LECA

D.2.2.4 PILOT ACTION IN PILOT AREA 4 BESKYDY-KYSUCE (CZ, SK) WOLF

O.2.4 Pilot Action implemented in the Beskydy-Kysuce region on the monitoring, poaching prevention and conflict prevention of wolves

Activity 2.2 Implementation of Pilot Actions in 4 pilot areas in the Carpathians

September 2025

PILOT ACTION IN PILOT AREA 4 BESKYDY-KYSUCE (CZ, SK) WOLF

Author: Duľa M. [1], Uhrinová R. [2], Frýbová Š. [1] & Kutal M. [1]

Main contributors: Bojda M. [1], Labuda J. [2], Váňa M. [2], Piaček V. [1], Hulva P. [3], Tkáčová N. [3], Dušková M. [1], Obzinová L. [1], Strečanská V. [4], Kissová L. [1]

1. Department of Forest Ecology, Mendel University in Brno, Czechia
2. Carnivore Conservation Programme, Friends of the Earth Czech Republic, Czechia
3. Department of Zoology, Faculty of Science, Charles University, Czechia
4. Kysuce Protected Landscape Area Administration, State Nature Conservancy of the Slovak Republic

Other contributors: Drengubiak P., Trulík V., Machciník B., Tyller Z., Václavová Z., Renčo Š., Pospecha P. & other volunteers, cooperating institutions/organisations

Suggested citation: Duľa M., Uhrinová R., Frýbová Š., Kutal M. 2025: Pilot action in pilot area 4 Beskydy-Kysuce (CZ, SK) wolf, D.2.2.4. Project Interreg Central Europe LECA "Supporting the coexistence and conservation of Carpathian LargE Carnivores". 37 p.

Content

1. Introduction

The Beskydy-Kysuce region, situated along the Czech-Slovak border, represents a key area for the conservation and management of large carnivores on the edge of the Western Carpathians and their natural dispersal to other adjacent areas where they were eradicated before. The permanent presence of lynx (*Lynx lynx*) has been documented for decades, while wolves (*Canis lupus*) have recolonised the area only recently, with the first reproduction confirmed in 2019. Brown bears (*Ursus arctos*) also occur sporadically, with the first confirmed reproduction in 2023. The return and expansion of wolves in particular has brought both opportunities for biodiversity conservation and challenges for human-wildlife coexistence, especially in relation to livestock breeding and poaching.

The pilot action implemented under the LECA project focuses on three interconnected pillars: monitoring of wolves, poaching prevention, and conflict prevention and mitigation. Together, these activities contribute to building a robust knowledge base on wolf ecology, strengthening cooperation with law enforcement, and developing practical tools to reduce human-wolf conflicts in a transboundary area.

Monitoring efforts combined several complementary approaches. Wolves were equipped with GPS collars to obtain high-resolution spatio-temporal data on their movements, home ranges, and interactions with human activities. Non-invasive genetic sampling and camera trapping were systematically applied across a 10×10 km grid, allowing the identification of individuals, the assessment of population structure, and the creation of standardized SCALP and occurrence maps. These maps provide harmonised information on the status and distribution of wolves and other large carnivores, and together with data from non-invasive monitoring form the basis for population estimates and trend analyses in the pilot area.

Conflict prevention activities addressed the most common source of conflicts between wolves and local communities: livestock depredation. Detailed data on damage cases were collected from national and regional authorities, and hot spots of wolf attacks were identified at the level of cadastral units. Farmers' attitudes towards large carnivores were assessed through structured interviews, offering insights into perceptions of risk, the use of preventive measures, and expectations regarding state support and compensation. In addition, several preventive tools were tested in cooperation with local farmers, including fladry and livestock guarding dogs equipped with GPS collars. Smart technologies such as proximity sensors and virtual fences were tested to evaluate their potential in monitoring wolf-livestock interactions.

Poaching prevention was addressed through capacity-building and cross-border dialogue with enforcement authorities. A dedicated seminar for police investigators and customs officers highlighted the scale of wildlife crime in the Western Carpathians, shared best practices in forensic investigation, and fostered cooperation through various institutions, organisations, and environmental police. Genetic analyses were presented as a key tool for forensic evidence, enabling species and individual identification and supporting the prosecution of illegal activities.

By integrating ecological monitoring, preventive measures, and law enforcement cooperation, the Beskydy-Kysuce pilot action demonstrates a comprehensive approach to managing the coexistence of wolves and humans in a densely populated and highly fragmented landscape. The lessons learned provide valuable guidance for scaling up these activities in other Carpathian regions and for strengthening cross-border collaboration in large carnivore conservation.

2. Introduction to the pilot area

The pilot area encompasses two Protected Landscape Areas (PLA Beskydy and PLA Kysuce) and is located along the Czech–Slovak border at the western edge of the Carpathians (Fig. 1). Elevations range from 350 to 1323 m a.s.l., creating a cold mountain climate with mean annual temperatures between 2 and 7 °C. Average yearly precipitation varies from 800 to 1400 mm, and snow cover typically lasts from mid-November until late March or April. Forests dominate the landscape, with Norway spruce (*Picea abies*)—largely in plantations—and European beech (*Fagus sylvatica*) as the principal species. Only small remnants of natural forests remain, mainly within protected reserves (Duľa et al. 2021).

The landscape is intensively used for a variety of human activities. In addition to forestry and hunting, the area supports extensive grazing and is a popular destination for tourism. Infrastructure such as roads, railways, and built-up areas creates a marked contrast between relatively remote, homogenous mountain ranges and densely used valleys and basins (Duľa et al. 2021).

All three large carnivore species are permanently present in the pilot area, though long-term reproduction has so far been confirmed only for lynx (Kutal et al. 2017, Duľa et al. 2021). Wolves recolonised the region more recently, with the first reproduction recorded in 2019, while brown bear reproduction was confirmed in 2023 (Duľa et al. 2023, author's unpublished data).

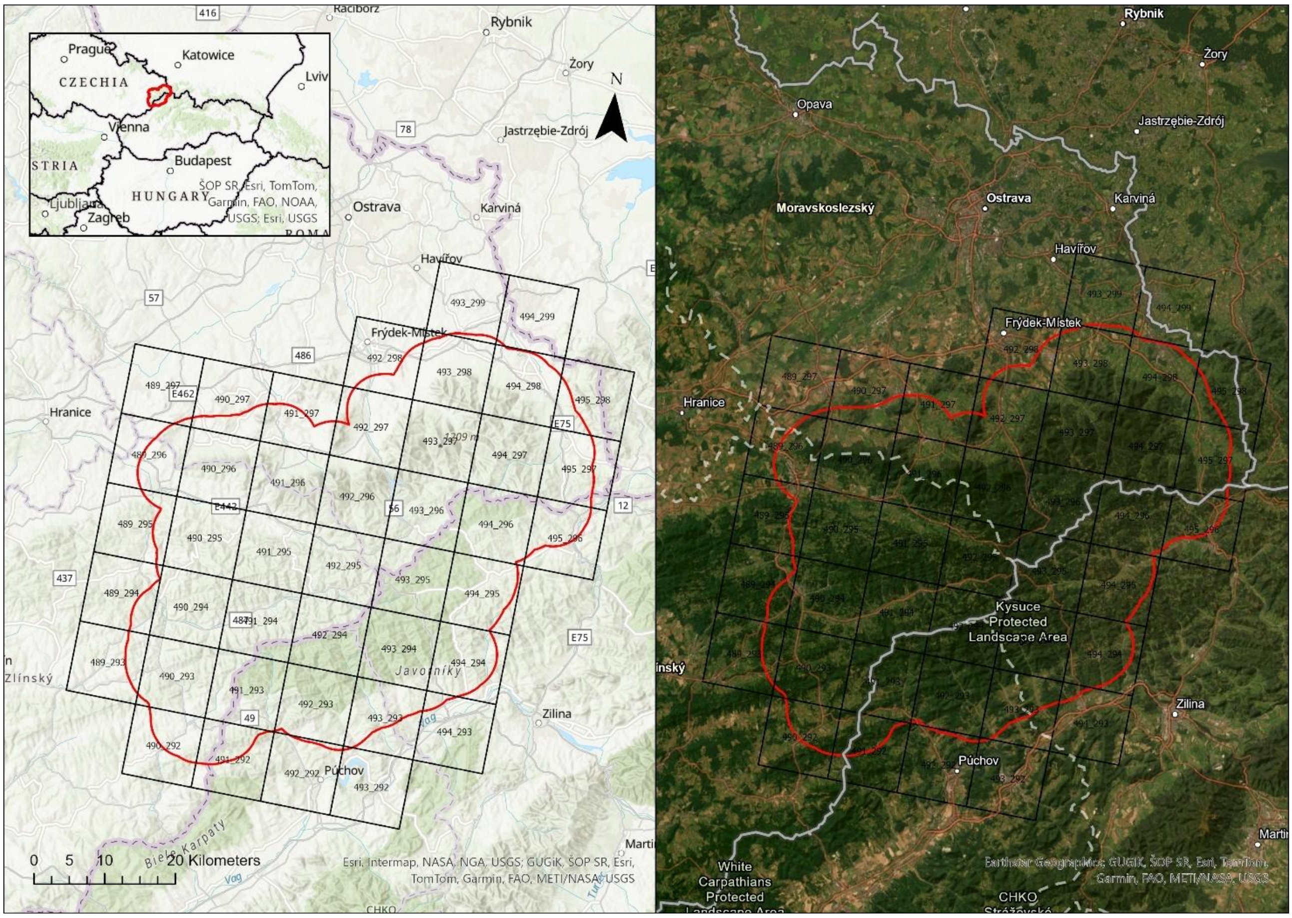

Figure 1: The cross-border study area Beskydy-Kysuce situated on the edge of the Western Carpathians with pre-defined pilot border (red) and 42 mapping grids (EEA 10×10 km).

3. Pilot activities: Monitoring harmonisation

3.1 Camera-trapping and documentation of signs of occurrence

A. Monitoring approach, data collection and analyses

Friends of the Earth Czech Republic, Carnivore Conservation programme (FoE CZ; PP9) was responsible for non-invasive monitoring and data collection on wolf occurrence, in cooperation with the Lead Partner, Mendel university in Brno (MENDELU) and State Nature Conservancy of the Slovak Republic (PP8) within the Beskydy–Kysuce pilot area in pre-defined 42 European Environmental Agency (EEA) grids of size 10×10 km.

During project periods 1–4, according to the detailed action plan (D.2.1.1), field mappers from FoE CZ consistently conducted regular non-invasive monitoring activities. These included documenting wolf signs in the field (e.g., tracks, scats), tracking wolves in areas with sufficient snow cover, collecting samples for genetic analysis, and using camera traps to monitor wolf and other large carnivore presence within the pilot area.

In total, over 800 field trips were carried out, and more than 200 camera traps were deployed in the field to monitor the presence of wolves and other large carnivores in the Beskydy–Kysuce region. FoE CZ, MENDELU, and SNC SR also actively participated in organizing two regular winter monitoring campaigns of large carnivores in the Beskydy Protected Landscape Area, held in February 2024 and 2025, in cooperation with the Nature Conservation Agency of the Czech Republic as the main responsible organisation for monitoring events. The collected data were shared among project partners, stored in a joint database, and validated using the SCALP methodology (Molinari-Jobin et al. 2012a,b), which classifies records according to their reliability. The highest category (C1) includes “hard data” such as camera trap photos, genetically confirmed samples, or documented visual observations. Category C2 covers signs such as scat or verified track sets, while the least reliable category, C3, includes unconfirmed sightings or single tracks (Fig. 2).

The validated data were subsequently used to produce SCALP distribution and occurrence maps for wolves as well as for other large carnivores (lynx and bear), following the EEA mapping grid and the methodological framework of Kaczensky et al. (2024) (see Chapter 3.4). Distribution maps were produced for the wolf years (i.e WY) 2023/24 and 2024/25, while maps illustrating the development of wolf territories and reproductive units were created for eight consecutive wolf years starting from WY 2017/18 (“wolf year” defined as spanning from 1st May to 30th of April of the following year).

Figure 2: Different types of documentation of wolf presence in the Beskydy-Kysuce pilot area: camera-trap records of wolves (A), tracking wolves and documentation of wolf tracks on sufficient snow cover (B), or wolf scats (C).

B. Results

Based on data obtained from non-invasive monitoring (i.e. signs of presence such as tracks and scats, camera trap pictures/videos, damages on livestock), wolf presence was confirmed in 67% of the defined pilot area grids (28 out of 42) in 2023/24 and in 71% in the 2024/25 wolf year (30 out of 42, see Fig. 3). In total, 5194 wolf signs of presence were documented. The majority was formed by C1 data – 3865 camera trap records (photos and videos), which represent 74% of the collected wolf presence dataset (see Fig. 3, 13).

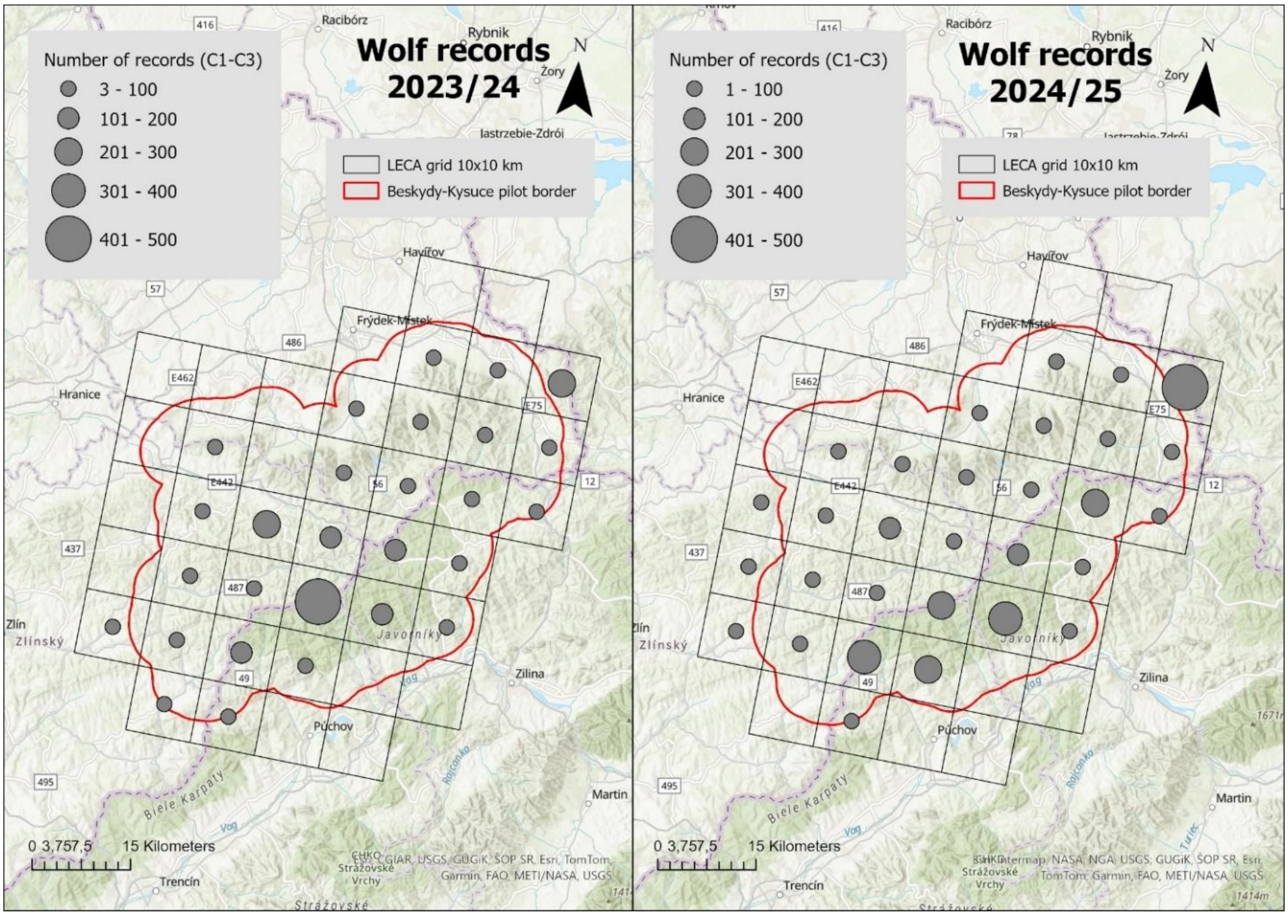

Figure 3: Number and distribution of obtained wolf presence records (C1-C3) in the two consecutive wolf years (2023/24 and 2024/25) across the Leca grid cells.

3.2 Extensive and intensive non-invasive genetic sampling

A. Monitoring approach, data collection and analyses

As part of the implementation of project activities under the approved detailed action plan D.2.1.1, extensive genetic sampling was implemented from April 2023 to November 2024. The purpose of this monitoring and analysis was to provide an initial screening of the genetic profile of the local wolf population, to obtain genotypes of wolf individuals within known territories, and to establish a reference dataset for intensive genetic monitoring of wolves in the region.

The collection of genetic material (primarily scats) involved all project partners, cooperating institutions, and volunteers across the defined pilot area as well as in its close surroundings. Samples were collected along tourist and forest trails, at road crossings, and by tracking wolf individuals/packs on sufficient snow cover. Genetic samples were preserved in ethanol tubes in accordance with methodological recommendations from the institution responsible for genetic analyses (Charles

University in Prague) and under the guidance of the coordinator of extensive and intensive genetic sampling at LP MENDELU.

During the fourth project period of the Beskydy–Kysuce pilot (December 2024 to March 2025), the Lead Partner MENDELU, in collaboration with FoE CZ (PP9) and SNC SK (PP8), cooperation stakeholders, and volunteers, carried out systematic non-invasive genetic sampling within the pilot area. The primary objective was to collect genetic samples for estimating wolf population size and density using non-spatial and spatial capture-recapture analysis, demographic structure, parental analysis, or kinship of wolves in the study area.

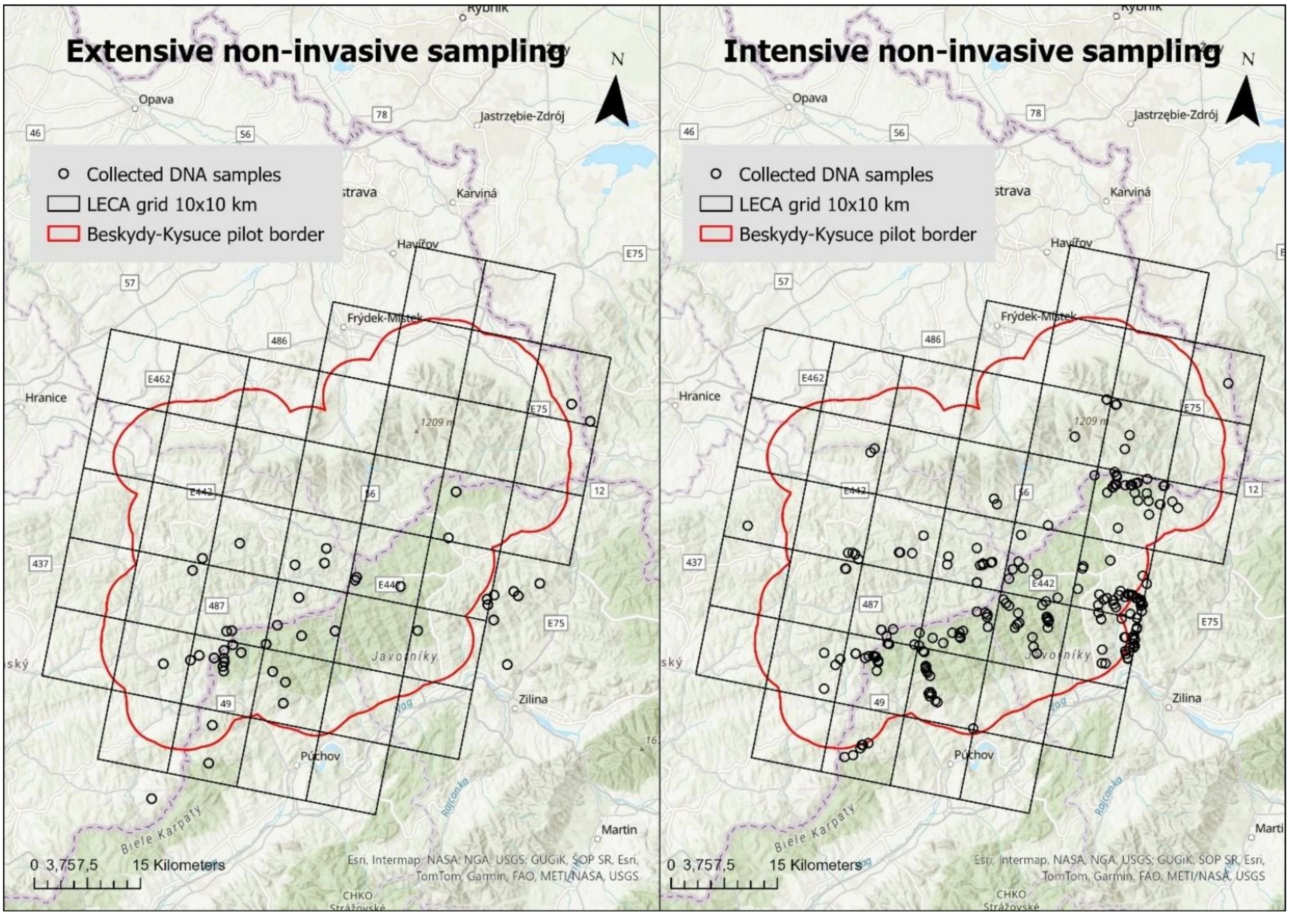

Figure 4: Distribution of collected samples (n=48) during extensive genetic sampling from April 2023 to November 2024 (left) and distribution of collected samples (n=226) during intensive sampling between December 2024 and March 2025.

The sampling methodology followed the approach published by Marucco et al. (2023a). Samples were collected within a 10×10 km grid system along predefined transects with two different mapping intensities: extensive, with each grid cell visited at least once every two months, and intensive, with each grid cell visited at least once per month.

In total, of the 42 grid cells in the Beskydy–Kysuce pilot area, 29 were mapped intensively, 9 extensively, and 4 were not mapped due to unsuitable habitat or not confirmed wolf presence in the previous period. The mapping intensity of individual grid cells was defined based on wolf occurrence during the 2022/23 wolf year.

Over the four months of intensive sampling, a total of 278 visits to grid cells were carried out, covering 38 different transects. In this period, 226 samples were collected for DNA analysis (mainly scats, 89% of all samples), of which one urine and two scat samples were excluded from further processing due to low reliability determined during the validation. Collected genetic samples (scat, urine, blood) were stored frozen. The validated samples were then submitted for analysis to Charles University in Prague. DNA analyses followed the same methodological approach as applied in previously published studies focusing on wolf genetics in Central Europe (e.g., Hulva et al. 2018, 2024).

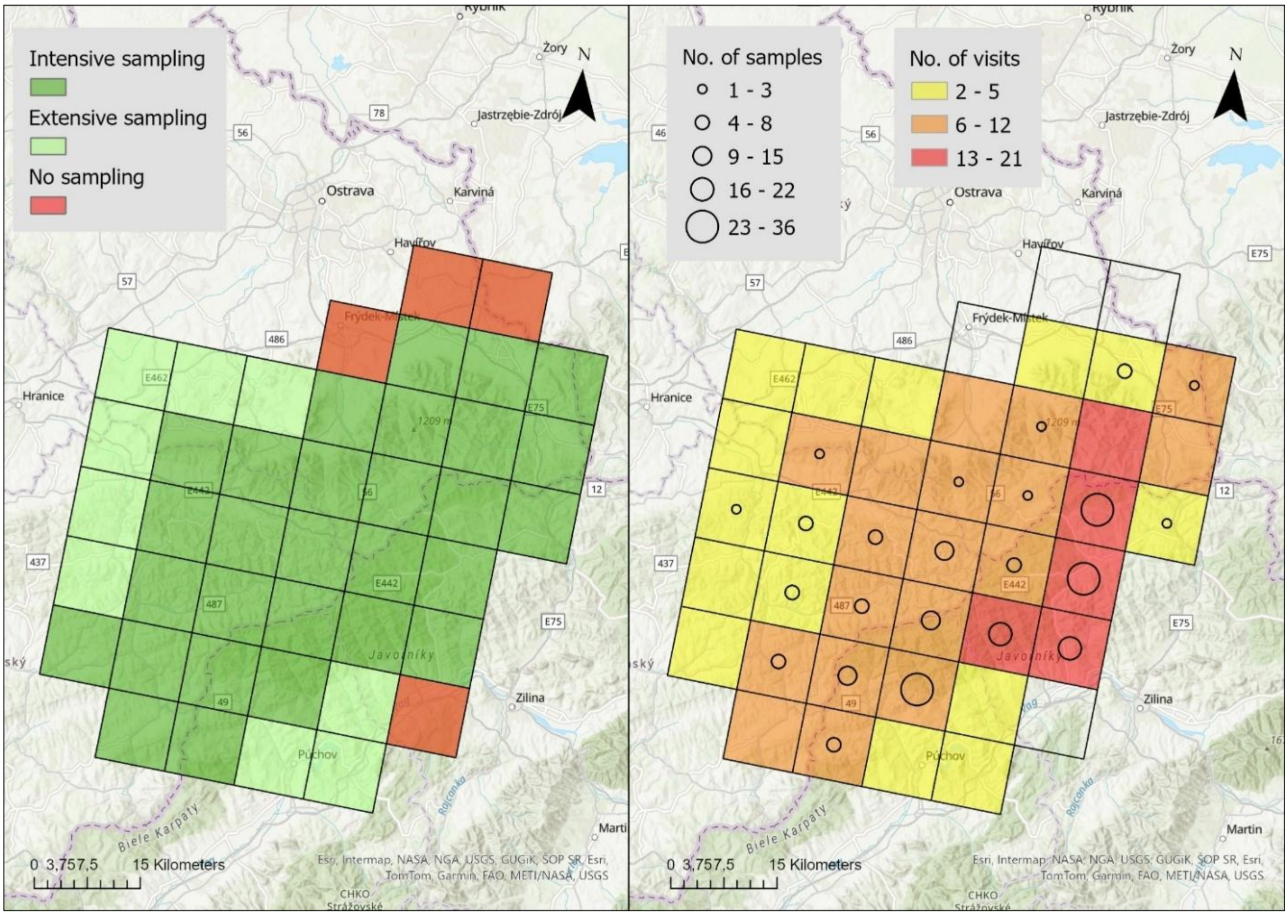

Figure 5: Selected mapping grids with different mapping intensity (left) and monitoring/sampling effort of intensive non-invasive genetic sampling (December 2024-March 2025) visualised at the grid level.

B. Results

Altogether, 274 samples were collected for DNA analysis, including 48 from extensive and 226 from intensive sampling, respectively (Fig.4). Based on the analysis of all collected samples, wolf presence was confirmed in 152 cases. Genotype and sex were successfully determined in 125 samples. DNA from domestic dog (*Canis lupus familiaris*) was detected in two samples, DNA from red fox (*Vulpes vulpes*) in four samples, and DNA isolation was unsuccessful in 116 samples. No evidence of hybrid individuals was detected in any of the analysed samples.

During extensive sampling, 16 unique wolves were identified (9 females and 7 males). During the intensive sampling period (December 2024 – March 2025), wolf presence was confirmed in 125 samples, with genotype and sex determined in 124 samples, resulting in 22 unique male and 20 unique female genotypes (Fig. 6).These results represent 42 unique individuals identified during the intensive sampling period, which provide the basis for subsequent estimates of population size and wolf density in the study area (Fig. 6).

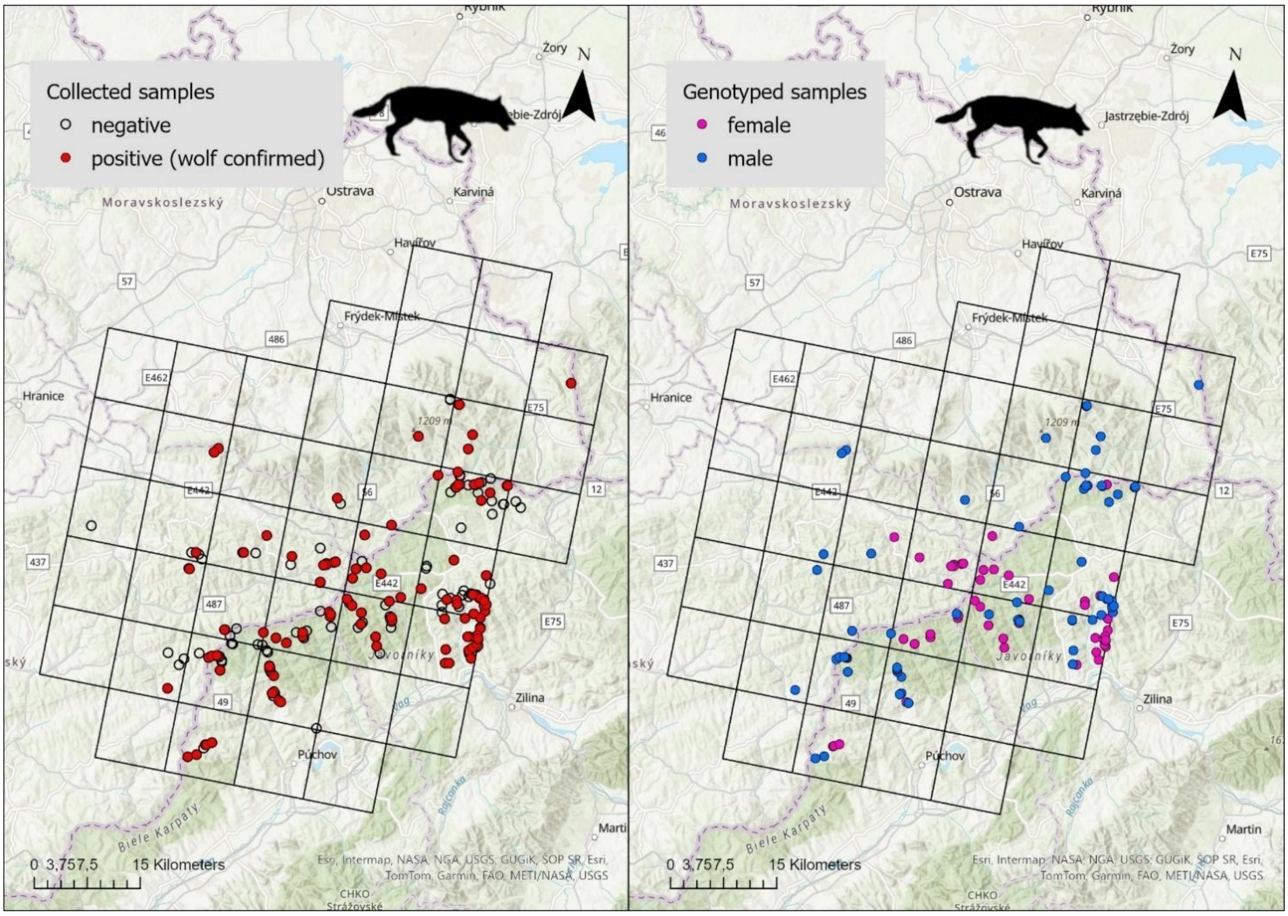

Figure 6: Collected genetic samples during intensive genetic sampling (December 2024 to March 2025) with wolf confirmation (left) and successfully genotyped samples (right).

3.3 GPS Telemetry

A. Monitoring approach, data collection and analyses

The Lead Partner MENDELU carried out four wolf trapping sessions (autumn 2023, spring 2024, autumn 2024, and spring 2025) and SNC SK (PP8) one capture session in spring 2025 to capture and collar wolves for telemetry purposes. These activities were implemented in line with the Detailed Pilot Action Plan for the Beskydy-Kysuce pilot (D.2.1.1) and the approved pilot framework. FoE CZ actively participated in both wolf capture sessions coordinated by MENDELU, contributing to the identification of optimal trapping locations based on intensive field monitoring and camera trap data.

Wolf trapping for telemetry purposes was carried out on the Czech as well as Slovak side of the pilot area, specifically in the Javorníky Mountains (CZ & SK), Vsetín Beskids (CZ), and Moravian-Silesian Beskids (CZ), both along the borders and within several identified wolf territories. Foot snares, "Belisle Foot Snare 8" were used for trapping wolves. Permits for wolf capturing were issued by the Nature Conservation agency of the Czech Republic, the Czech Ministry of the Environment, and the State Nature Conservancy of SK.

A total of five female wolves were fitted with GPS collars on the Czech side of the Beskydy-Kysuce pilot area during implementation of pilot activities. Three females were collared within the LECA project (Hanka, Zuzka, Lucka) and two within the LIFE WILD WOLF project (Taťána, Dana). One female was captured and collared within the project Operational Programme Environment before the start of the LECA project, and this female was actively monitored by GPS telemetry during the first period of LECA implementation (Šárka).

Wolves were fitted with GPS Vertex Plus collars programmed to record locations every two hours, and during periods of intensive prey searches from 6 pm to 9 am every 30 minutes, to increase the likelihood of detecting prey remains at verified GPS clusters.

Location data from GPS collars was obtained automatically from the storage server via the Inventa application, by downloading data through a terminal, or by retrieving data directly from the collar in the field after monitoring ended. The evaluation of spatio-temporal activity (including home range size estimation for resident animals) was carried out in a GIS environment and in R, using various packages and methodological approaches described in recently published studies (e.g., Vorel et al. 2024).

Figure 7: MENDELU trapping team during handling and GPS collaring of wolf female “Zuzka” in the Vsetín Beskids in spring 2024 (left) and the same female shortly after waking up from anaesthesia (right).

B. Results

Spatio-temporal behaviour, feeding patterns and interactions with human activity

Wolf female “Šárka”

The female wolf was the first successfully captured and collared wolf in the Czech Carpathians. The female was captured on 21 October 2022 in the Javorníky Mts. At the estimated age of 2–3 years, she was given the working name “Šárka”. By the end of 2022, the female wolf remained within the home territory of her natal pack, with occasional excursions into the Vsetín Beskids. Genetic analyses confirmed her as the offspring of the breeding pair from the central part of the Javorníky Mts. Camera trap data documented her presence within the natal pack’s territory on multiple occasions, where she most likely contributed to pup rearing during that year.

During the monitoring period, autumn and beginning of winter 2022, using available data (telemetry, field surveys, and reports of depredation incidents from both the Slovak and Czech sides), we recorded one case of livestock depredation of female Šárka on sheep (*Ovis aries*) in the Javorníky Mts. No additional reports of unusual behaviour (such as frequent or conspicuous occurrences near human settlements or public sightings) were documented.

At the turn of the year 2023/22024, the female wolf displayed exploratory behaviour, with signs of dispersal attempts into adjacent mountain ranges and subsequent stabilization of her own territory. During January and February, during the wolf mating season, this assumption of territory establishment was confirmed. Telemetry data and intensive field inspections of kills indicated that the female was accompanied by a male. The pair established a territory in the Czech part of the Javorníky Mts., where the female gave birth to 4 pups in mid-May. The den and core area of this new territory were located only a few kilometres from the core of the natal pack's territory in the Slovak part of the Javorníky Mts.. Without telemetry, reproduction in this locality would almost certainly have gone unnoticed, and any pups detected through camera traps, other field signs, or simulated howling would most likely have been attributed to the Javorníky pack in the central Javorníky Mts., which reproduced at the same time. The rendezvous sites of the Slovak pack were located only approx. 5 km in a straight line from the den of female Šárka.

Figure 8: GPS telemetry monitored wolf female Šárka recorded on a camera-trap in the Vsetín Beskids during the dispersal phase.

During 2023, using available data (telemetry, field surveys, and records of depredation events on both the Slovak and Czech sides), we documented a single damage incident – the predation of an alpaca in the Javorníky Mts. Throughout both winter and part of the summer period, intensive searches for prey remains were conducted. In the winter, within 30 days (20 February – 23 March 2023), 11 freshly killed ungulates were found (9 roe deer *Capreolus capreolus* and 2 red deer *Cervus elaphus*). The female also visited several older carcasses, either previously killed or that had died from other causes (2 roe deer, 1 red deer, 1 discarded sheep). In summer (20 July – 2 August), over just 14 days, she killed another 11 ungulates (7 roe deer and 4 red deer) and visited two additional carcasses from earlier kills (wild boar *Sus scrofa* and red deer). The estimated size of the home range using the AKDE95% method was 451 km^2.

<u>Wolf female "Hana"</u>

Wolf, approx. 2 years old female, as captured and collared in the Javorníky Mts. Shortly after being captured, the female wolf Hana moved to the Makov area, where she spent most of her time. Camera trap data from the area confirmed that she was moving alone, and her activity was concentrated in a region without an established wolf territory. She occasionally visited known territories in the Vsetín Beskids and Javorníky Mts. In December 2023, she began dispersing towards the Vizovické Mts. area, where she soon established a stable territory. Camera traps later recorded her in the company of a male wolf. The last GPS coordinates were obtained in mid-January, and based on this data, it is believed that the female was illegally hunted in that area. Her spatial activity covered the mountain ranges of the Javorníky Mts., Vsetín Beskids, and Vizovické Mts. (Fig. 12).

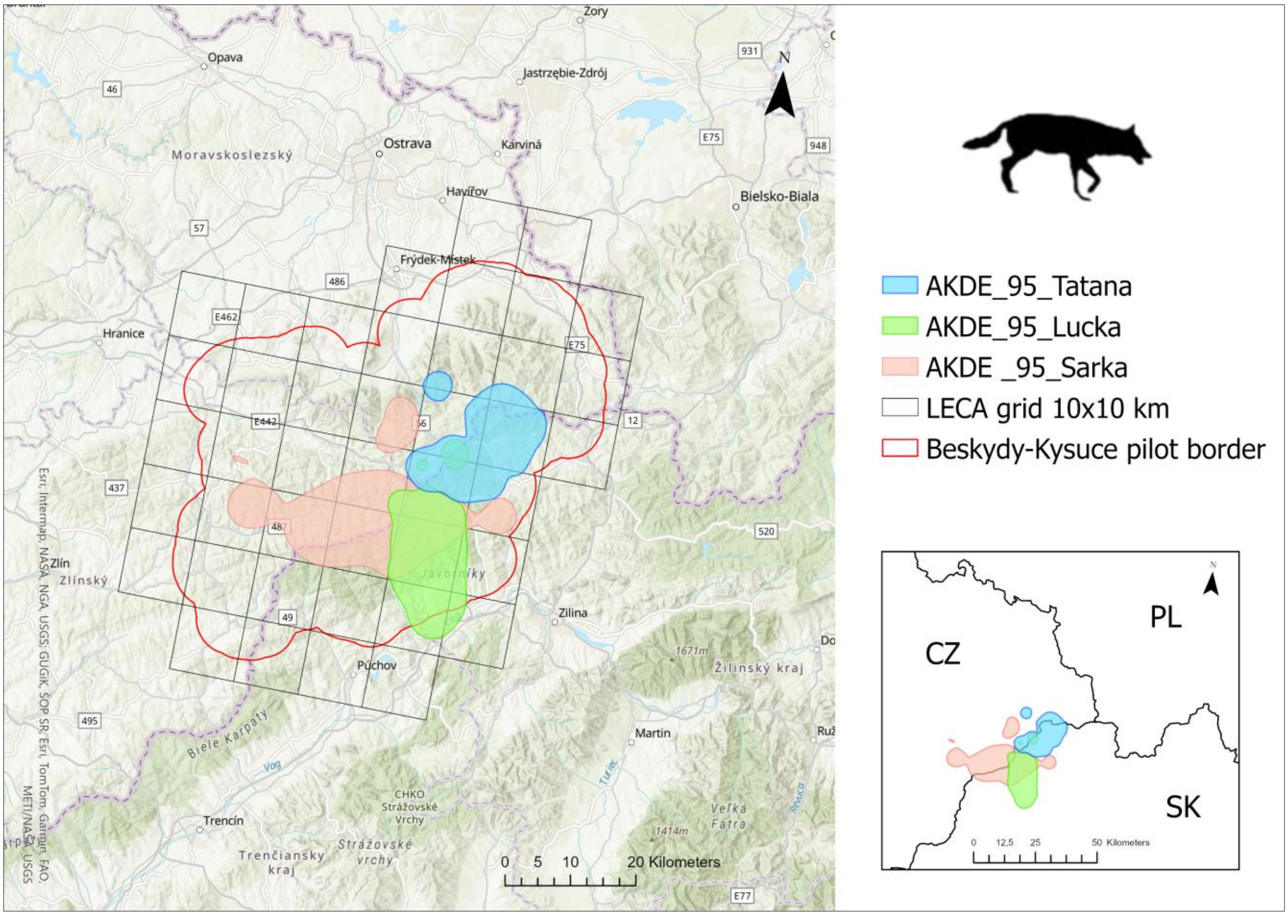

Figure 9: Spatial activity and estimation of home range of three resident wolf females by 95% autocorrelated kernel density estimation (AKDE95%).

<u>Wolf female "Zuzka"</u>

The female wolf, given the working name "Zuzka", was captured and collared in the Vsetín Beskids in spring 2024. At the time of capture, she was less than one year old. Subsequent genetic analyses confirmed that she was the offspring of the telemetrically monitored female wolf Šárka from 2023, which had reproduced in the Javorníky Mts. Within the pilot area, Zuzka ranged over a large area (739 km² by AKDE95%), with her core activity located in the eastern part of the Vsetín Beskids and in the areas of Makov in the Javorníky Mts. and the Turzovská Highlands (Fig. 12). After the disappearance of her natal pack, she exhibited exploratory behaviour and moved across and along the boundaries of established wolf territories in the region.

At the beginning of summer 2024, in the Raková area, telemetry data and field inspections (camera traps, Fig. 10) revealed an injury to her right hind leg (likely a gunshot wound), which caused serious impairment and limited mobility. In the following weeks, her movements became restricted compared to her previous activity. Field investigations of GPS clusters showed that she was no longer capable of active hunting but survived by scavenging carcasses of ungulates that had died naturally, remains of prey killed by other wolves or lynxes, discarded parts of game left after hunting, and carrion from feeding sites. Despite her handicap, she adapted and continued to use this strategy through the winter, gradually improving her condition. During intensive prey searches in January and February 2025, we located seven different ungulate carcasses on which she fed intensively, consuming even the bones (four red deer and three roe deer). Nevertheless, she was never observed hunting actively and remained solitary throughout the monitoring period.

Before sustaining the injury, Zuzka had caused three livestock depredation events: killing two lambs in Setechov in the Javorníky Mts., and five sheep at two different farms in Turzovka. Despite her handicap, no further damages to livestock or close encounters with people seeking easy food sources were recorded. She was monitored until 15 April 2025, when contact with her collar was lost in the Makov area. Since she was not subsequently recorded by camera traps at any monitored sites, it is assumed that she was illegally killed.

Figure 10: Wolf female Zuzka with a serious handicap, which caused poor body condition and one of the red deer remains (most probably prey of other wolves or naturally dead) that Zuzka was using as a source of food for a couple of weeks, as she was unable to hunt actively.

Wolf female „Lucka”

During the autumn capture session in October 2024, a female wolf named Lucka was captured in the Javorníky Mts. At the time of capture, she was estimated to be 2–3 years old. Shortly after, camera trap records and subsequent genetic confirmation revealed that she had formed a pair with a male wolf that had previously been part of the reproductive pair in the Javorníky Mts., where the first reproduction had been documented in 2019. Together, Lucka and the male established a stable territory in the eastern part of the Western Javorníky Mts., bordered by Makov and the Czech border to the north and the Váh River canal to the south.

Figure 11: Wolf female Lucka recorded on camera-trap in the core area of its territory (left) and female Dana in her dispersal phase captured on camera-trap in the Silesian Beskids.

Based on telemetry data and camera-trap monitoring, reproduction was confirmed in the monitored pair. However, subsequent field evidence indicated that the pair most likely lost their pups due to predation by a red fox. According to telemetry data by the end of May 2025, the territory covered an area of 248 km² (AKDE95%; Fig. 9). During intensive prey searches in the winter period (January–February 2025), this pair was found to prefer hunting roe deer (6 individuals) and red deer (7 individuals), mainly females and juveniles. In one case, a wild boar was also detected among the kills, along with a stray Cameroon ram roaming freely in the area. The female wolf is still being monitored by telemetry.

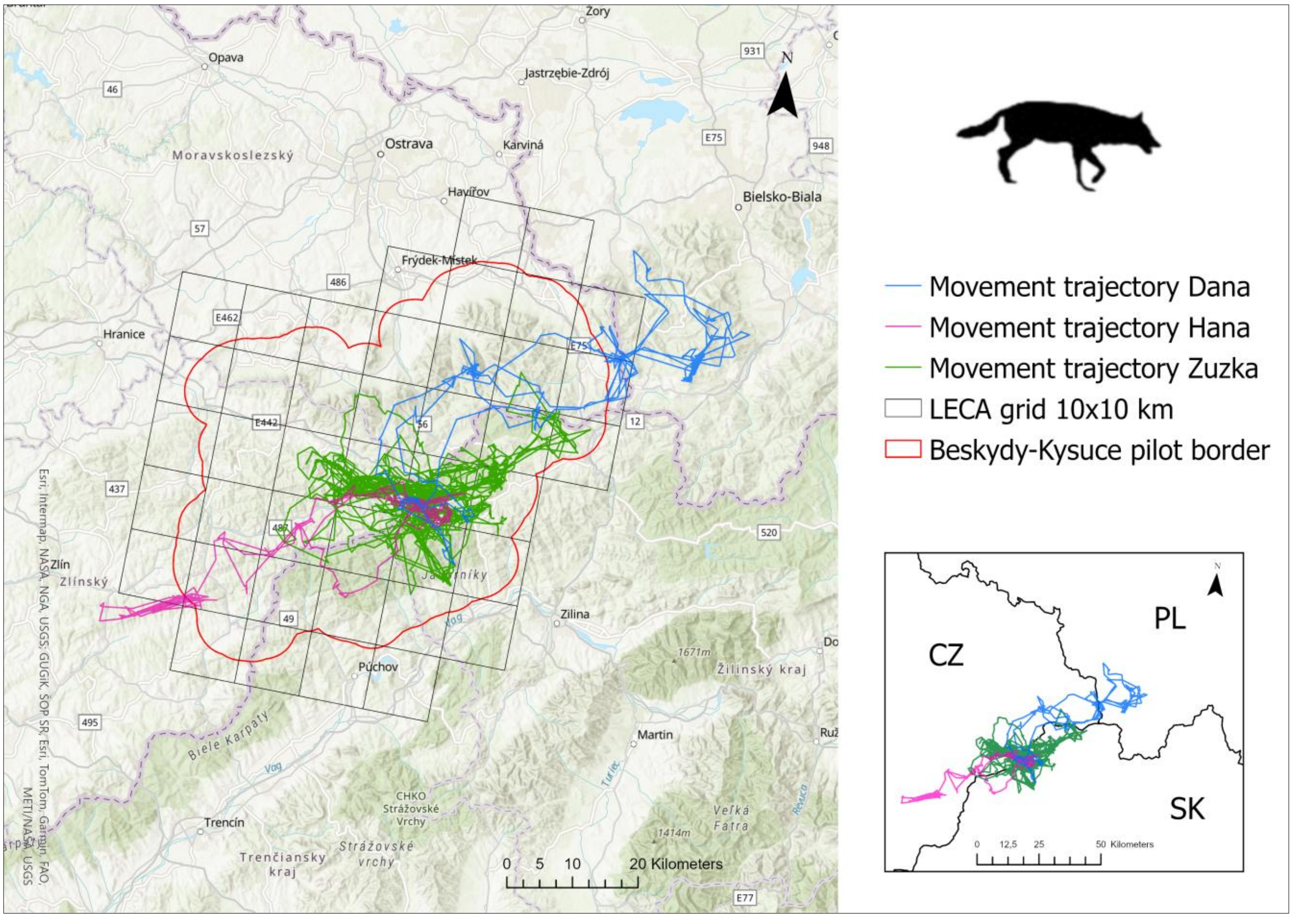

Figure 12: Movement trajectories of three GPS-monitored wolf females with exploratory/dispersing status.

<u>Wolf female „Taťána"</u>

The female wolf was captured in March 2025 in the Moravian-Silesian Beskids near Bílá. Based on initial biometric measurements and collaring, she was identified as an adult, reproducing female, which was later confirmed by telemetry and genetic data. She was given the working name "Taťána" and is part of the breeding pair occupying a territory in the northeastern Moravian-Silesian Beskids and the Turzovská Highlands. A few weeks after capture, she gave birth, which was confirmed by movements from telemetry data and later also by data from camera-traps, where pups were recorded.

Together with the male, older offspring and this year's pups, she ranged over an extensive area that by the end of May 2025 covered approximately 246 km² (AKDE95%; Fig. 9). However, according to the most recent telemetry and genetic data (August 2025), the size of this pack's territory is estimated to be about twice as large with the core of the pack's territory located directly on the Czech-Slovak border. The female wolf is still being monitored by telemetry.

Figure 13: Remains (wild boar and red deer calf) of prey killed by wolf female Lucka found during intensive checking clusters during winter 2025.

Wolf female „Dana"

The day after the capture of the female wolf Taťána, another female named Dana was captured in the Javorníky Mts. Biometric measurements indicated that she was a young female, estimated to be a maximum of 2 years old. The first telemetry data confirmed her status as a dispersing animal searching for its own territory. By the end of May, she had moved across a wide area and crossed the Jablunkovská Brázda several times, demonstrating the permeability of this corridor despite several significant migration barriers (Fig. 12). Genetic analyses did not confirm her kinship with any of the resident packs or pairs within the Beskydy-Kysuce pilot area, suggesting that she may be the offspring of a wolf pair or pack inhabiting the Silesian Beskids in Poland. As we can see, wolves roam across vast areas spanning several countries, unaffected by state borders and capable of overcoming numerous obstacles. A clear example is the female wolf Dana, which continues to be actively monitored.

3.4 Synthesis of the main results

3.4.1 Status & distribution/occurrence maps: Wolf

A. SCALP map

According to the SCALP methodology (Molinari-Jobin et al. 2012a,b; Kaczensky et al. 2024), wolf presence was confirmed in 28 mapping grids (67% of all grids) during the 2023/24 wolf year, with C1 evidence (camera trap records, telemetry data, or confirmed genetic samples) documented in all of them. In 2024/25, the number of grids with confirmed C1 signs increased to 30 (71% of all grids). In addition, wolf presence was recorded in two further grids: one based on C2 evidence and another on C3 evidence, respectively (Figure 14).

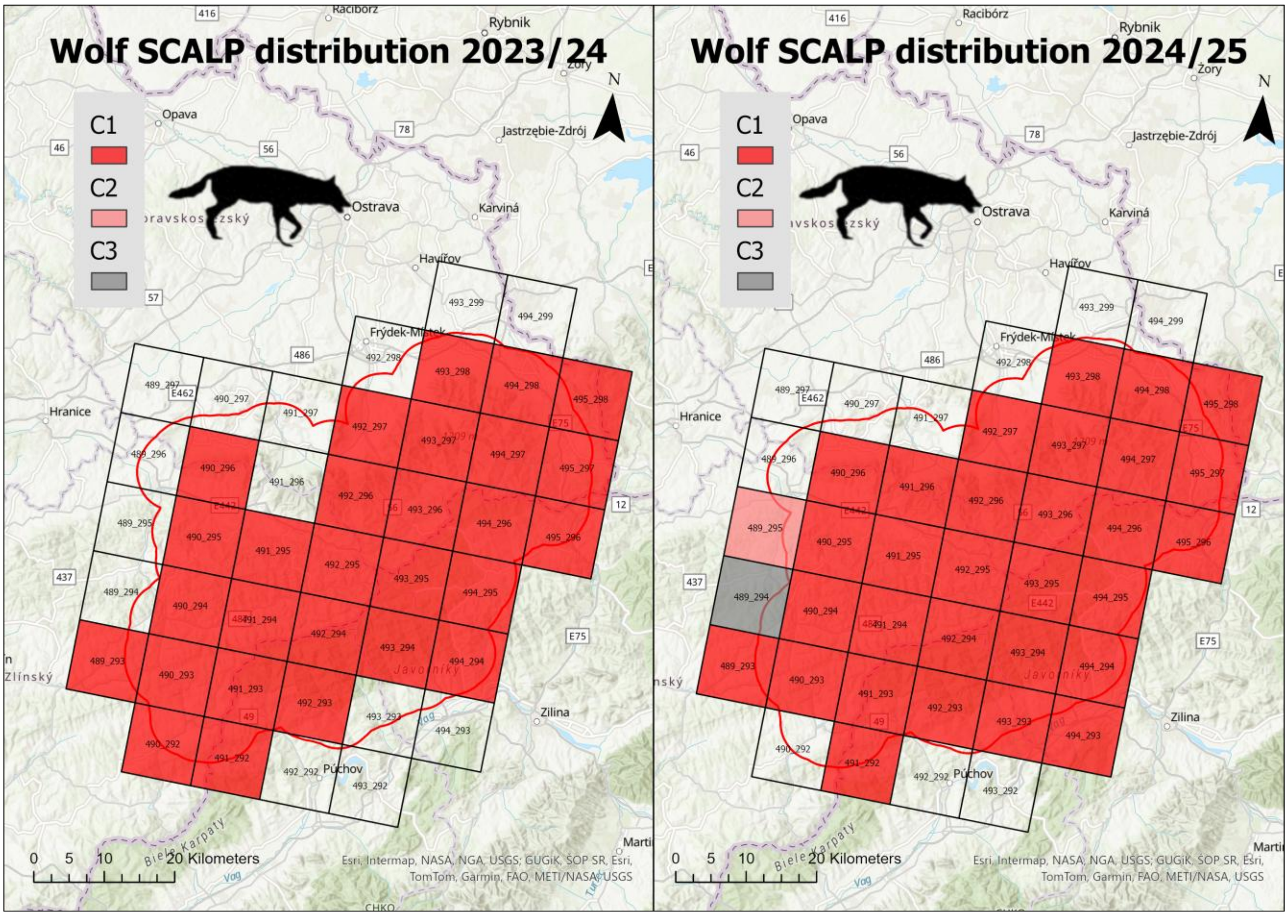

Figure 14: Wolf distribution based on data (C1–C3) validated according to the SCALP methodology at the EEA 10×10 km grid level in the two consecutive wolf years (2023/24, 2024/25).

B. Occurrence map

Wolf occurrence was confirmed in 28 (67% of all grids) mapping grids in the wolf year 2023/24 and in 31 mapping grids (74%) in the wolf year 2024/25. Confirmed presence in these grids was based only on C1 and C2 data (i. e., camera trap records, telemetry, genetics, scats, etc.) following the methodology reported in Kaczensky et al. (2024).

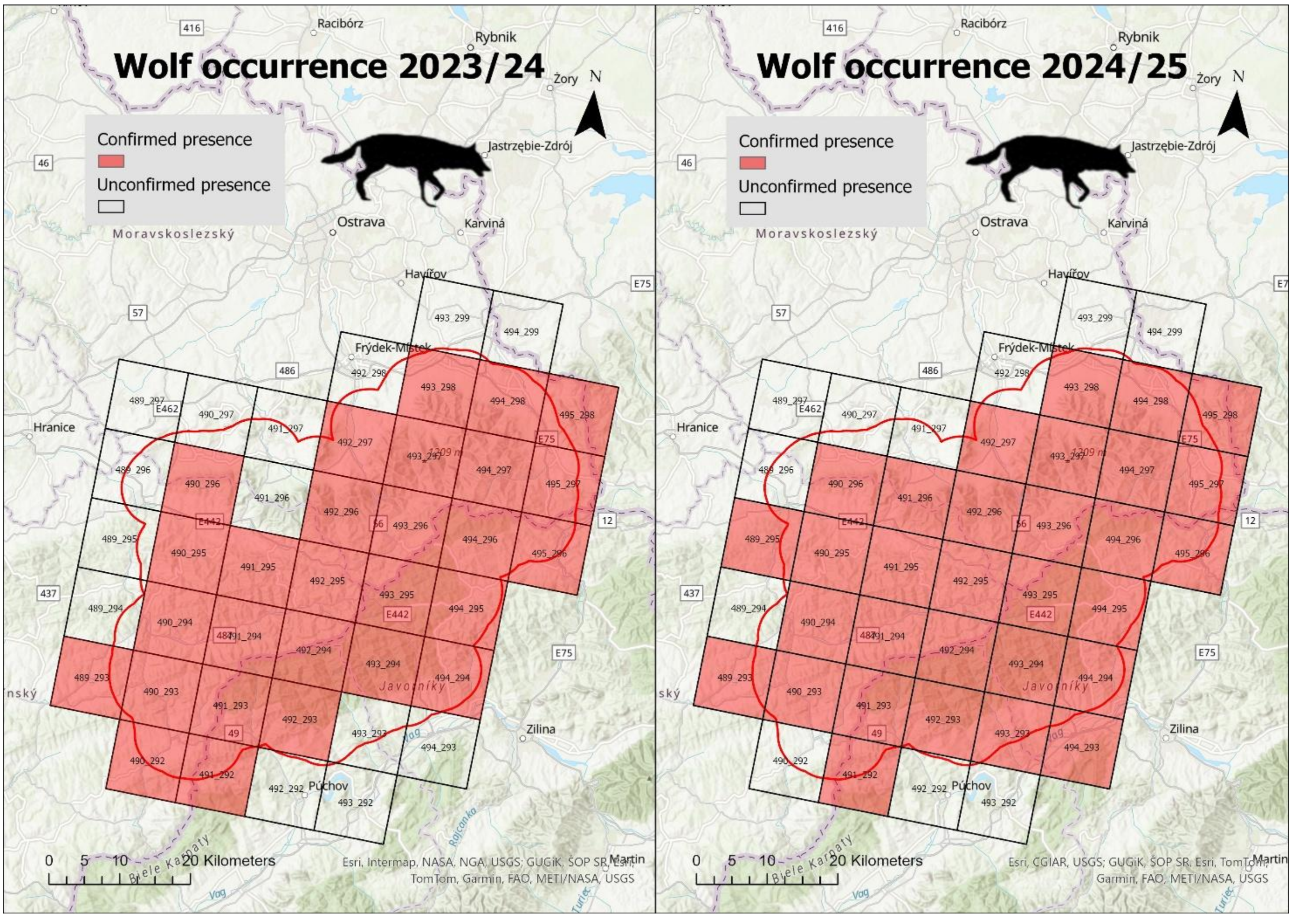

Figure 15: Confirmed wolf presence based on SCALP data (C1 & C2) at the EEA 10×10 km grid level in the wolf years 2023/24 and 2024/25.

C. Distribution maps of wolf territories & reproduction units

By integrating data from telemetry, camera trapping, snow tracking, genetic sampling, and howling sessions, within the pilot area, we preliminarily identified 9 distinct wolf territories (6 territories occupied by wolf packs with confirmed reproduction and 3 territories occupied by wolf pairs) in the wolf year 2023/24 and 10 distinct wolf territories in the wolf year 2024/25 (4 territories occupied by wolf packs with confirmed reproduction and 6 territories occupied by wolf pairs; Fig. 16).

From a long-term perspective, since 2017 when wolves began to recolonize the Czech–Slovak border region (with the first reproduction documented in 2019), the number and distribution of territories and reproductive units fluctuate both temporally and spatially, reflecting a highly dynamic system (Fig. 18). This finding is particularly important for national-level population reporting and for wolf management in both countries, especially in transboundary areas.

D. Estimation of population size and density

By integrating data from telemetry, camera trapping, and snow tracking, 47 wolves were documented in winter WY 2023/24 (26 pups in summer) in an area approx. 1920 km^2 (area permanently occupied by pack and pair with average size of the territory 214.3 km^2 according to Vorel et al., 2024) and 36 wolves documented in winter WY 2024/25 (19 pups in summer) in an area approx. 2133 km^2. Based on non-invasive genetic sampling, 42 unique individuals were identified in the wolf year 2024/25 (sampling area 3800 km^2).

More precise population size and density will be estimated through spatial and non-spatial capture-recapture models.

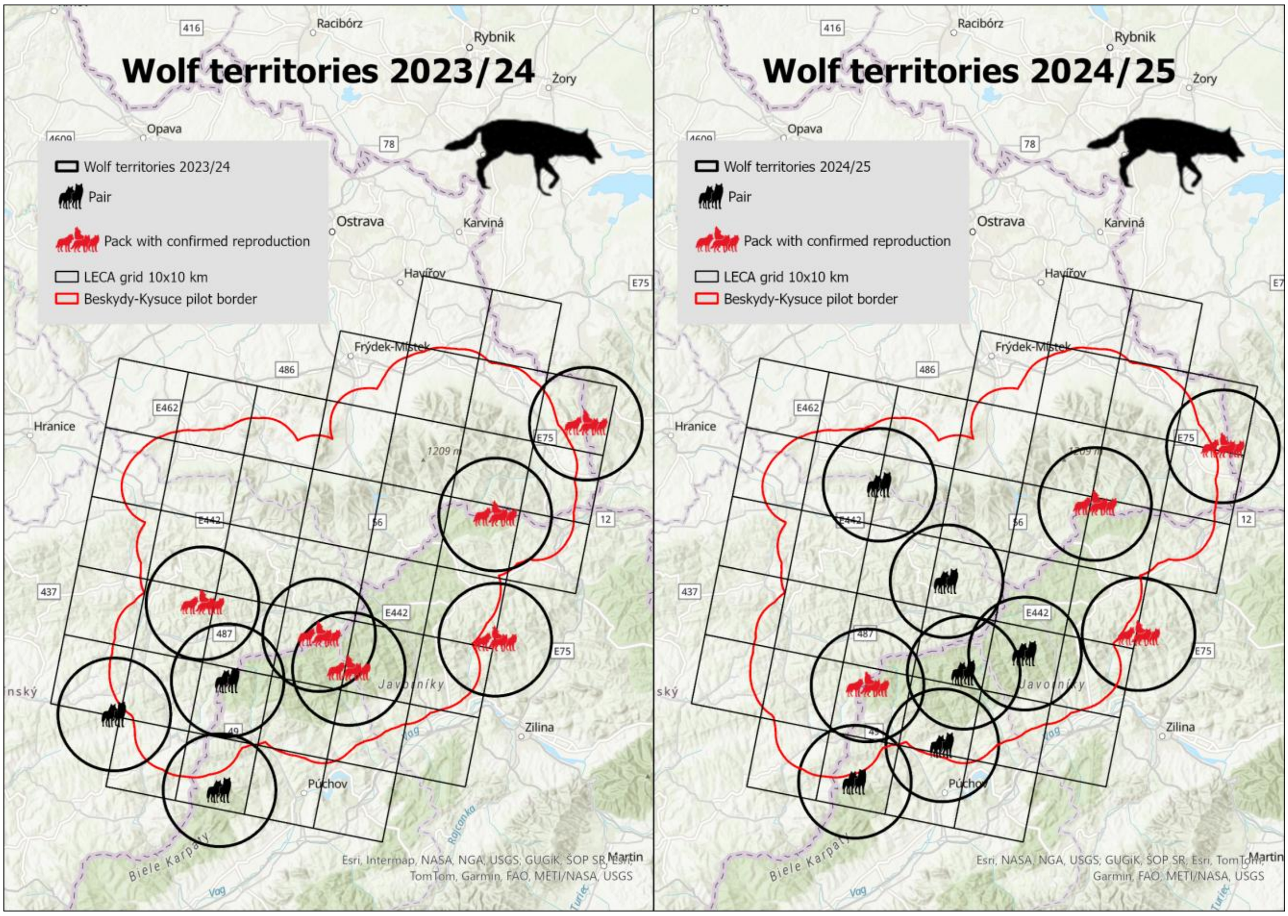

Figure 16: Distribution of wolves' territories and reproduction units documented in two wolf years in the cross-border area Beskydy-Kysuce by a combination of various methods (camera-traps, snow tracking, genetic, telemetry, howling sessions, etc.) following the approach reported by Marucco et al. (2023b). Circles represent one territory (pair, pack, pack with confirmed reproduction) and their size (approx. 214 km^2) refers to the average size of wolf territory in Central Europe known from GPS telemetry reported by Vorel et al. (2024).

Figure 17: Two different wolf individuals from a breeding pair captured on camera traps installed within their core areas.

The average pack size during the winter period across both wolf years was 7 (±1.2) individuals, with an average of 4.5 pups per pack (±0.9). Population density was estimated in areas occupied by a pack based on the average size of home ranges in Central Europe (Vorel et al. 2024) and data from our study (9 observations from 7 packs). To obtain a robust estimate, 10,000 Monte Carlo simulations were performed using the mean pack size per wolf pack (n=7) combined with known territory sizes (n=16) in study Vorel et al. (2024) to calculate average wolf density with 95% confidence intervals. All analyses were conducted in R using the dplyr package. Estimated population density for both wolf years was 5.01 (±1.21) individuals per 100 km² (95% CI: 2.92–7.69).

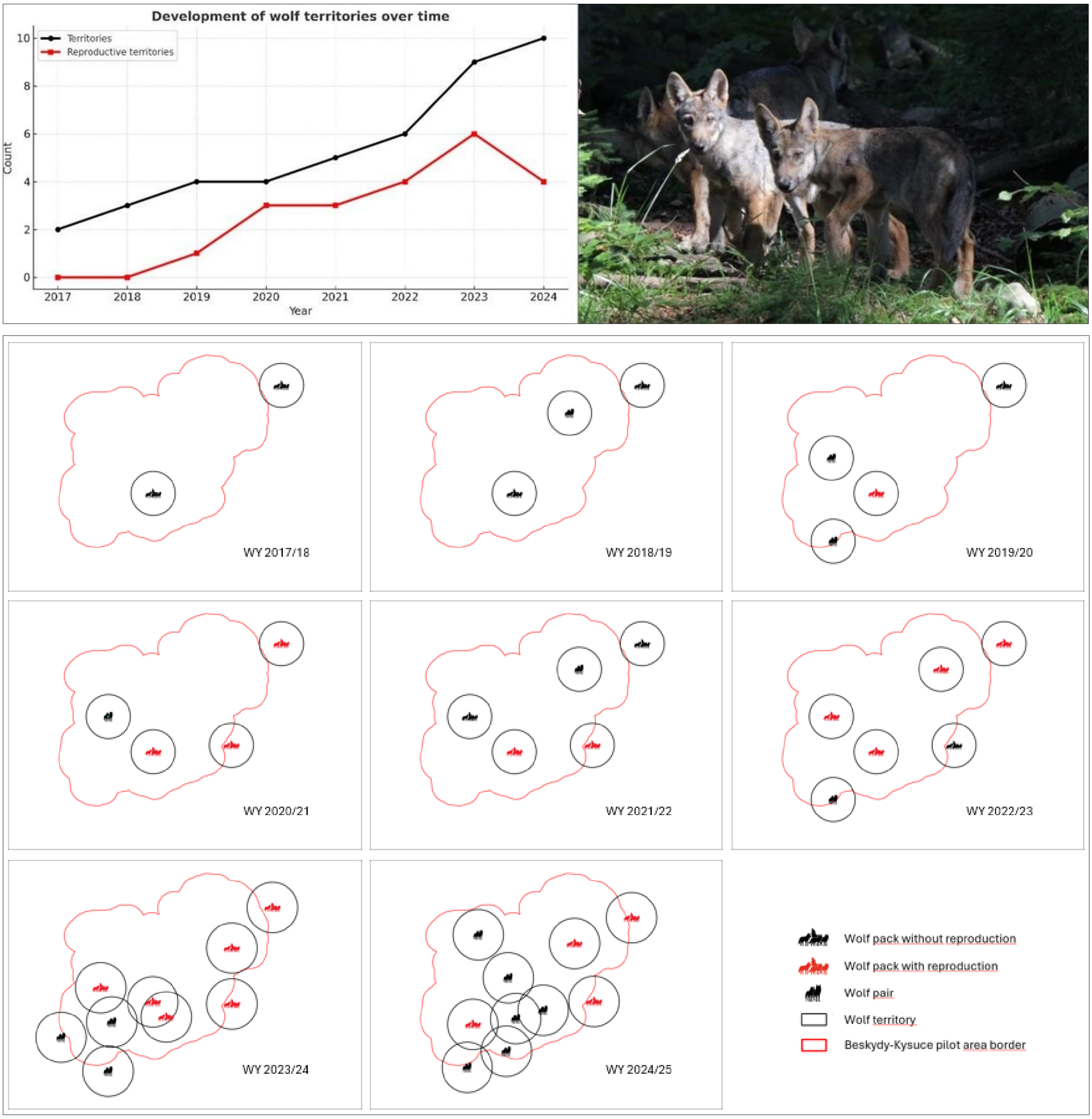

Figure 18: The development of wolf territories in the Beskydy-Kysuce cross-border area. Since 2017, the number of wolf territories has increased steadily, while the number of reproductive territories has also grown but with year-to-year fluctuations, peaking in 2023 and slightly declining in 2024. These trends reflect a gradual expansion and highlight the highly dynamic system.

3.4.2 Status & Distribution/occurrence maps: Lynx

A. SCALP map

According to the SCALP methodology (Molinari-Jobin et al. 2012a,b; https://www.kora.ch/en/kora/scalp), lynx presence was confirmed in 20 mapping grids (48% of all grids) and reproduction in 6 grids (14% of all grids) in the 2023/24 lynx year. In 2024/25, the number of grids with confirmed C1 reproduction increased to 9 (33% of all grids), and overall presence by various SCALP signs was confirmed in 29 grids (69% of all grids).

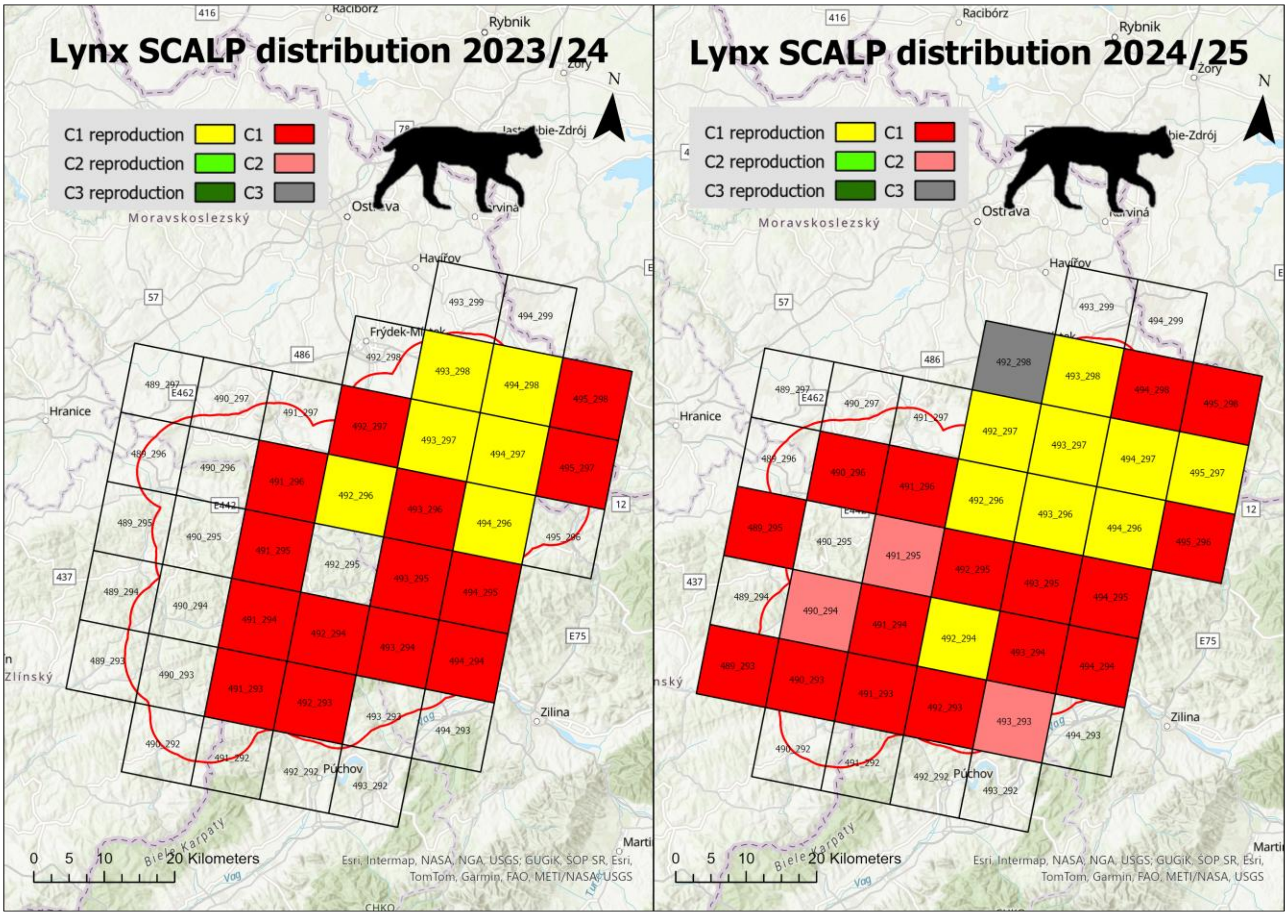

Figure 19: Lynx distribution based on data (C1–C3) validated according to the SCALP methodology at the EEA 10×10 km grid level in two consecutive lynx years (2023/24, 2024/25).

Based on extensive camera-trap monitoring, a total of 14 different individual Eurasian lynx were identified in the Beskydy–Kysuce pilot area over two consecutive lynx years. This included 6 males and 6 females in 2023/24, and 8 males and 6 females in 2024/25. Reproduction was confirmed in both lynx years, with a total of 5 different breeding females (2 females in the first and five in the second lynx year, respectively).

B. Occurrence map

Lynx occurrence was confirmed in 20 (48% of all grids) mapping grids in 2023/24 and in 28 grids (67%) in the 2024/25 lynx year (Fig. 20). Confirmed presence was based only on C1 and C2 data following the methodology by Kaczensky et al. (2024).

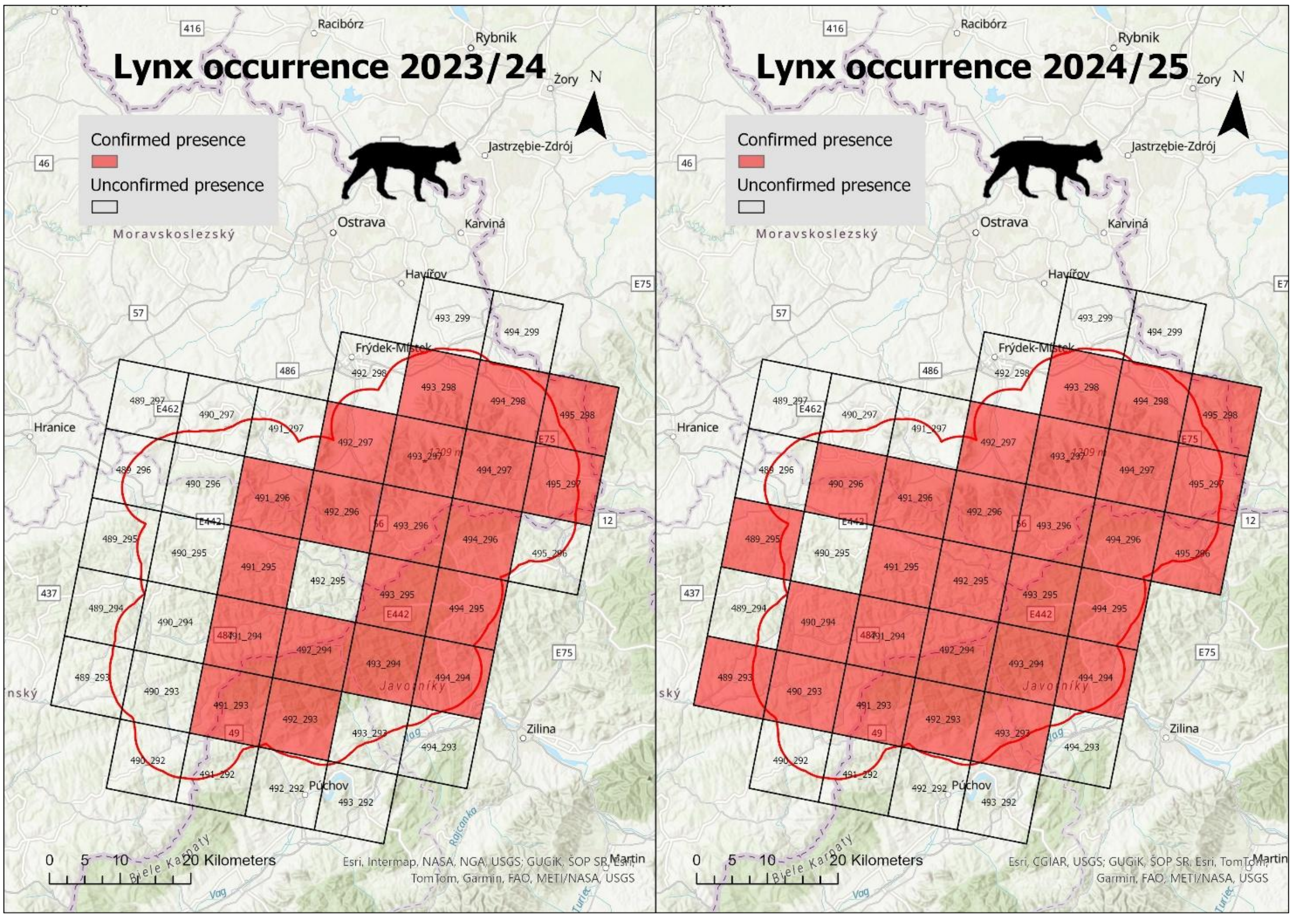

Figure 20: Confirmed lynx presence based on SCALP data (C1 & C2) at the EEA 10×10 km grid level in lynx years 2023/24 and 2024/25.

Figure 21: Lynx female Gabriela with one of her kittens recorded by camera-trap in the Moravian-Silesian Beskids (left) and female Žakelína monitored by GPS telemetry recorded by camera-trap in the Javorníky Mts.

3.4.3 Status & Distribution/occurrence maps: Bear

A. SCALP map

Bear presence by validated C1 records (camera-trap pictures) was confirmed in 3 mapping grids (7% of all grids) in the year 2023 and in 9 grids (21%of all grids) in the year 2024 (Fig. 22).

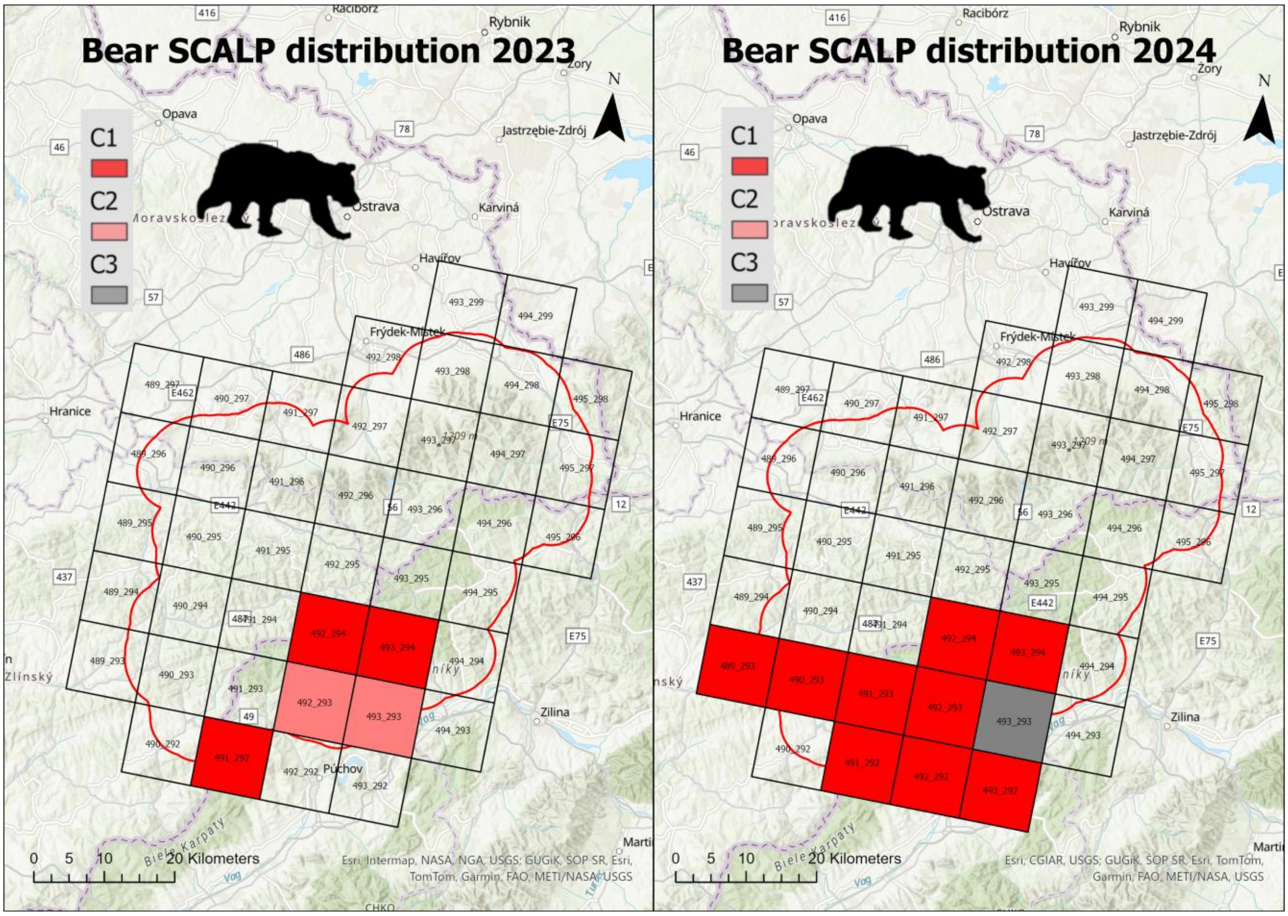

Figure 22: Bear distribution based on data (C1–C3) validated according to the SCALP methodology at the EEA 10×10 km grid level in years 2023 and 2024.

In the Beskydy-Kysuce pilot, by using non-invasive data (camera-traps or other signs of presence such as footprints), at minimum three different bear individuals were recorded in both years. In 2023, reproduction was also confirmed, where a female with two cubs were recorded on camera traps in the Slovak part of the Javorníky Mts.

B. Occurrence map

Bear presence was confirmed in 5 mapping grids (12% of all grids) in the year 2023 and in 9 mapping grids (21%) in the year 2024 (Fig. 23). Confirmed presence was based only on C1 and C2 signs of presence (i. e., camera trap records, tracks, scats etc.) following the methodology by Kaczensky et al. (2024).

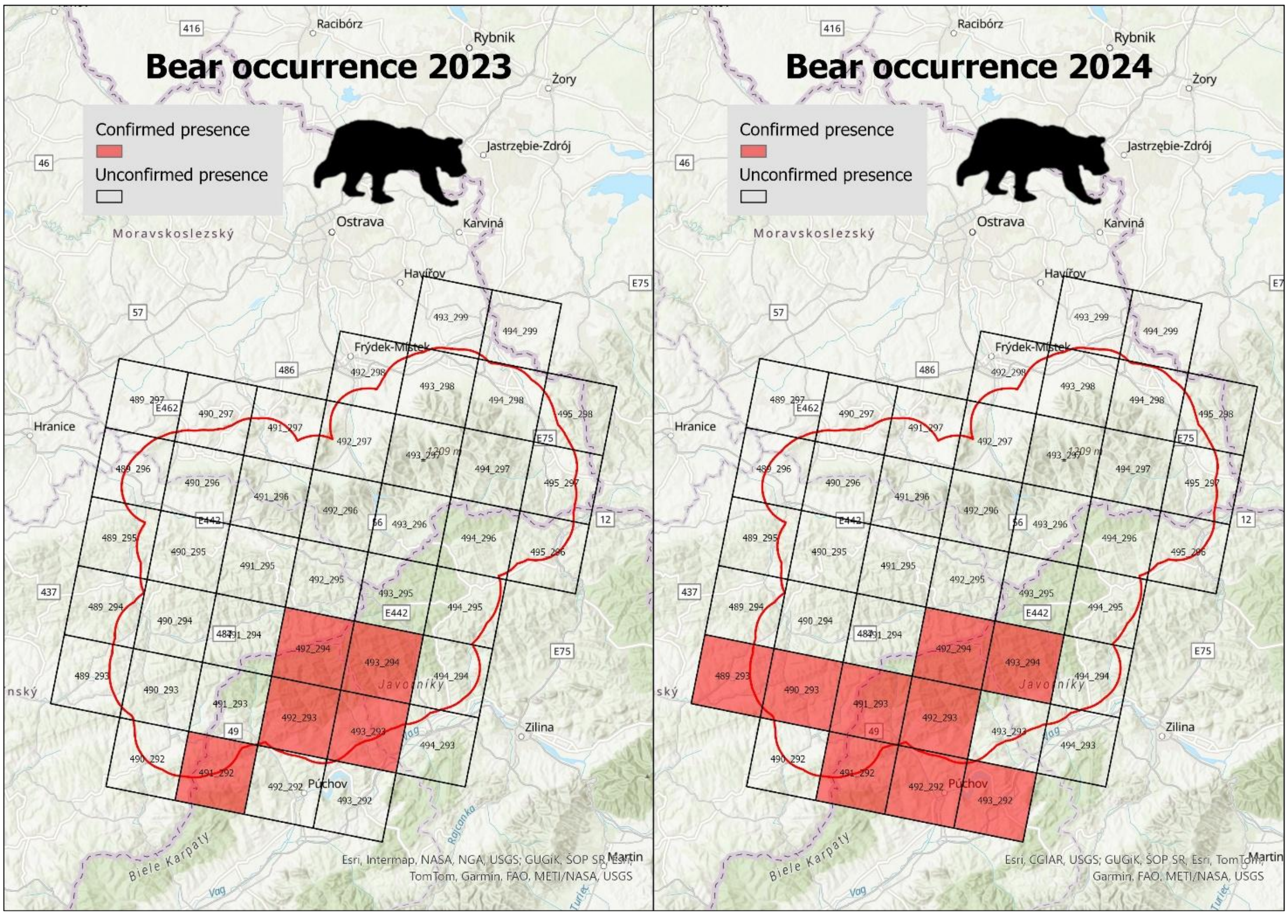

Figure 23: Confirmed bear presence (C1&C2 data) in the Beskydy-Kysuce pilot area in two consecutive years (2023, 2024).

Figure 24: Bear individuals recorded by camera-traps in the Javorníky Mts.

4. Pilot activities: Conflict prevention

4.1 Monitoring/identification of livestocok damages & attractants

A. Methods, data collection and analyses

For the effective mitigation of conflicts between the return of wolves and human activities, particularly livestock farming, it is essential to have detailed data on livestock damages and to identify areas or specific localities with frequent attacks. The number of attacks and hot spots was evaluated over two consecutive wolf years as well as a longer period (wolf years 2017-2024) based on available data from the Nature Conservancy of the Czech Republic, regional offices, and the State Nature Conservancy of the Slovak republic, at the level of cadastral units within the pilot area in both the Czech Republic and Slovakia. In the second wolf year (2024/25), data on damage incidents were available only up to the end of the year 2024.

B. Results

In total, we documented 140 wolf attacks in the two consecutive wolf years (2023/24, 2024/25) in the Beskydy-Kysuce area, where the majority of attacks (88%) occurred in the Czech side of the pilot area (Fig. 25).

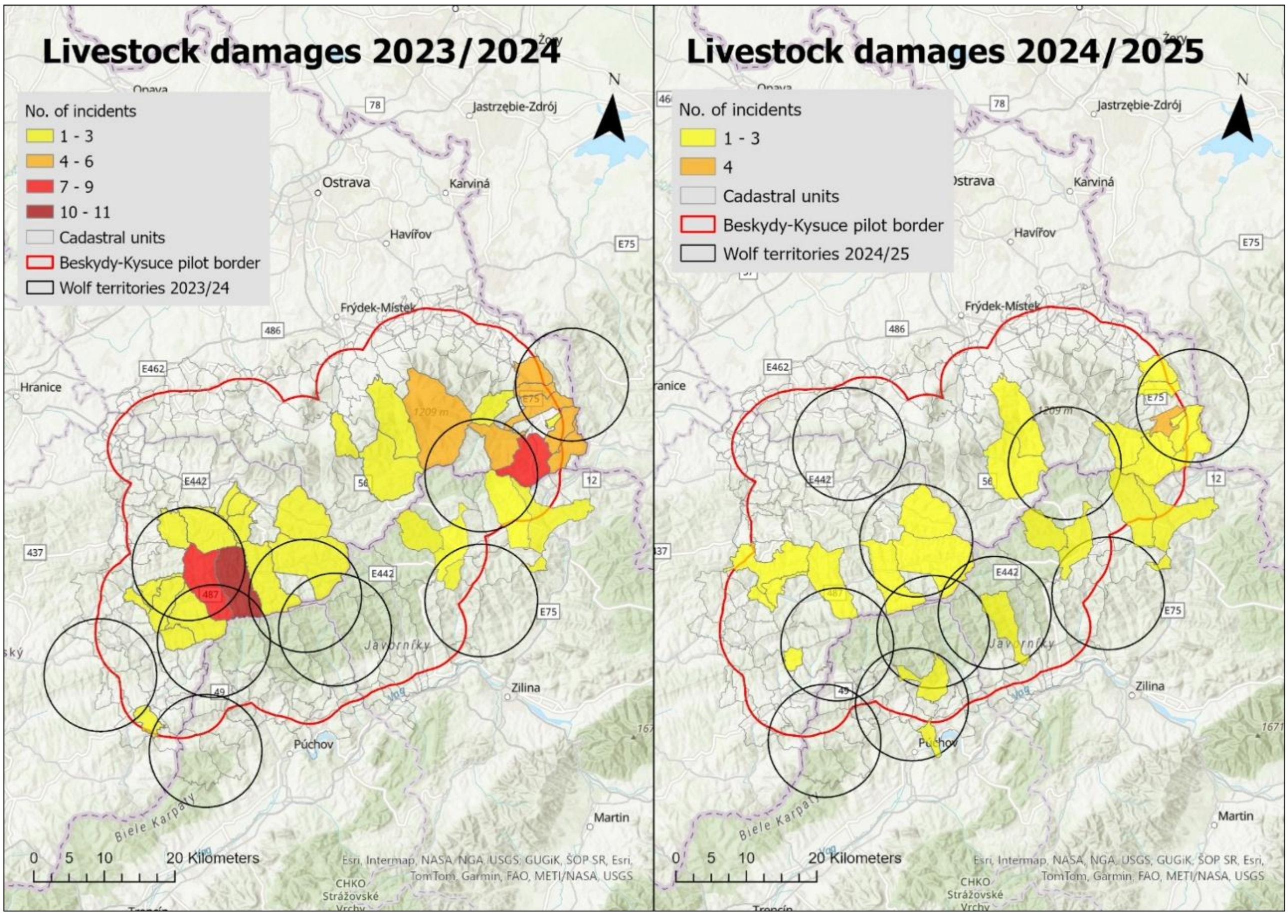

Figure 25: Distribution and number of wolf attacks in the Beskydy-Kysuce pilot area in the two consecutive wolf years (2023/24 and 2024/25), scaled at the cadastral units level.

In the first wolf year, we recorded a total of 100 wolf attacks, concentrated in areas of intensive grazing within the pilot region: the Silesian Beskids, the Jablunkovské mezihoří area, and the Vsetínská Bečva valley located between the Javorníky Mts. and Vsetín Beskids. The highest damages were documented in three territories where reproduction was also recorded during the same wolf year: the territory in the Vsetín Beskids, and the territories in the Moravian-Silesian and Silesian Beskids.

In the second wolf year, despite the absence of data from spring 2025 (according to non-official information, wolf attacks were at a very low level), we recorded 40 wolf attacks in total, which represent a marked decrease in depredation events compared to the previous wolf year (100 attacks in 2023/24 vs. 40 attacks in 2024/25). The decline was most pronounced in the Silesian Beskids, despite confirmed reproduction in the area. Based on available non-invasive monitoring data (camera trapping, genetics), a change occurred in the breeding pair, which may have influenced a shift in feeding behaviour with respect to livestock predation. The decline in damages in the Vsetínská Bečva valley may be linked to the disappearance of the pack in the Vsetín Beskids following the loss of the breeding male, as well as the disappearance of the pack in the Javorníky Mts., where reproduction was subsequently absent.

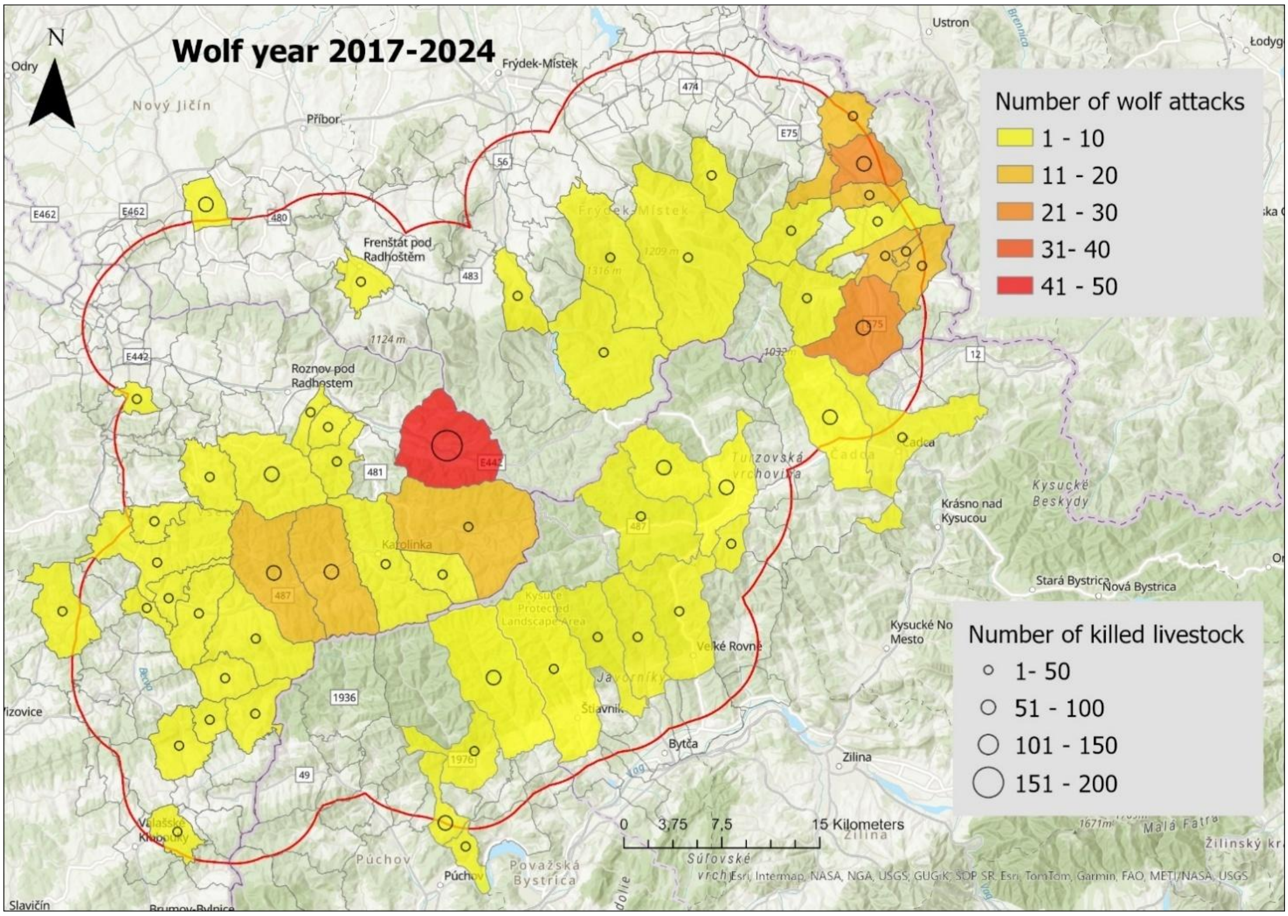

Figure 26: Distribution and number of wolf attacks as well as number of killed livestock in the Beskydy-Kysuce pilot area over eight consecutive wolf years following the establishment and development of the wolf population (2017/18 to 2024/25), scaled at the cadastral units level.

From a long-term perspective, over the eight wolf years (2017–2024), which reflects the development of the wolf population along the Czech–Slovak border, we recorded 452 depredation events and 1610 livestock killed (Fig. 26). As much as 93% of wolf attacks occurred on the Czech side of the pilot area, with sheep representing the majority of the animals killed. The highest numbers of wolf attacks and livestock losses were recorded in the cadastral territories of Horní Bečva, Nýdek, and Bukovec u Jablunkova, which together accounted for 27% of all attacks and 28% of all livestock killed on the Czech side of the pilot area. On the Slovak side, most incidents occurred in the cadastral territories of Korňa, Raková, and Turzovka, representing 52% of all attacks and 60% of all livestock losses recorded in Slovakia. This was the result of a long-standing lack of adequate protection measures by local sheep farmers in the area, despite repeated wolf attacks. Several hundred sheep grazed in electric fences of insufficient height or other standardized parameters against attacks, and the absence of preventive measures, such as livestock guarding dogs.

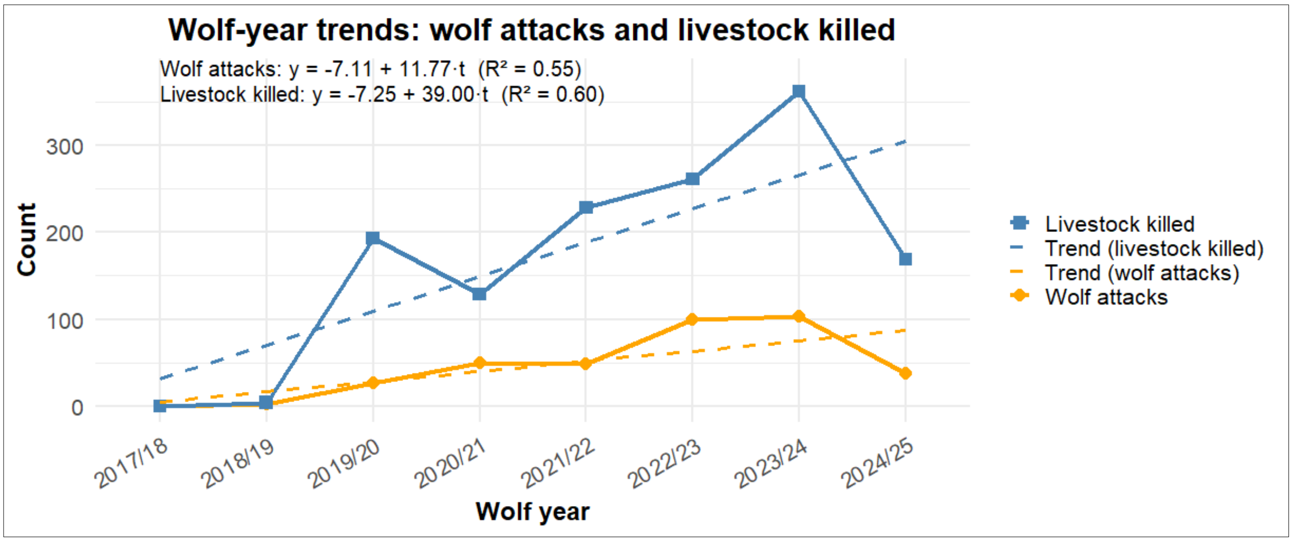

Figure 27: Annual number of wolf attacks (orange line) and livestock killed (blue line) in the wolf years 2017/18–2024/25. Dashed lines show linear trend lines with corresponding regression equations and coefficients of determination (R^2).

Other hot spots of wolf attacks were identified in the Vsetínská Bečva valley, the Silesian Beskids, and the Jablunkovské mezihoří area, where most incidents also occurred at inadequately protected livestock grazing pastures. Both the number of wolf attacks and livestock killed show a clear long-term increasing trend, although with notable year-to-year fluctuations. Losses of livestock have grown more steeply than the number of attacks, suggesting that individual wolf attacks increasingly involve higher numbers of animals due to the surplus killing effect. The last wolf year (2024/25) shows a decline compared to the peak in 2023/24. The observed pattern may reflect a short-term fluctuation or a gradual decline in the overall trend due to the improvement and implementation of more effective preventive measures. Nevertheless, a longer temporal dataset and more robust analytical approaches are required to confirm this interpretation.

Figure 28. Sheep killed by GPS telemetry wolf female Lucka at an insufficiently protected pasture in the Javorníky Mts. (left; source: V.Trulík) and Slovak cuvach as an effective combination with high electric netting in the Silesian Beskids to prevent damages from wolves (right).

4.2 Data collection and assesment of attitudes of sheep farmers towards large carnivores

A. Methods, data collection and analyses

Attacks on livestock by large carnivores represent the most fundamental conflict in the coexistence of large carnivores and humans in a human-dominated landscape. The attitudes of sheep farmers are therefore crucial for mitigating this conflict in rural areas, where the grazing of animals is also an important means of maintaining the landscape and conserving biodiversity. The Czech Carpathians have been gradually recolonised by all three species of large carnivore since the mid-20th century, but wolves have only fully recovered in recent years. Therefore, it is interesting to compare the shift in attitudes following a period during which their presence was only occasional.

To explore current attitudes in the region, we surveyed 62 farmers who graze sheep and goats in the Beskydy Protected Landscape Area and its surroundings. The questionnaire, which contained 17 questions related to sheep farming and large carnivores as well as basic questions about the farmers' sex, age, and number of animals owned, was carried out as face-to-face interviews between April 2024 and January 2025.

B. Results

The presence of large carnivores was perceived as a threat to sheep farming by 32% of respondents, which was the most frequent single response to the open question. However, administrative problems (23%), time and financial difficulties (21%), low demand for sheep products (21%), and various factors related to climate change, land fragmentation, and a lack of veterinarians (33%) were also common. This suggests that farmers have to deal with a complex set of problems, one of which is the presence of carnivores.

Almost all farmers are aware of preventive methods for protecting livestock (92% mentioned at least one method), but most of them (65%) did not take the opportunity to request government support for preventive measures, and 74% did not request support for additional work, such as maintaining preventive measures or feeding livestock guarding dogs. However, 78% of farmers who have suffered damage caused by wolves have asked for compensation from the state budget.

The largest groups of farmers believe that attacks by carnivores should be solved by making better use of preventive measures (37%) and by regulating carnivores (35%). This is a significant change from 2014, when 47% of farmers suggested supporting preventive measures (which did not exist at the time), and 43% suggested regulating carnivores, with only 20% suggesting preventive measures. This shows that introducing support for preventive measures has impacted farmers' attitudes towards the regulation of carnivores, possibly increasing their tolerance towards them.

This shift is also illustrated by the more positive overall attitude towards wolves and lynx, although the questions were not exactly the same as in 2014 (Kovařík et al. 2014). Despite most farmers thinking that wolves cause a lot of damage to livestock, only a minority (<20%) consider them to be pests, with more than 60% considering them to be important for regulating wild ungulates.

4.3 Installation and testing of additional preventive measures

A. Methods, data collection and analyses

During the implementation of project activities, close and intensive cooperation was established between Mendel University and five local farmers (Mr. Válek & Ms. Válková, Mr. Krpeš, Mr. Machu, Mr. Kabeláč, Mr. Szarzec) from the Beskydy and Javorníky areas (Czech part of the Beskydy–Kysuce pilot). The farmers have been using various preventive measures of differing effectiveness. All of them have experience with wolf attacks and livestock damage.

One of the additional preventive measures tested was the use of fladry. Fladry are a type of deterrent in which strips of fabric fluttering in the wind are intended to discourage wolves from approaching pastures where livestock are grazing. Historically, fladry were used for wolf hunting, but today they are often applied as an additional preventive measure to strengthen existing protection systems, or as a temporary solution where pastures are insufficiently protected or completely unprotected. Fladry are used to protect livestock mainly in the USA but also in parts of Europe (e.g., https://coloradooutdoorsmag.com/2024/05/21/fladry-non-lethal-conflict-mitigation/or https://www.polskiwilk.org.pl/images/pliki/2020_Poradnik_och_zwierz_hod.pdf). However, their effectiveness under European conditions has not been sufficiently evaluated, and little attention has been paid to their testing, including assessments of the financial and time demands of installation.

Fladry must meet certain parameters to function properly:

- made of durable, quick-drying red fabric material,
- each strip measuring approx. 10 × 60 cm and fixed onto a strong cord at regular intervals of 40–50 cm,
- installed on plastic posts

Since fladry are not commercially manufactured or sold as a preventive product in the Czech Republic or Europe, LP MENDELU commissioned the production of 5 km of fladry based on the above parameters and required materials.

In addition, audiovisual deterrents were tested with one farmer. These were installed along the perimeter of a sheep pasture where the primary preventive measure was an electric net fence. The devices served as a complementary measure, emitting a range of ultrasonic signals combined with light flashes when any object approached within 8 meters.

The installation and testing of these additional preventive measures took place at the farms of the cooperating partners in the Beskydy-Kysuce pilot area:

- Mr. Krpeš:

This farmer grazes in the mountain meadows of the Moravian-Silesian Beskids, breeding and grazing are focused on sheep and goats. Existing preventive measures against attacks by large carnivores consist only of standard electric netting. Therefore, Mendel University provided and installed approx. 1 km long fladry around pasture (49.4795636N, 18.4609625E). So far, no damage from wolves has been detected (Fig. 29).

- Mr. Machu:

This farmer grazes in the mountain meadows of the Vsetín Beskids and meadows surrounding villages (49.3375306N, 18.1574117E), breeding and grazing are focused on sheep. Existing preventive measures against attacks by large carnivores consist only of standard electric netting. Therefore, Mendel University provided audiovisual deterrents which were installed by the farmer around the pasture. So far, no damage from wolves has been detected.

- Mr. Kabeláč:

This farmer grazes in the mountain meadows in Zděchov, Javorníky Mts., breeding and grazing are focused on sheep and goats. Existing preventive measures against attacks by large carnivores consist of old, appropriate sheep netting. Therefore, Mendel University provided and installed approx. 500 m long fladry around pasture (49.2529308N, 18.0809117E). So far, no damage from wolves has been detected (Fig. 30).

Figure 29: Fladry installed in the Moravian-Silesian Beskids around a sheep pasture, which was primarily protected by a standard-height electric net fence.

- Mr. Szarzec:

This farmer grazes in the meadow near his property at locality Třinec - Podvrch in the Moravian-Silesian Beskids, where grazing is focused on sheep. Existing preventive measures against attacks by large carnivores consist of only standard electric netting. Therefore, Mendel University provided and installed approx. 150 m long fladry around pasture (49.6403408N, 18.6244328E). So far, no damage from wolves has been detected (Fig. 31).

Figure 30.: Fladry installed in the Javorníky Mts. around a sheep pasture, which was protected only by old, unsuitable sheep fencing.

- Mr. Válek & Ms. Válková:

These farmers graze in the mountain meadows of the Vsetín Beskids and Javorníky Mts. (e.g. 49.3364619N, 18.3180508E), breeding and grazing is focused on sheep and goats. Existing preventive measures against attacks by large animals consist of standard electric netting and livestock guarding dogs (4 active Bosnian Tornjaks).

Mendel University provided three GPS collars for tracking livestock guarding dogs to increase the effectiveness of preventive measures and increase information about the work of dogs and their activity during grazing. In total, three units were deployed on dogs in combination with proximity UHF collars to record what happens when a wolf with a collar approaches the pasture where dogs with proximity collars move (Fig. 31, 33, 34).

Figure 31. Fladry was/were installed in the Moravian-Silesian Beskids around a sheep pasture, which was primarily protected by a standard-height electric net fence.

B. Results

At all farms where fladry and audiovisual deterrents were installed, no further livestock depredation was recorded, despite confirmed wolf activity in the area, the presence of established territories, and documented reproduction.

The financial costs for material and production of fladry in this project amounted to approximately €5,000 for 5 km. Installation is neither physically nor time demanding on pastures located in flat terrain, but in exposed areas with steep slopes and numerous terrain depressions, it requires careful setup and adjustment. Proper functionality of fladry also depends on regular inspections, as weather conditions—particularly wind—can cause the strips to become deformed or tangled, rendering them ineffective.

To evaluate the actual effectiveness and representativeness of both fladry and audiovisual deterrents, it is necessary to expand testing to more sites, mountain ranges, and territories with different wolf packs. This is important since wolves are known to vary in their behavior and in their ability to overcome different types of preventive measures.

4.4 Testing smart technologies to collect data on wolf-human conflict

A. Methods, data collection and analyses

To improve understanding of wolf depredation patterns on livestock, two types of proximity sensors were installed in the home ranges of GPS-collared wolves at sites of interest. These devices communicated with the GPS collars based on predefined settings. The first type, developed by Vectronics, was a stationary unit with an antenna (“Street UHF ID Tag Transmitter”), which could be deployed at various sites of interest (e.g., human settlements, pastures, migration corridors). When a collared wolf approached the unit, the two devices communicated, triggering a change in the GPS fix interval as defined by the user.

The second type consisted of UHF ID tag transmitters integrated into collars, which could be fitted either to wild animals of interest (e.g,. ungulates as wolf prey) or to domestic animals such as livestock or guarding dogs. As in the first case, the purpose was to intensify data collection (more frequent GPS and proximity fixes) when a GPS collar with an active proximity sensor came into range of a UHF tag.

In total, 6 long-range UHF tag transmitters were installed at selected pasture sites with sheep grazing, and 2 collar-mounted transmitters were deployed on livestock guarding dogs in cooperation with the "Za Kopcom" farm grazing on pastures in Vsetín Beskids and Javorníky Mts. (Fig. 32, 33, 34). For better oversight, the UHF collars were supplemented with GPS devices from Tractive, which allowed farmers to monitor their dogs remotely in real time via a mobile application (Fig. 32, 35).

Figure 32: Livestock guarding dog Tornjak with deployed UHF proximity collar (left) combined with GPS unit on the same collar belt (right; source: M. Válek & K.Válková).

In addition to proximity units, another approach for intensive data collection was tested using the virtual fence mode within GPS telemetry (Fig. 33). This feature enables the definition of a virtual boundary around an area of interest. When a monitored wolf entered such a zone, the GPS fix interval automatically increased (e.g., to every 10 minutes). Compared to the proximity option, the virtual fence also allowed the reception of alert messages when the animal entered or left the defined zone (e.g., a pasture, settlement, or forest block).

The proximity mode was activated for two collared wolves (Zuzka and Taťána). The virtual fence mode was tested in pastures within the territory of the female Lucka, and in the Jablunkovská Brázda corridor between the Silesian and Moravian-Silesian Beskids, a critical area with intensive livestock grazing as well as migration corridor used by the dispersing female Dana (Fig. 33). In addition to natural proximity events, simulated events were also conducted by bringing a UHF tag proximity collar close to collared animals to test the effective communication distance between devices and the subsequent change in GPS fix rate.

B. Results

In the case of proximity sensors, only a single natural event was recorded when the female wolf Zuzka approached a sheep pasture in the Vsetín Beskids, though no damage occurred. For the virtual fence mode, a total of 3 events were documented in two different females. For the female Lucka, two events were recorded when she entered a polygon of interest with increased livestock grazing, but, as in the case of

Zuzka, no depredation occurred. For the female Dana, one virtual fence event was recorded while she was crossing the Jablunkovská Brázda corridor from the Moravian-Silesian to the Silesian Beskids.

The GPS units attached to livestock guarding dogs proved reliable in providing information on their current location and spatio-temporal activity. From the perspective of cost, design, and functionality, they represent a useful tool for livestock owners who already employ guarding dogs. However, their limitations include short battery life, requiring frequent charging, and dependence on sufficient mobile signal coverage and internet connection.

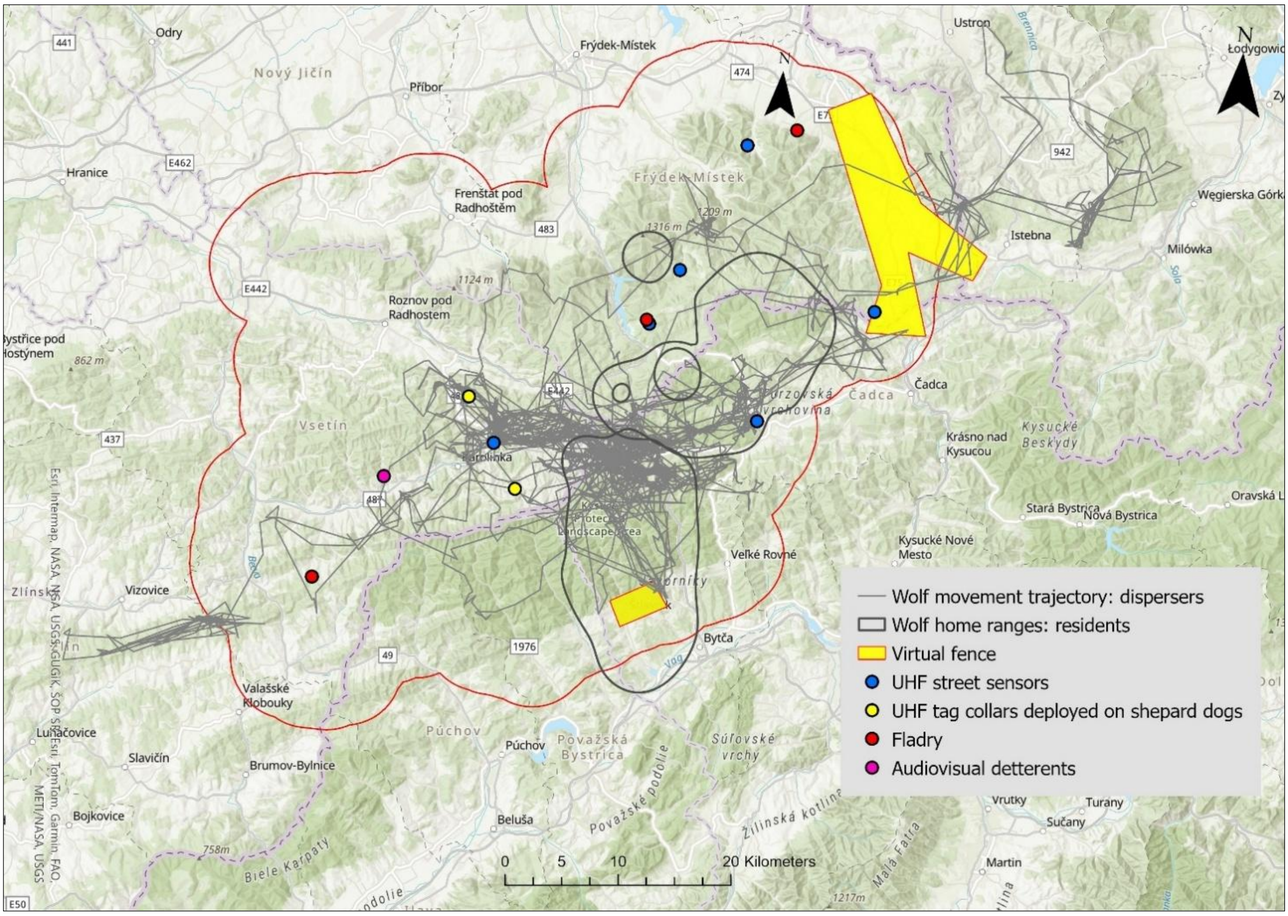

Figure 33. Location of various preventive measures, proximity sensors, and virtual fences in the cross-border pilot area, combined with the spatial activity of dispersing wolves and resident animals during the implementation of pilot activities.

During the pilot activities and testing of the units, the proximity method proved to be of limited effectiveness and robustness in providing detailed spatio-temporal data on wolf depredation patterns and interactions with human activities. To obtain larger datasets using this approach, several conditions would need to be met, particularly a sufficient number of collared wolves in the study area and a sufficient number of proximity units placed at pastures or other sites of interest. A further limitation of proximity data is the need to successfully retrieve the collar from the field.

From both the perspective of cost-effectiveness and the quality of data obtained, the virtual fence approach appears to be the preferred method. It not only provides detailed spatio-temporal information but, in the case of wolves with high depredation tendencies, also generates alert messages when the animal enters a zone of interest, enabling immediate intervention in the field (e.g., aversive conditioning). Nevertheless, this method has its own limitations, as the defined polygon must be sufficiently large to ensure reliable detection of the monitored animal, which depends on fix frequency—an inherent challenge for highly mobile species such as wolves. However, it seems that a regular GPS fix every one to two hours, combined with a sufficiently large buffer zone around areas of interest (e.g., pastures), can provide more reliable data and the desired effect.

Figure 34: UHF long-range transmitter installed on the pasture with sheep in the Moravian-Silesian Beskids (left) and livestock guarding dog (Tornjak) with UHF tag and GPS collar in combination with high electric netting as an effective prevention measure against wolf attacks in the Javorníky Mts.

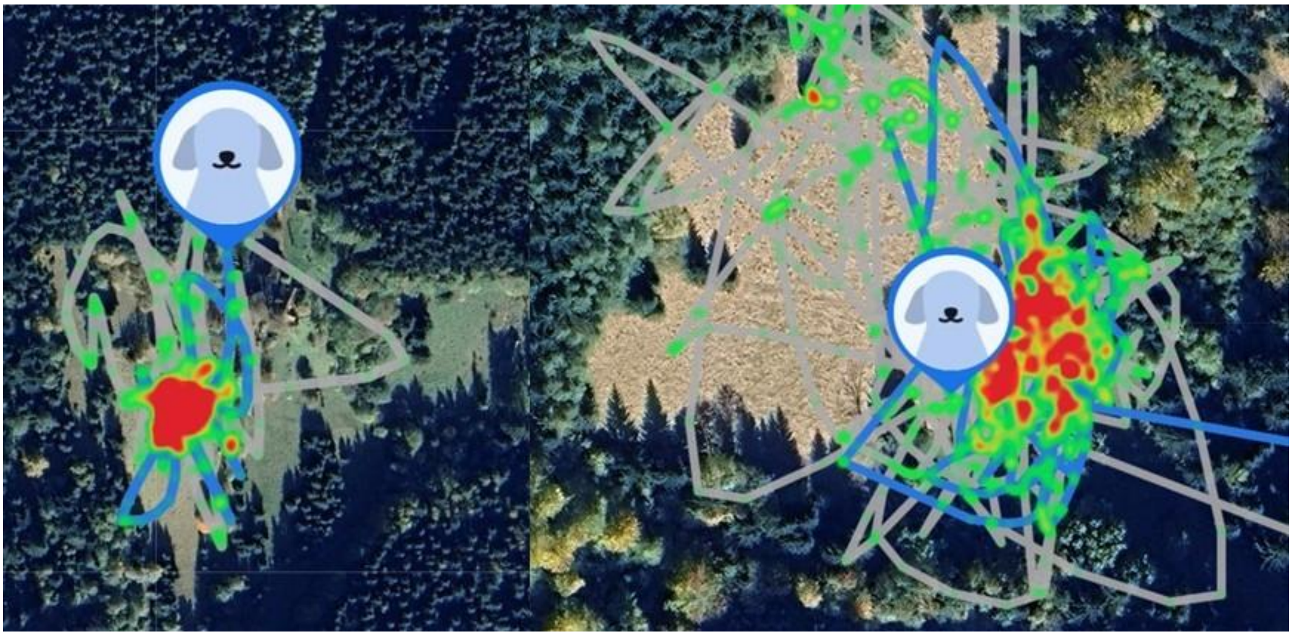

Figure 35: Example of movement trajectories and heatmaps of spatio-temporal activity obtained from GPS collars deployed on livestock-guarding dogs (tornjaks) in different pastures (source: Tractive).

5. Pilot activities: Poaching prevention

5.1 Seminars for police investigators

A cross-border seminar on tackling poaching was held on 3–4 September 2024 in the Beskydy-Kysuce pilot area at Hotel Portáš. The event, organized within the LECA project, brought together representatives of the Police of the Czech Republic and the Slovak Republic, the Customs Administration of the Czech Republic, and the Police Presidium of the Czech Republic. Its main aim was to strengthen cross-border cooperation in addressing poaching and wildlife crime related to large carnivores.

The programme included a presentation of the LECA project and its contribution to international cooperation and data sharing. Experts discussed the population dynamics of large carnivores along the Czech–Slovak border and pointed to the existence of "black holes," areas where repeated losses of individuals occur. The Slovak Environmental Police provided an overview of crime statistics, noting that crimes against protected species represent about two percent of all recorded cases, while stressing that perpetrators are often involved in other serious crimes. Further contributions highlighted the role of forensic support in investigations, pointing out that around 250 cases are handled annually in the Czech Republic, with new techniques such as touch DNA offering new evidence opportunities.

Figure 36. Seminar for police investigators organised in the Beskydy-Kysuce pilot.

The Customs Administration shared its experience with environmental crime and the "LOVEC" case, which revealed illegal hunting, trophy trading, and the involvement of taxidermists. The case also led to new opportunities for cooperation and awareness raising, including engagement in the EUROPOL platform European Great Carnivores. Presentations on genetic monitoring of wolves, bears, and lynx emphasized the importance of DNA analyses for both conservation and forensic purposes, enabling species identification, kinship and origin analysis, and the identification of individuals. This work is supported by international collaboration within the CEwolf consortium. Results from the SWiPE project (2020–2023) were also presented, showing that only a small number of cases make it to court, that penalties tend to be very low, and that compensation for damages is rarely decided upon. The Czech Police introduced the newly emerging ENVIRO working group, which will coordinate cases of wildlife crime, although a separate specialized unit is not yet being created.

Practical demonstrations showed how conservation data can support investigations, and researchers offered their maximum cooperation with law enforcement. The seminar concluded with a summary of key outputs, including the identification of poaching “black holes” in the Beskydy and Javorníky Mts.. It was emphasized that seized specimens, skins, and other animal parts can be identified through comparative photo databases or DNA analyses, and that within the LECA project, genetic analysis of up to 80 samples is available to enforcement authorities. The seminar underlined that perpetrators of wildlife crime are often engaged in other serious illegal activities, that expert support is crucial for effective investigations, and that combining scientific and forensic approaches is essential. Genetic analyses now make it possible to confirm species, origin, kinship, and the identity of individual animals, with lynx also identifiable from photographs based on their unique coat patterns.

Key contacts for follow-up were shared, including experts from Mendel University, Charles University, the Czech Academy of Sciences, Friends of the Earth Carnivore Conservation Programme, and WWF Slovakia, covering areas such as field monitoring, telemetry, forensic identification, and radiocarbon dating. The seminar thus significantly contributed to strengthening cooperation between law enforcement authorities and researchers in tackling poaching and wildlife crime in the Carpathian border region.

6. Conclusion

The Beskydy-Kysuce pilot action has provided valuable insights into the monitoring, conflict prevention, and poaching prevention of wolves in a transboundary region of the Western Carpathians. By integrating diverse monitoring methods with practical measures and cross-border cooperation, the project has demonstrated how conservation challenges in highly fragmented and human-dominated landscapes can be effectively addressed.

A harmonised monitoring framework combining camera trapping, genetic sampling, and GPS telemetry significantly improved the knowledge base on wolf distribution and dynamics. Wolves were confirmed in over two-thirds of the mapping grids, with population size estimated at 36–47 individuals, depending on the method, with an average pack size of 7 individuals and 4–5 pups per pack. Population density in wolf packs' territories reached 5.01 (±1.21) individuals per 100 km². Telemetry provided detailed data on space use, including home range size, dispersal, reproduction, and mortality. The identification of unique individuals through genetics and telemetry confirmed the presence of at least 42 wolves in 2024/25. These results underline the dynamics of wolf territories and the whole population in the area, which expands and fluctuates in relation to reproduction, mortality and dispersal. Livestock depredation remains the main source of conflict. In the eight wolf years (2017–2024), 452 attacks and 1610 livestock losses were recorded, with the vast majority occurring on the Czech side. However, improving preventive measures is yielding promising outcomes. Additional preventive measures, such as fladry and audiovisual deterrents, installed in cooperation with local farmers, prevented further damage at tested farms despite ongoing wolf activity. Livestock guarding dogs equipped with GPS units proved reliable, though limited by battery life and mobile signal. Innovative tools such as proximity sensors and virtual fences were tested for the first time in this region. While proximity sensors proved to be of limited efficiency due to technical and logistical constraints, the virtual fence approach showed greater promise by providing more detailed data and the ability to send alerts when wolves entered high-risk zones. Although still requiring optimisation, this method offers potential for direct field intervention in areas with high depredation risk. Farmers' attitudes showed gradual shifts over the past decade: while wolves are still perceived as a threat by many, tolerance is improving thanks to multi-level state support for preventive measures and awareness of their ecological role. These findings highlight the importance of targeted support, broader testing of preventive measures under different conditions, and continuous farmer engagement to increase the tolerance.

A major added value of the pilot was the focus on poaching, a critical but often underestimated threat. A dedicated cross-border seminar for police, customs, and researchers significantly strengthened collaboration, highlighted hotspots of illegal killings, and promoted the use of forensic genetics in investigations. This work confirmed that poaching is closely linked to other forms of criminality, and that combining scientific expertise with enforcement action is essential for tackling wildlife crime effectively.

The Beskydy-Kysuce pilot actions demonstrate that wolf conservation and management in Central Europe must be transboundary, science-based, and adaptive. Harmonised monitoring provides robust data for population assessment, while preventive tools and smart technologies can reduce conflicts if tailored to local conditions. Engaging farmers and enforcement authorities proved to be crucial for building trust and implementing solutions on the ground.

Overall, the pilot action delivered practical tools, strengthened partnerships and cooperation, and generated knowledge that is directly applicable to conservation and management of large carnivores not only in the Czech-Slovak borderlands but across the wider Carpathian region. Scaling up these activities and ensuring their long-term institutional support will be essential for securing coexistence between humans and wolves in the future.

7. References

Duľa, M., Bojda, M., Chabanne, D. B., Drengubiak, P., Hrdý, Ľ., Krojerová-Prokešová, J., ... & Kutal, M. (2021). Multi-seasonal systematic camera-trapping reveals fluctuating densities and high turnover rates of Carpathian lynx on the western edge of its native range. Scientific Reports, 11(1), 9236.

Duľa, M., Bojda, M.; Labuda, J., Váňa, M., Kutal M. (2023). Jak se daří velkým šelmám v CHKO Beskydy?. Živa: časopis přírodnický. 71(6), 314-317.

Hulva, P., Černá Bolfíková, B., Woznicová, V., Jindřichová, M., Benešová, M., Mysłajek, R. W., ... & Antal, V. (2018). Wolves at the crossroad: Fission-fusion range biogeography in the Western Carpathians and Central Europe. Diversity and Distributions, 24(2), 179-192.

Hulva, P., Collet, S., Baránková, L., Valentová, K., Šrutová, J., Bauer, H., ... & Heurich, M. (2024). Genetic admixture between Central European and Alpine wolf populations. Wildlife Biology, 2024(6), e01281.

Kaczensky, P., Ranc, N., Hatlauf, J., Payne, J. C. et al. (2024). Large carnivore distribution maps and population updates 2017-2022/23. Report to the European Commission under contract N° 09.0201/2023/907799/SER/ENV.D.3 "Support for Coexistence with Large Carnivores", "B.4 Update of the distribution maps". IUCN/SSC Large Carnivore Initiative for Europe (LCIE) and Istituto di Ecologia Applicata (IEA).

Kovařík, P., Kutal, M., & Machar, I. (2014). Sheep and wolves: Is the occurrence of large predators a limiting factor for sheep grazing in the Czech Carpathians?. Journal for Nature Conservation, 22(5), 479-486.

Kutal, M., Belotti, E., Volfová, J., Mináriková, T., Bufka, L., Poledník, L., ... & Duľa, M. (2017). Výskyt velkých šelem-rysa ostrovida (*Lynx lynx*), vlka obecného (*Canis lupus*) a medvěda hnědého (*Ursus arctos*)-a kočky divoké (*Felis silvestris*) v České republice a na západním Slovensku v letech 2012-2016 (Carnivora). Lynx, 48, 93-107.

Marucco, F., Boiani, M. V., Dupont, P., Milleret, C., Avanzinelli, E., Pilgrim, K., ... & Bischof, R. (2023). A multidisciplinary approach to estimating wolf population size for long-term conservation. Conservation Biology, 37(6), e14132.

Marucco, F., Reinhardt, I., Avanzinelli, E., Zimmermann, F., Manz, R., Potočnik, H., ... & Duchamp, C. (2023b). Transboundary monitoring of the wolf alpine population over 21 years and seven countries. Animals, 13(22), 3551.

Molinari-Jobin, A., Kéry, M., Marboutin, E., Molinari, P., Koren, I., Fuxjäger, C., ... & Breitenmoser, U. (2012a). Monitoring in the presence of species misidentification: the case of the Eurasian lynx in the Alps. Animal Conservation, 15(3), 266-273.

Molinari-Jobin, A., Wölfl, S., Marboutin, E., Molinari, P., Wölfl, M., Kos, I., ... & Breitenmoser, U. (2012b). Monitoring the Lynx in the Alps. Hystrix, 23(1), 49.

Vorel, A., Kadlec, I., Toulec, T., Selimovic, A., Horníček, J., Vojtěch, O., ... & Barták, V. (2024). Home range and habitat selection of wolves recolonising central European human-dominated landscapes. Wildlife Biology, 2024(6), e01245.