Endangered Landscapes & Seascapes Programme | Cambridge Conservation Initiative

Wolves

Objective: Stabilise abundance

Carpathian Mountains

status: data collection in progress

Problem: Legal and illegal sport and trophy hunting as well as disturbance from logging have led to a decline in populations of apex predators including wolves.

Action: Foundation Conservation Carpathia has leased hunting concessions in which hunting has been halted, and has also purchased forest land where they have ceased logging and started to restore native mixed forest. Over time, the cessation of hunting and reduction in disturbance, as well as improved connectivity through habitat restoration, should lead to an increase in wolf populations. To reduce human-wildlife conflict, local farms have been equipped with electric fences as well as Carpatin breed livestock-guarding dogs. Rapid response teams have also been set up to resolve conflicts.

Indicator: An increase in wolf numbers indicates increased ecological integrity and intact food webs, with greater prey abundance.

Eurasian wolves (Canis lupus lupus). Photo: Barbara and Christoph Promberger.

Methods

Monitoring aimed to estimate the wolf population size within the hunting-free area of the project. To do this, sampling was conducted over 1100 km^2 from 2017-2019, expanded to 1400 km^2 from 2019-2024. Biological samples (hair, urine and faeces) were collected during snow-tracking sessions in winter along trails and forest roads. Tracks were followed on foot as long as possible, and all scat and urine samples found were collected. Occasionally, tissue samples from dead individuals or saliva from prey carcasses were also collected. The maximum age of sample that was used was 5 days, to ensure good preservation.

Samples were preserved in ethanol before being sent to the University of Ljubljana in Slovenia for genetic analysis.

DNA sampling. Photo: Călin Șerban.

Wolf DNA sample collection. Photo: Ruben Iosif.

Baseline sampling in 2019-2020 returned 250 samples. Foundation Conservation Carpathia planned to repeat this data collection in winter 2022-2023 to make a first measure of population trend after five years. Unfortunately, the very warm winter and absence of snow affected sampling success, returning only 140 samples. While useful in tracking pedigrees and families over time, this data was not enough for population estimates. Further monitoring was conducted in winter 2024-2025, which returned sufficient samples to be able to compare density across different time frames. These results will be updated once data is available.

Genetic fingerprinting was used to identify individual wolves. Combined with spatial data on the location of collected samples, this was used to estimate population density as well as reconstruct pack composition and dynamics. Additionally, genetic data was analysed to identify any cases of wolf-dog hybridisation. Further detail on these approaches can be found in Iosif et al. (2025).

Results

Baseline sampling in 2019-2020 returned a population density estimate of 2.35 individuals per 100 km^2, with a Bayesian credible interval (confidence interval) of 1.68-3.03. An updated population density estimate will be calculated using data collected in winter 2024-2025, for which analysis is ongoing.

Between 2017 and 2023, 76 unique individuals were genotyped (31 females and 45 males). Using pedigree reconstruction, these animals were initially grouped into six different packs (Fig. 1).

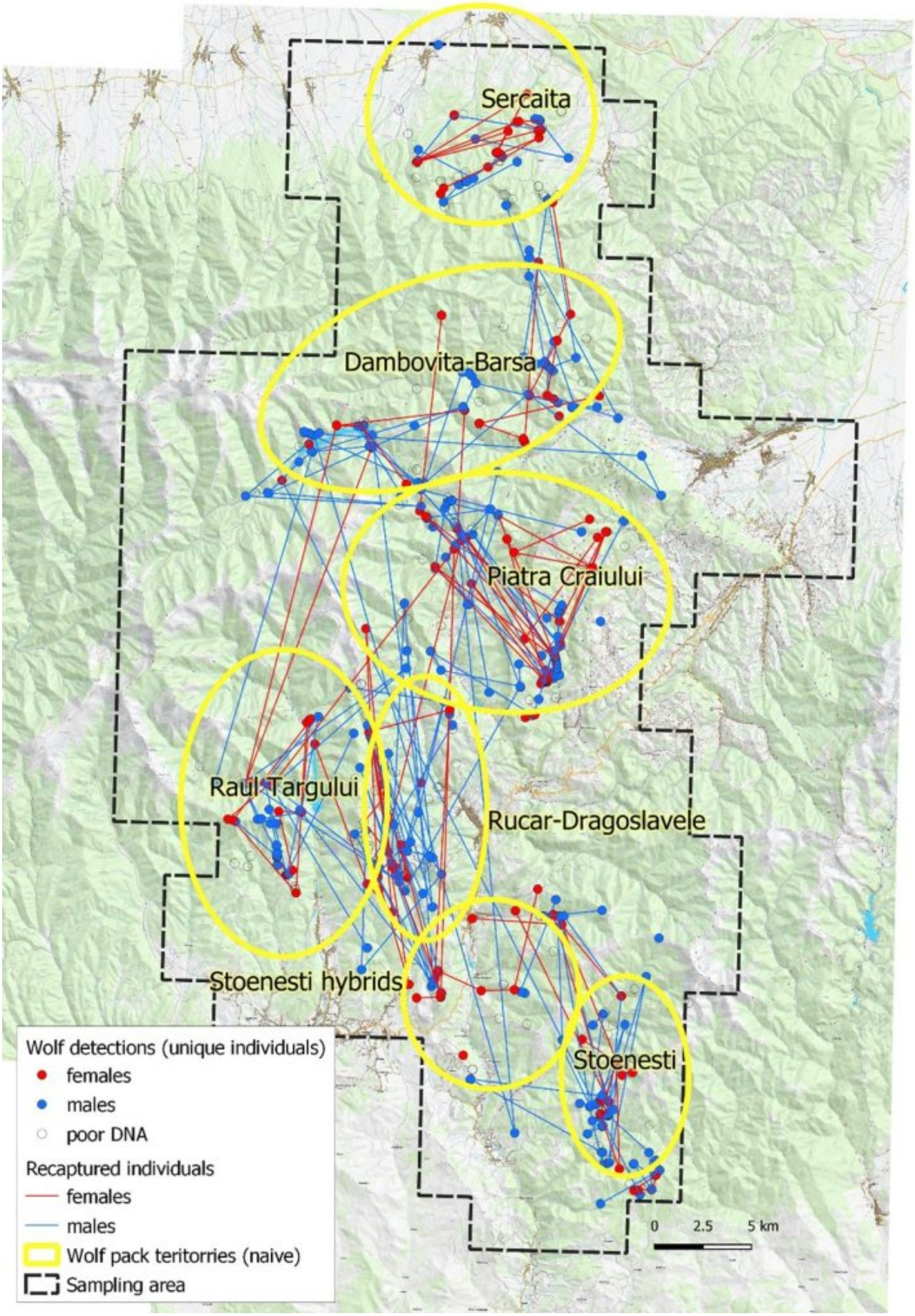

Figure 1. Distribution of wolf individuals detected during baseline surveys (males in blue, females in red), and approximate delineations of wolf pack territories (yellow circles).

Over the monitoring period, some of the initial six packs split while others merged, making the number of packs variable in time (Fig. 2). Pack size varied between 2 and 7 individuals, with high variability in pack composition from one year to another. None of the initial breeding pairs was stable across all years, with some packs changing at least one of the reproductive individuals two or three times. Six out of seven packs included at least one individual that was not genetically related to the breeding pair. The maximum number of wolves detected in a single sampling winter was 31 during winter 2019-2020, when sampling success was highest.

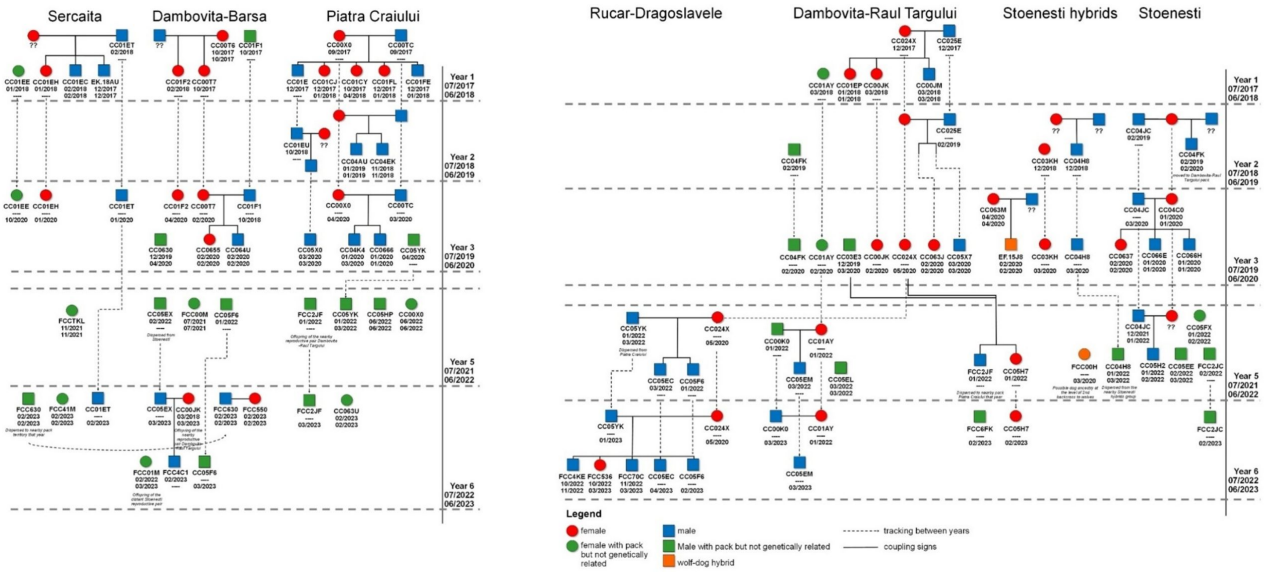

Figure 2: Reconstruction of the composition of wolf packs in the area, 2017 – 2023. Each row represents pack composition in a particular year. Each shape represents an individual wolf: circles are females and squares are males. Green individuals are not genetically related to the pack they associate with. Vertical dashed lines follow individuals from year to year, showing movement between packs.

Wolf-dog hybridisation did not increase over the period, with only one confirmed case of an first-generation wolf-dog hybrid, and a second individual with possible dog ancestry.

Interpretation

The limited monitoring time period and the social and ecological complexity of the project area mean it is difficult to draw conclusions on whether wolf populations are increasing at present. However, at a minimum, the wolf population appears to be stable, which may indicate stable predator-prey relations. Additionally, there is enough exchange between family groups to maintain healthy genetic diversity. This is likely to result in part from the full protection of wildlife, including ungulates, in the game management units under Foundation Conservation Carpathia's concession and

the nearby Piatra Craiului National Park.

Although wolf-dog hybridisation has occurred at least once, there is no indication that it has had a significant impact on the population.

Next steps

To overcome the issue of a lack of reliable snow in winter to allow wolf tracking and monitoring, Foundation Conservation Carpathia are exploring a novel approach of sampling the snow footprints of wolves and identifying individuals using environmental DNA. This has the advantage that detectability of footprints is significantly higher than that of scat and urine even during short snow events.

Wolf tracks in the snow. Photo: Zsolt Miholcea.

Publications

Report: Genetic monitoring of wolf

Iosif, R., Skrbinšek, T., Erős, N., Konec, M., Boljte, B., Jan, M., & Promberger‐Fürpass, B. (2025). Wolf Population Size and Composition in One of Europe's Strongholds, the Romanian Carpathians. *Ecology and Evolution*, *15*(4), e71200.

Partners