of game or fish (43.1%) were identified as the most frequent forms of poaching, while trapping was noted as a particularly widespread method used by offenders (79.2%).

Respondents highlighted multiple challenges encountered during poaching investigations, with insufficient evidence (50%) and inadequate technical equipment (33.3%) reported as the most common obstacles. Furthermore, 66.7% stated that existing penalties for poaching are inadequate and fail to deter offenders. A substantial majority (73.6%) expressed interest in additional training—particularly in forensic investigation, legislation, and species identification—underscoring that collaboration with experts and peer learning are essential for improving the investigation and prevention of wildlife crime.

6. Conclusions

The overall trend of the Carpathian lynx population is generally considered to be stable (Kaczensky et al. 2013; 2024). However, this assessment is not supported by sufficiently robust data, and the true population trend therefore remains uncertain (Kubala et al. 2021). This highlights the urgent need for more accurate information and the implementation of a standardised monitoring system based on spatially explicit principles and scientifically robust methods that can be applied consistently across countries by national wildlife authorities, with active involvement of hunting and forestry organisations (Kubala et al. 2023). In addition, it is essential to establish targeted programmes seriously mitigate anthropogenic factors jeopardising lynx survival, aimed at mitigating conflicts between lynx and local communities and stakeholders, particularly hunters in order to reduce illegal killing and support long-term population viability. Moreover, effective conservation and management of the Carpathian lynx population as well as other large carnivores and wildlife requires robust, coordinated cooperation among all countries within its range.

The Eastern Carpathians pilot action was designed precisely to address these gaps, substantially advancing transboundary monitoring and conservation of the lynx across one of Europe's most ecologically intact mountain regions. By integrating non-invasive research methods, institutional cooperation, and stakeholder engagement, the project strengthened the scientific basis for conservation and demonstrated effective, scalable approaches for managing large carnivores within a complex tri-national landscape.

The integration of systematic monitoring yielded the first coordinated dataset on lynx distribution and population structure across the pilot area. These findings confirm the persistence of a viable and interconnected lynx population within the Eastern Carpathians. Beyond data collection, the pilot action significantly enhanced regional capacity for coordinated large carnivore monitoring and deepened understanding of lynx spatial ecology, demography, and habitat use. Collaboration with local stakeholders proved essential for ensuring field access, maintaining data continuity, and promoting coexistence between people and large carnivores. The combination of systematic data collected by hunters, foresters, and rangers improved detection probability and fostered local ownership of conservation objectives.

Conflict prevention activities addressed the principal drivers of human–large carnivore interactions. A range of preventive measures including bear-proof waste containers, electric fencing for beehives and livestock, and targeted awareness campaigns were implemented jointly with park authorities and local communities. These interventions demonstrably reduced property damage and increased social tolerance toward large carnivores.

The project also underscored the importance of standardised data protocols, interoperable databases, and continuous cross-border communication (Breitenmoser et al. 2006; Kubala et al. 2021). These components establish a robust foundation for future transnational monitoring and management of lynx populations throughout the Carpathian range (Kubala et al. 2023). The Eastern Carpathians experience highlights that effective large carnivore conservation in multi-jurisdictional landscapes requires coordinated, evidence-based, and adaptive management approaches underpinned by stakeholder participation and institutional collaboration.

However, a new and critical challenge has emerged. Since the onset of the war in Ukraine in 2022, the enforcement of martial law has resulted in the construction of fortified border infrastructure along Ukraine's western frontier with the European Union. This system characterised by extensive razor-wire fencing—was implemented for national security purposes but now represents a substantial barrier to wildlife movement. As a consequence, previously connected subpopulations of lynx and other large carnivores in the Eastern Carpathians are becoming increasingly fragmented and isolated. This development threatens the continuity of key ecological corridors that are essential for dispersal, gene flow, and the long-term viability of lynx, other large carnivores, and wider wildlife populations across the Carpathians.

The isolated lynx population in the Western Carpathians, as well as along the western margin of the Eastern Carpathians, does not reach a sufficient size to remain demographically and genetically viable in the long term without functional connectivity to the larger core population in the Eastern Carpathians. This part of the Carpathian metapopulation plays a crucial role in ensuring lynx persistence across several countries (Czechia, Poland, Slovakia, Ukraine, and Hungary) and directly affects the success of ongoing and planned reintroduction and reinforcement programmes in Europe (von Arx et al. 2004; Port et al. 2024; Krofel et al. 2025). An analogous and likely even more severe threat concerns the isolated population in the Ukrainian Carpathians, which faces similar constraints related to small population size, limited gene flow, and increasing habitat fragmentation.

Further investigation and systematic, range-wide monitoring are urgently needed to quantify current and future risks, diagnose demographic and environmental constraints, and evaluate management strategies critical for the long-term viability of the Eurasian lynx. Such coordinated efforts should provide a rigorous scientific basis for evidence-driven lynx conservation across the Carpathians and Europe. In this context, the findings and outputs from the Eastern Carpathians pilot area and the LECA project represent an important contribution, supporting ongoing IUCN Red List and Green List assessments and informing the development of a comprehensive Conservation Strategy for the Carpathian lynx population.

Overall, the Eastern Carpathians pilot action generated essential baseline data, strengthened both technical and institutional capacities, and established a replicable model for transboundary monitoring of elusive species. The knowledge base, partnerships, and harmonised monitoring framework developed through this initiative provide a solid foundation for the long-term conservation of the lynx and the preservation of ecological connectivity across the Carpathians (Bonn Lynx Expert Group 2021; Kubala et al. 2021). Sustained international cooperation, transparent data exchange, and proactive mitigation of emerging barriers (Kubala et al. 2020) particularly those threatening cross-border movement are indispensable for securing the future of lynx and other large carnivore or wildlife populations at the geographic scope of this unique transboundary ecosystem, Carpathian region and whole Europe.

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