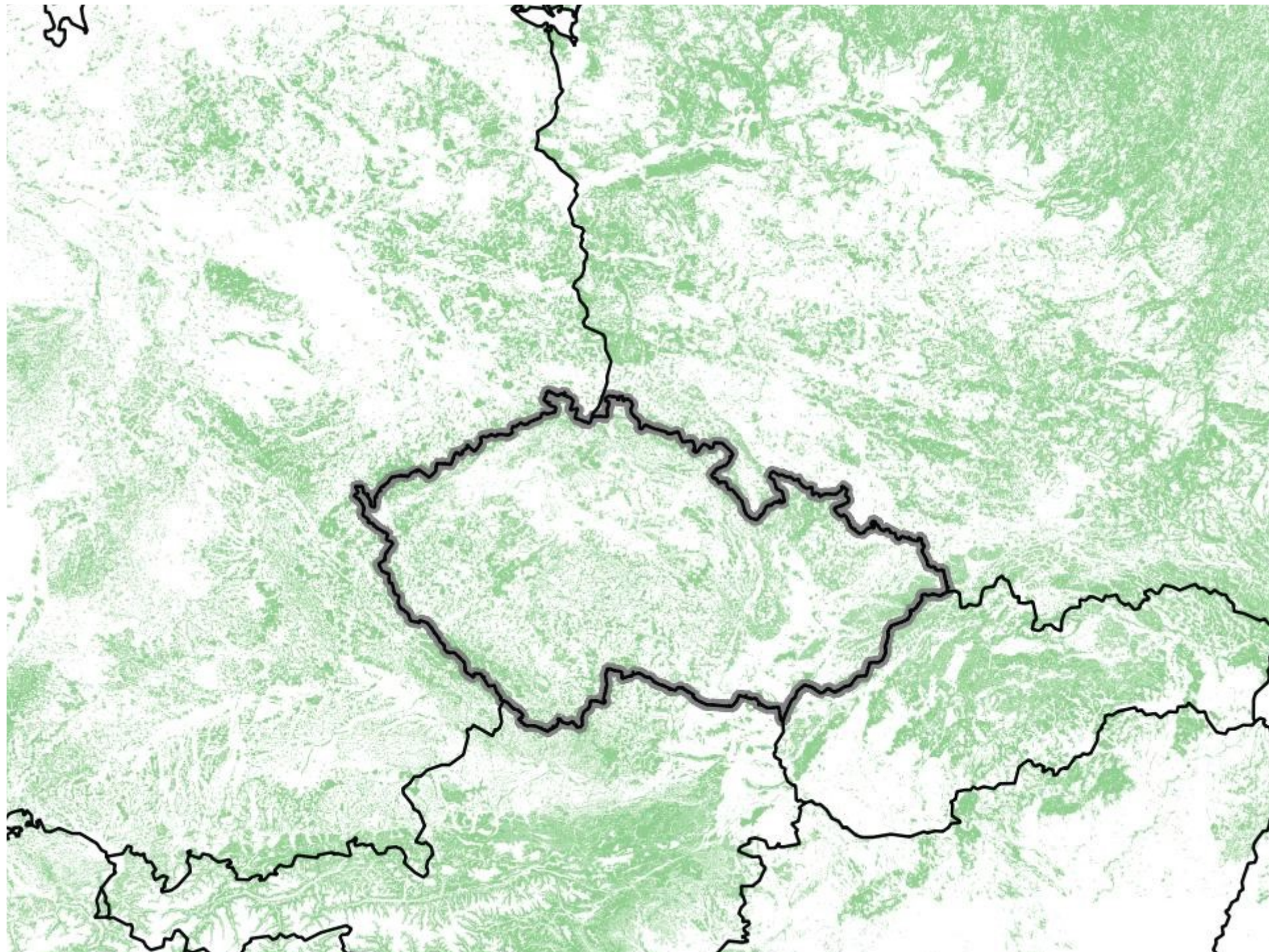
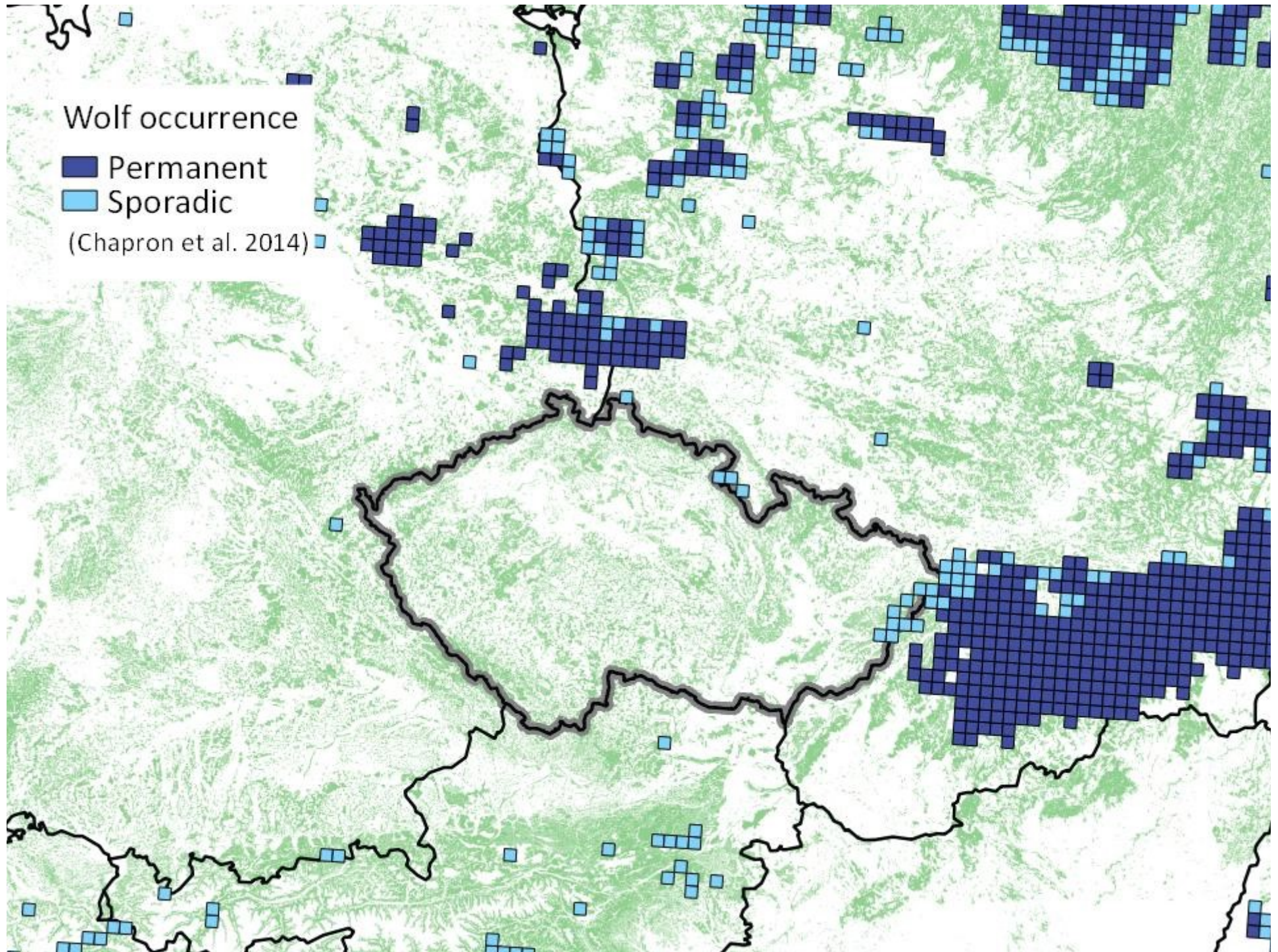
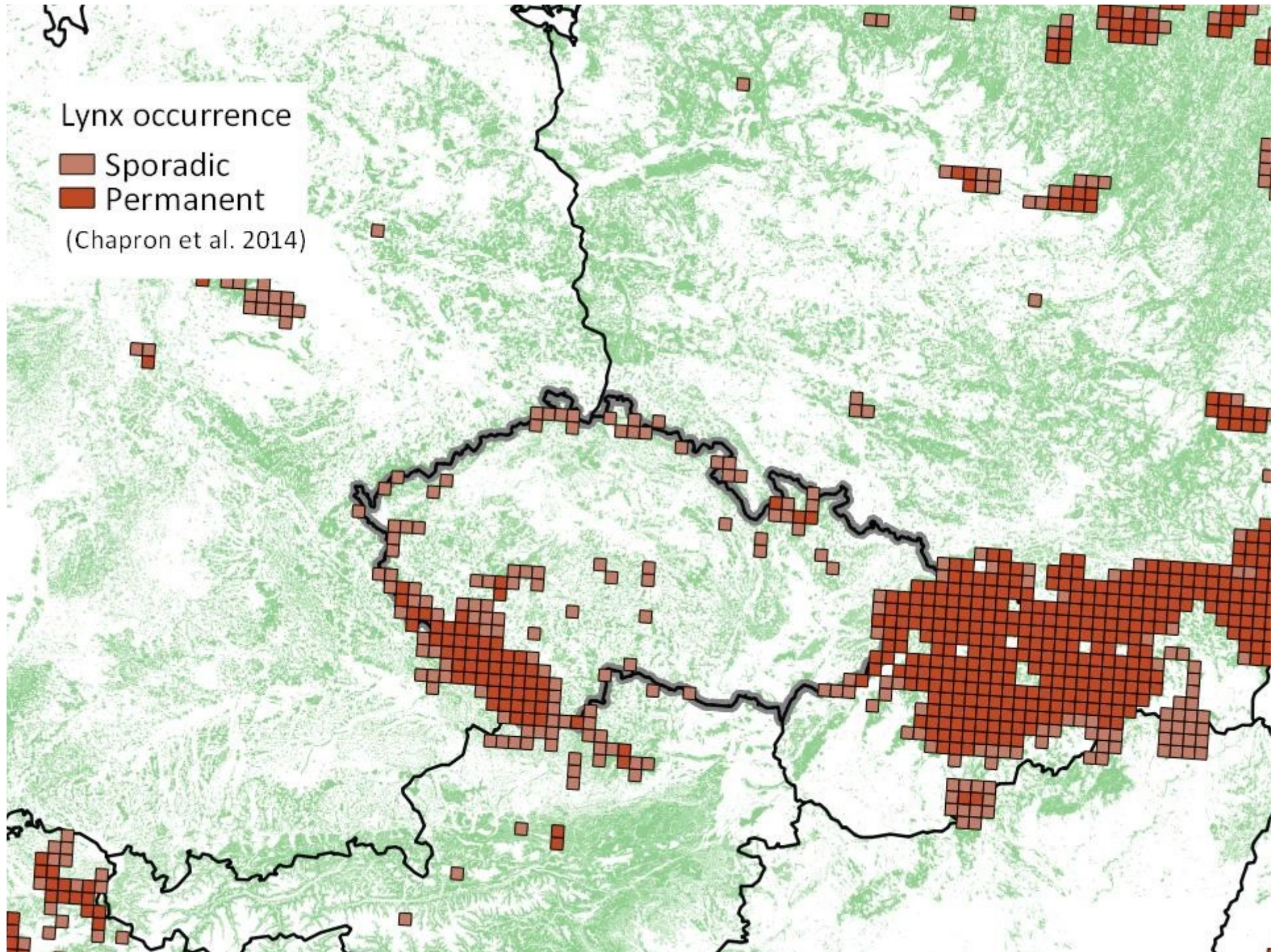
A photograph of a wolf standing in a forest, partially obscured by tree branches. The wolf is looking towards the camera. The background is a dense forest with many thin tree trunks and branches.

Monitoring carnivores of European significance in selected Sites of Community Importance in the Czech Republic

Miroslav Kutal, Martin Váňa, Michal Bojda, Jiří Beneš, Leona Kutalová, Barbora Turbaková, Dušan Romportl, Pavel Hulva, Barbora Černá Bolfíková, Jiří Flousek, Petr Kafka & Martin Duľa







Wolf recovery in Central Europe

Western Poland 2001-2013

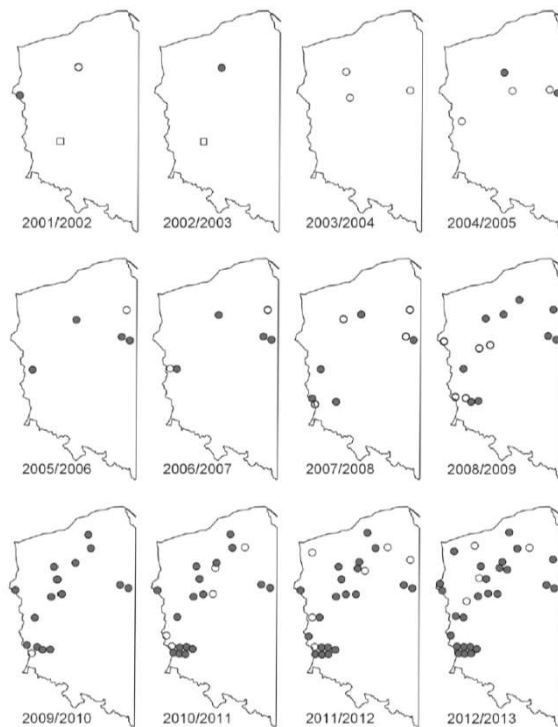
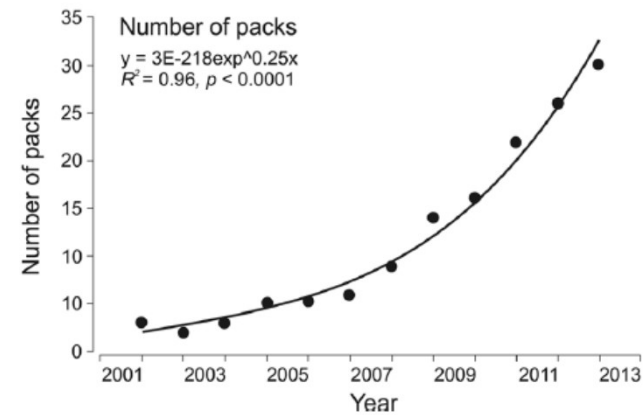
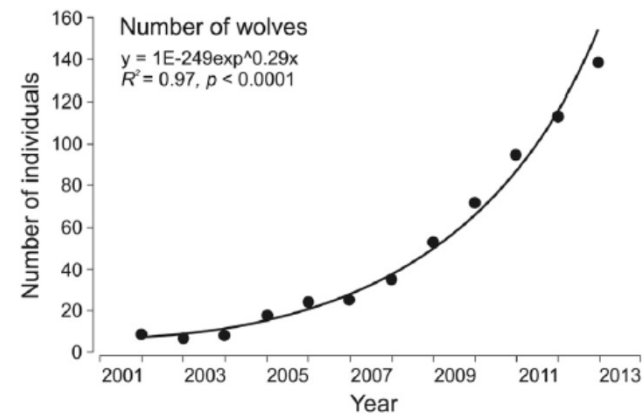
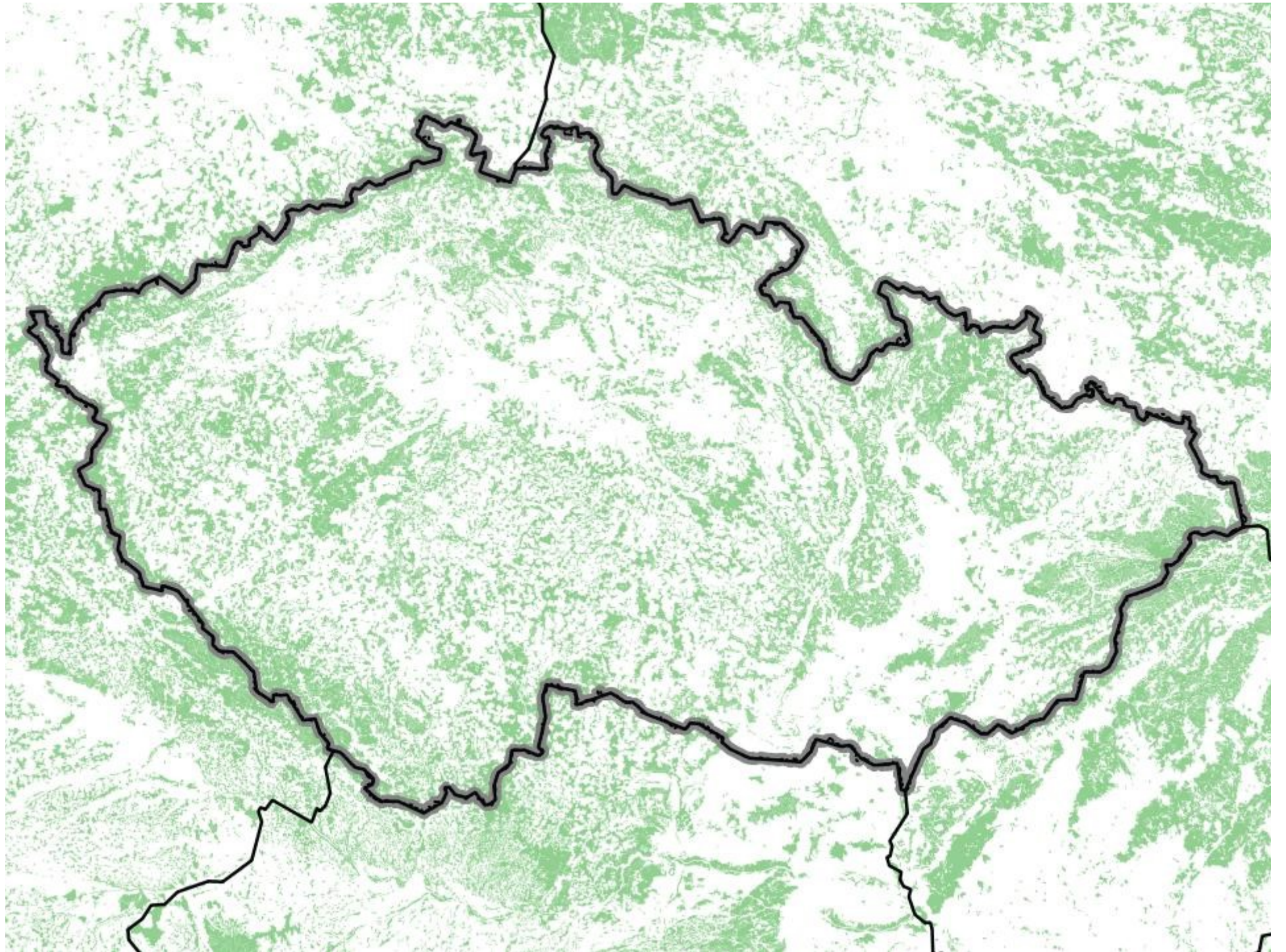


Fig. 2 Distribution of wolf groups in Western Poland in winter seasons 2001/2002–2012/2013. *Filled circles* denote groups with confirmed reproduction, *open circles* groups with no evidence of reproduction, *squares*—group established by wolves that escaped from captivity

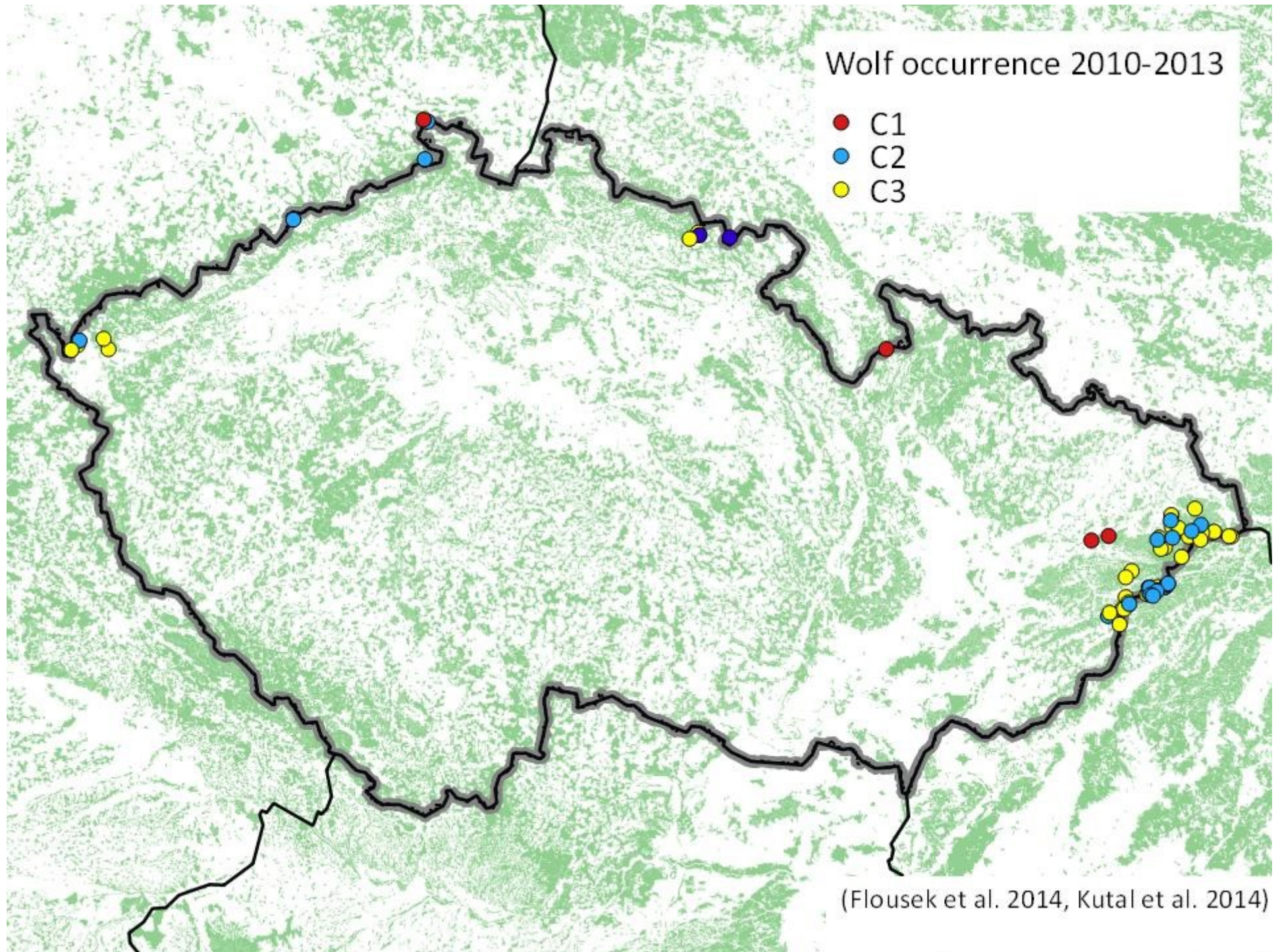


Nowak & Mysłajek (2016)



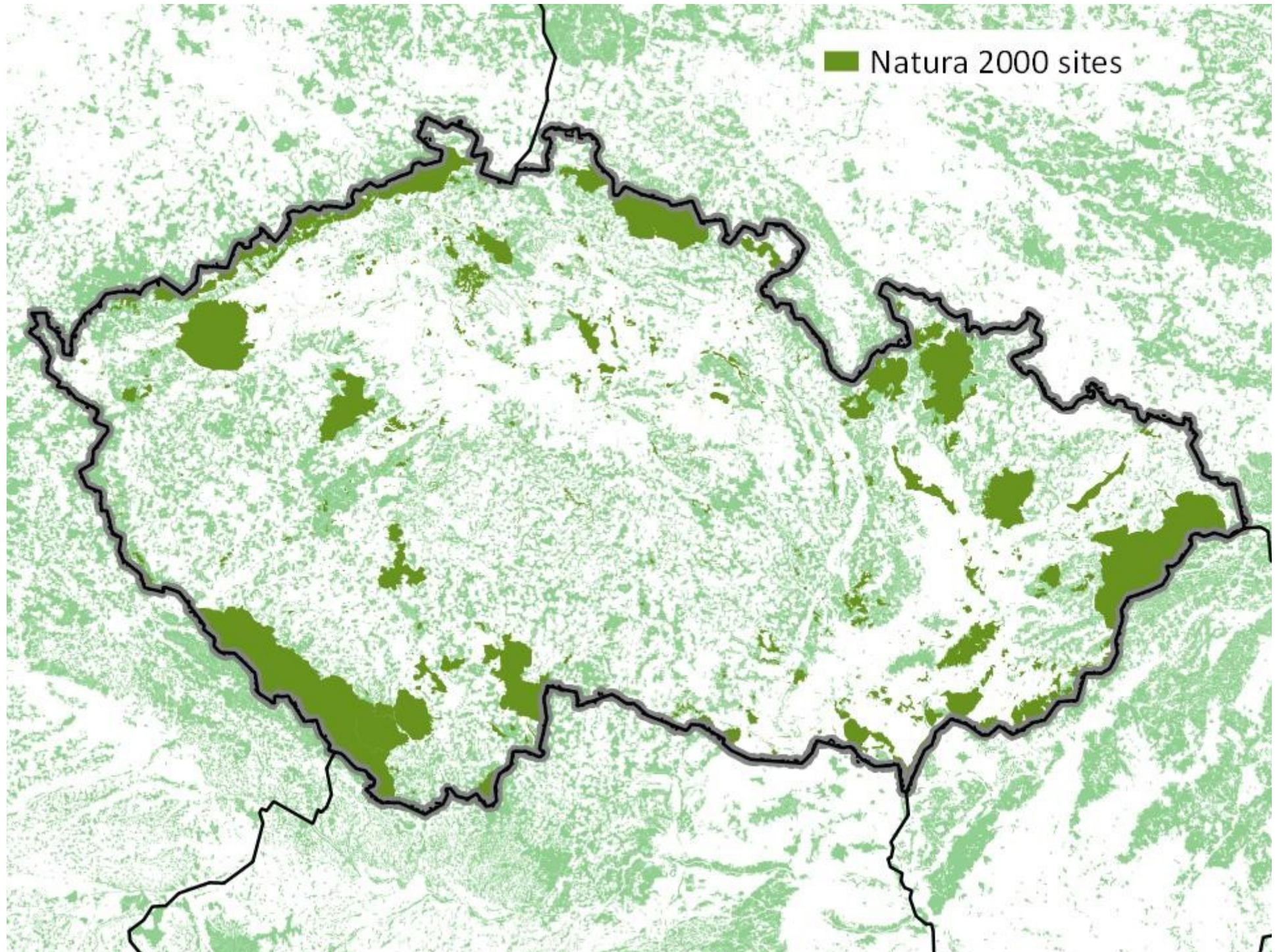
Wolf occurrence 2010-2013

- C1
- C2
- C3



(Flousek et al. 2014, Kutal et al. 2014)

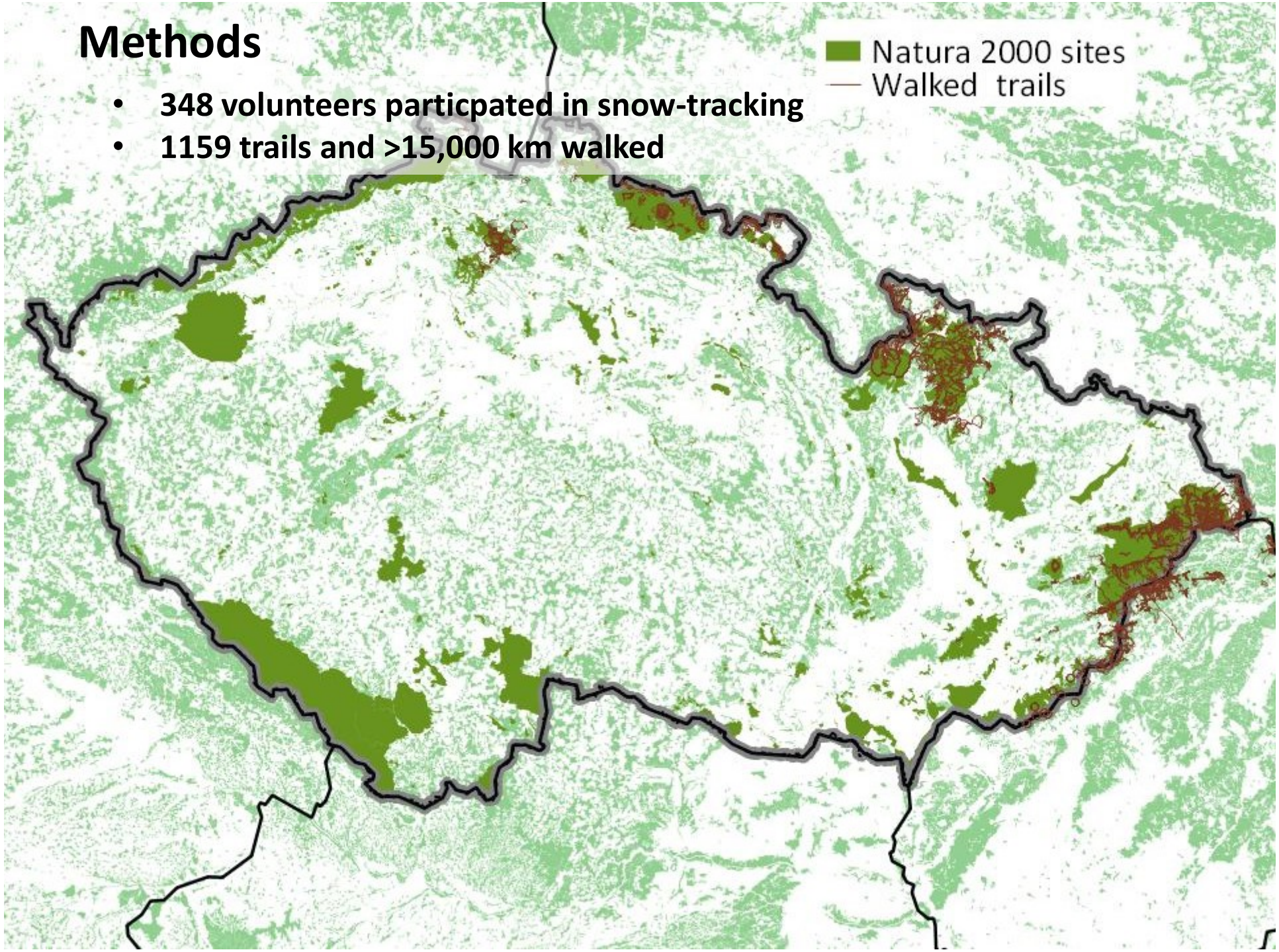
■ Natura 2000 sites



Methods

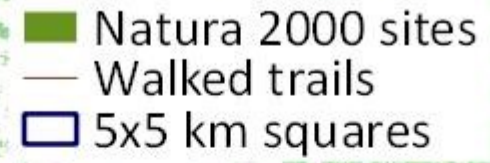
- 348 volunteers participated in snow-tracking
- 1159 trails and >15,000 km walked

■ Natura 2000 sites
— Walked trails

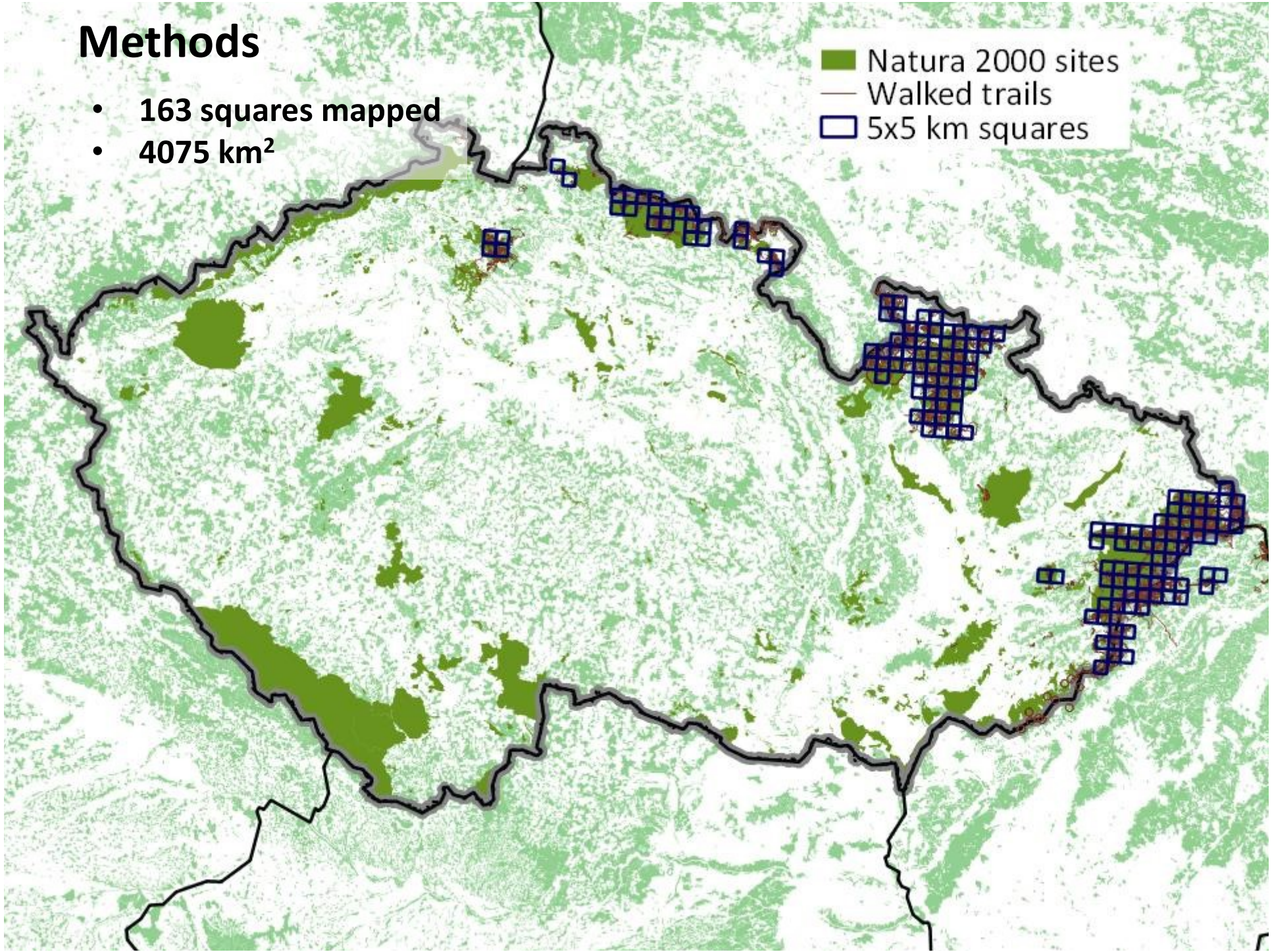


Methods

- 163 squares mapped
- 4075 km²



■ Natura 2000 sites
— Walked trails
□ 5x5 km squares



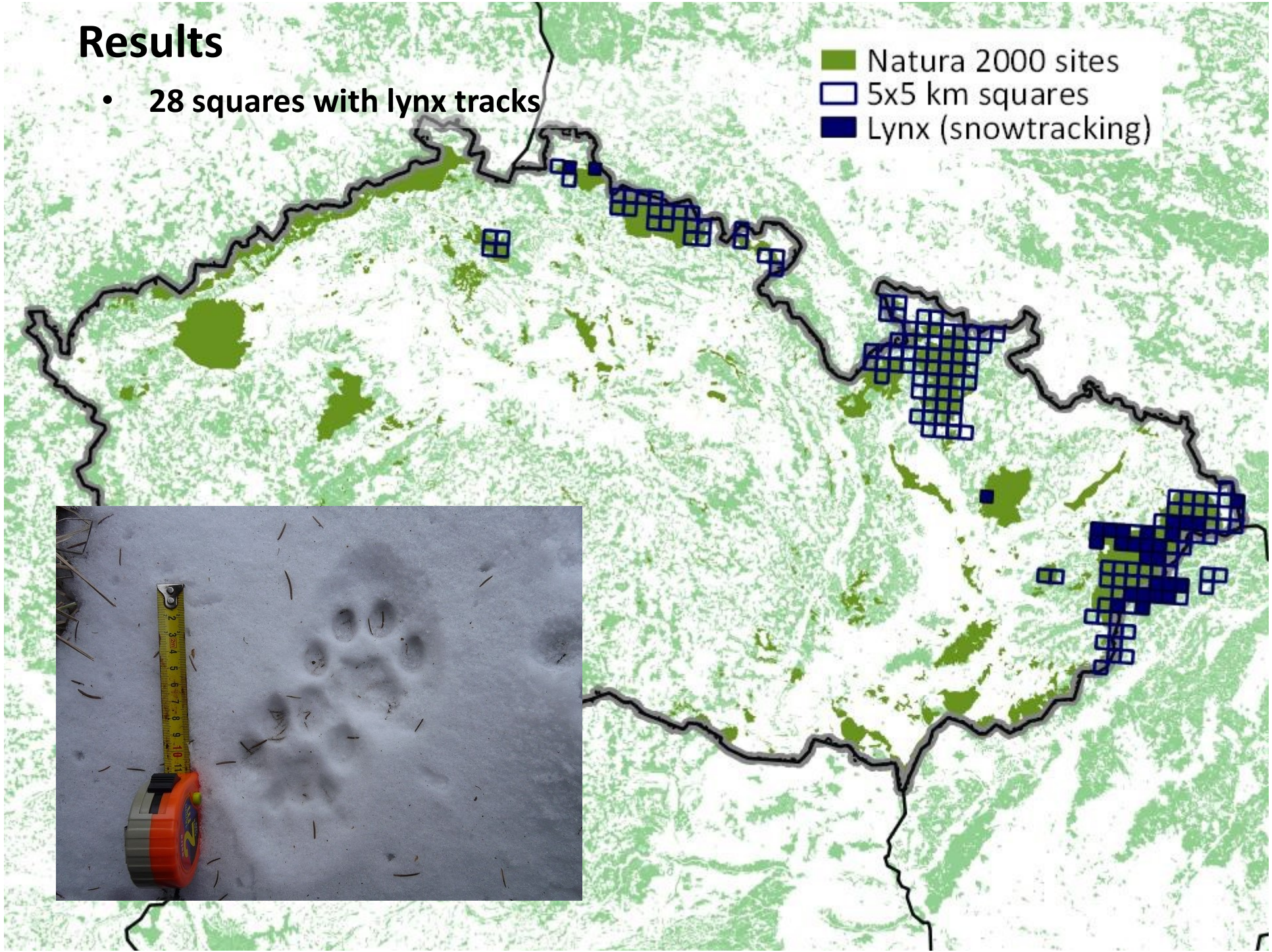
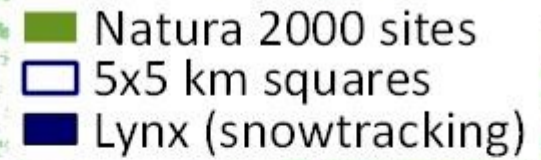
Methods

- 269 locations of camera traps
- 183 squares covered
- >34,000 trap nights

- 
- Legend:
- Natura 2000 sites
 - Walked trails
 - 5x5 km squares
 - ★ Camera traps
- The map displays a study area with a black outline. It features several green patches representing Natura 2000 sites. A network of grey lines indicates walked trails. A grid of blue-outlined squares represents 5x5 km squares, with 183 squares covered. Yellow stars mark the locations of 269 camera traps. The background is a light green and white textured map.

Results

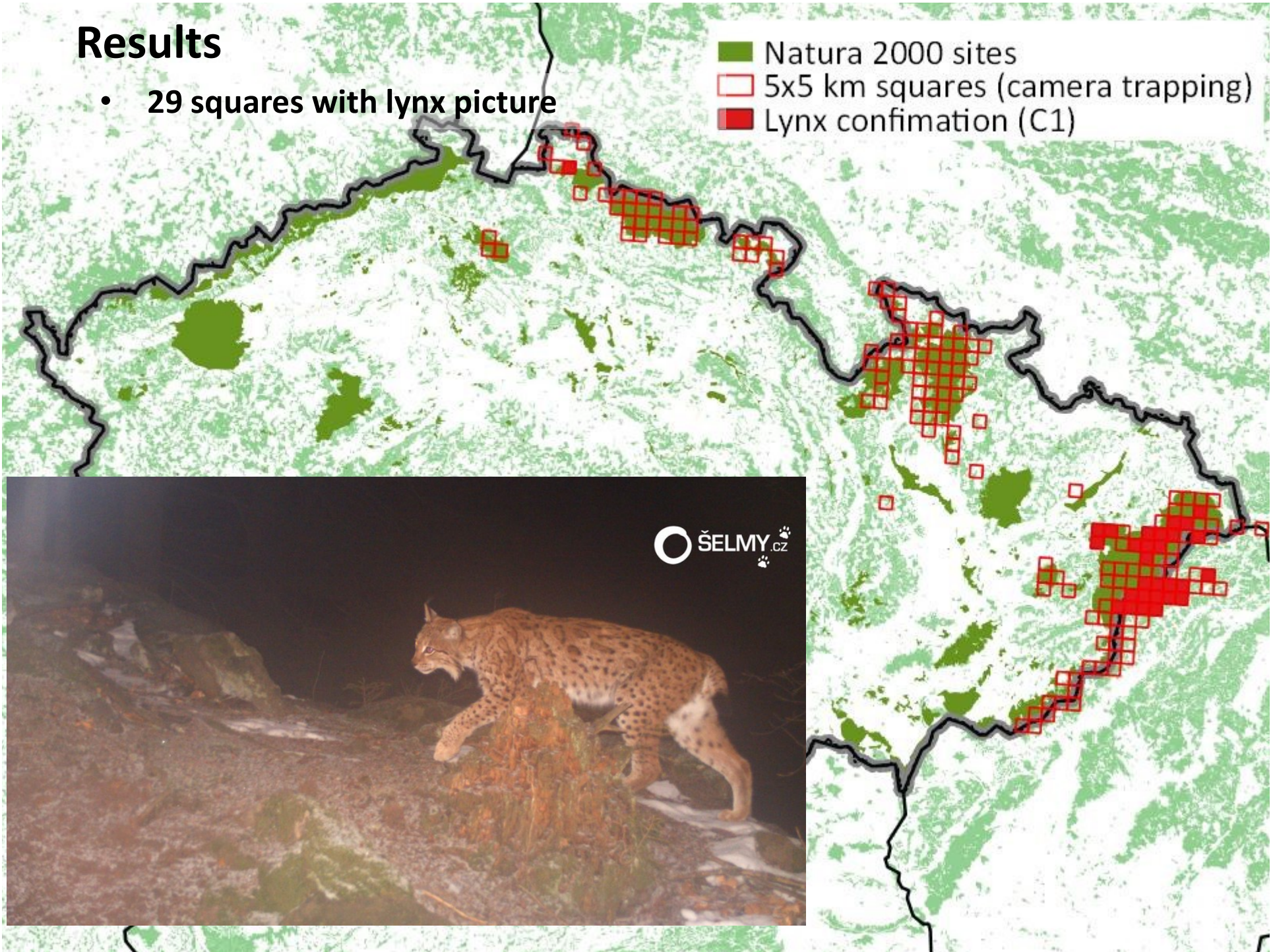
- 28 squares with lynx tracks



Results

- 29 squares with lynx picture

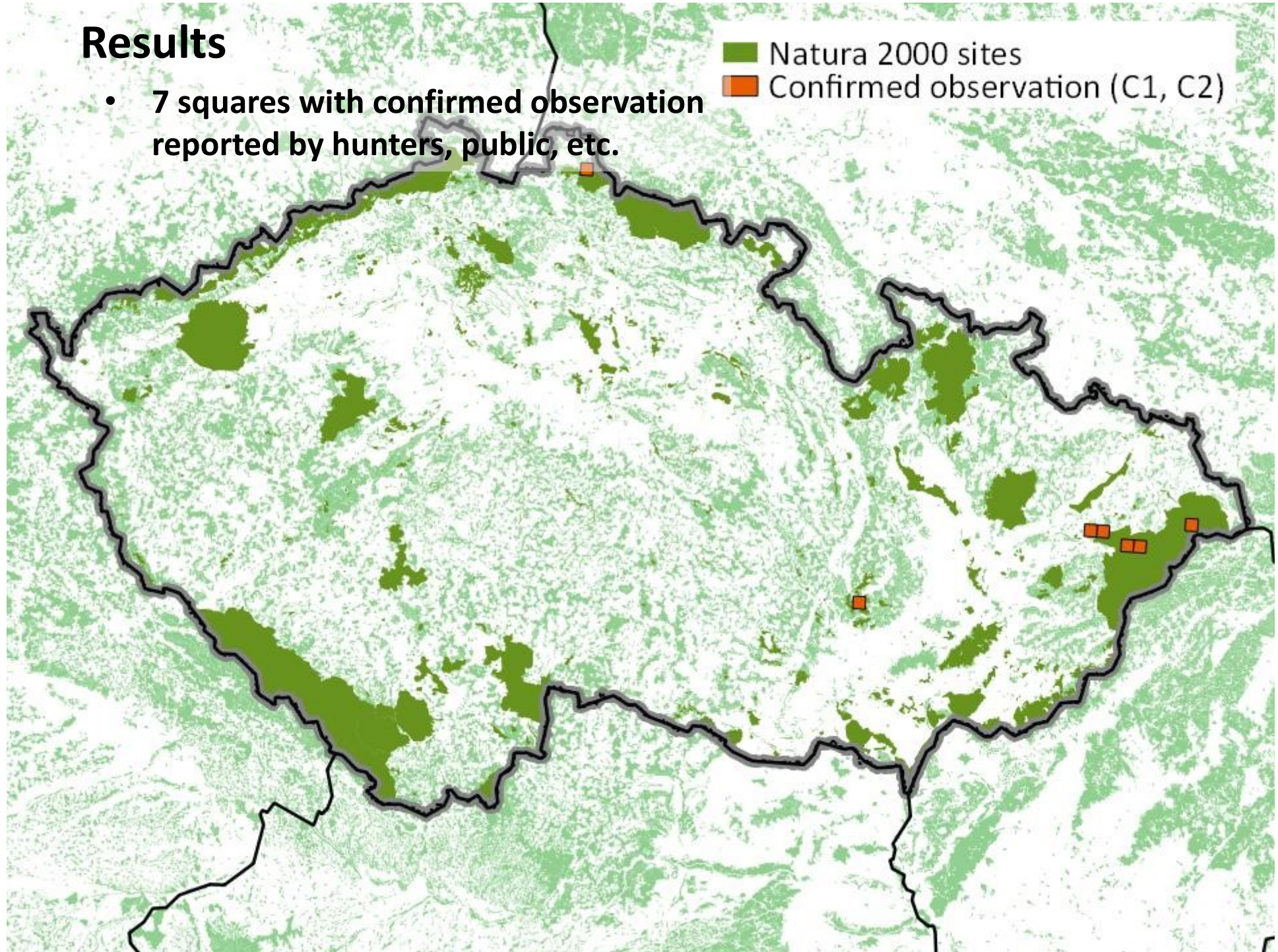
■ Natura 2000 sites
□ 5x5 km squares (camera trapping)
■ Lynx confirmation (C1)



Results

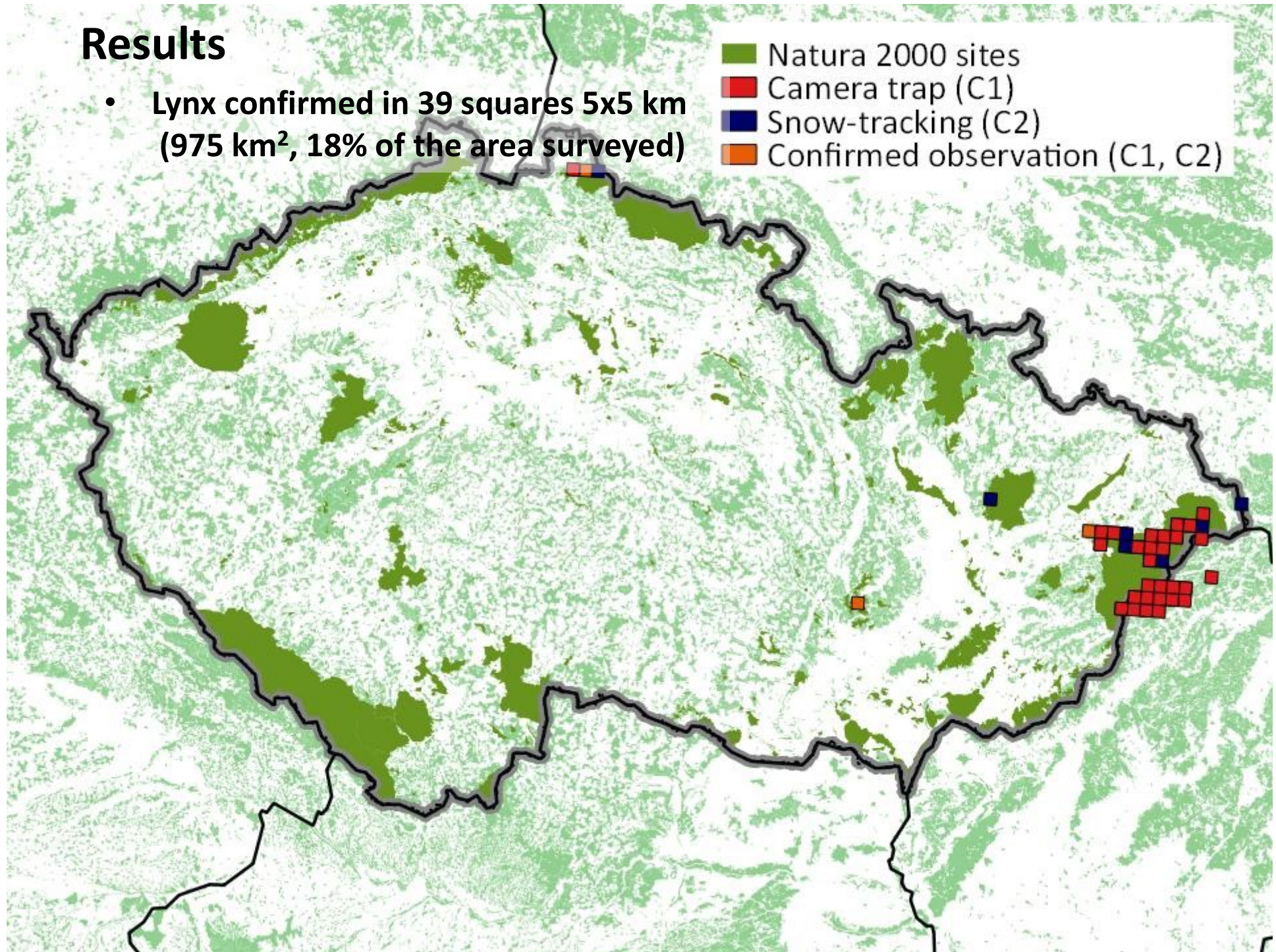
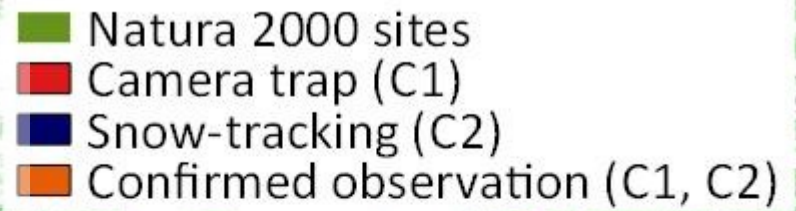
- 7 squares with confirmed observation reported by hunters, public, etc.

■ Natura 2000 sites
■ Confirmed observation (C1, C2)



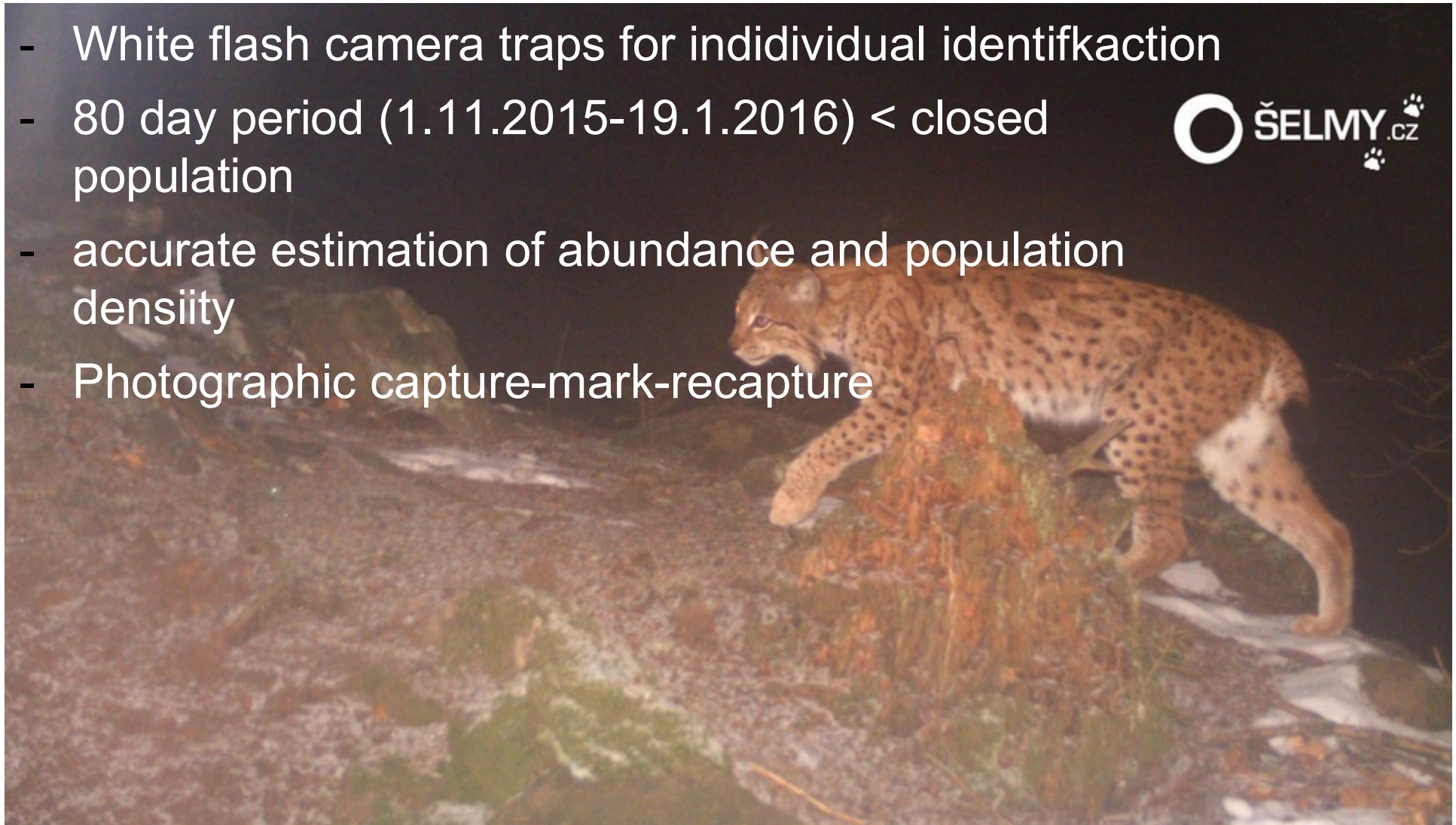
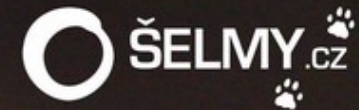
Results

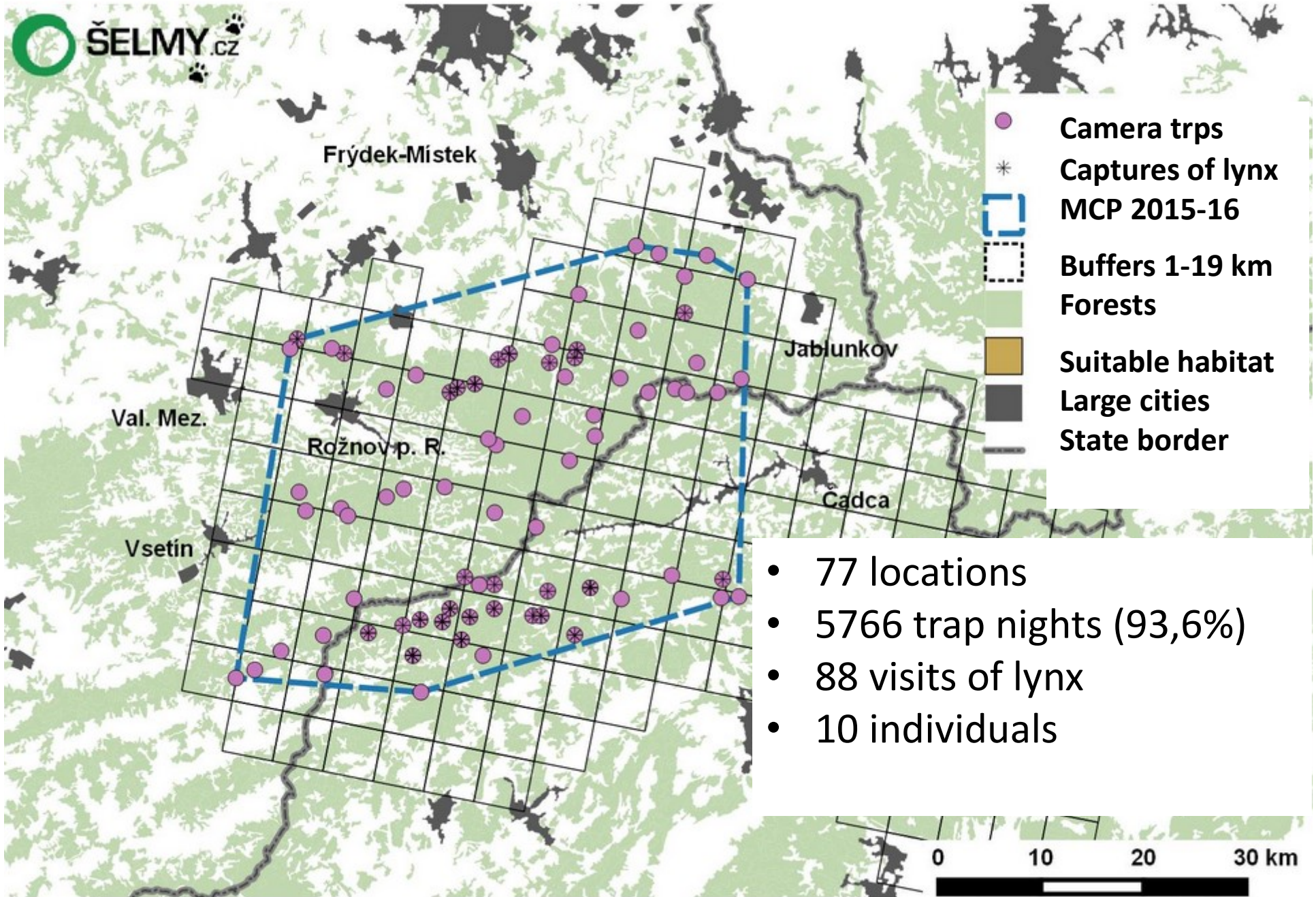
- Lynx confirmed in 39 squares 5x5 km (975 km², 18% of the area surveyed)



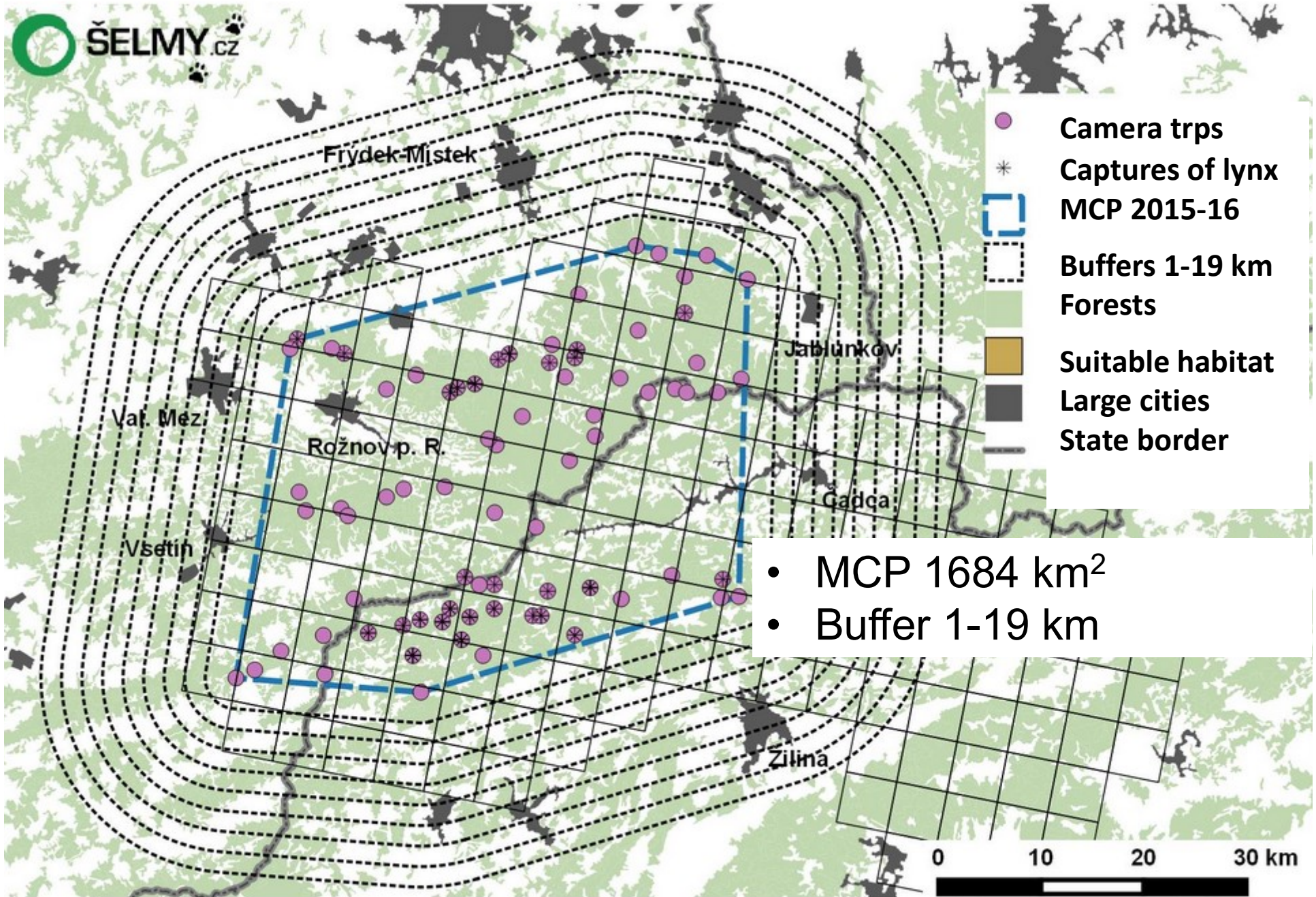
Deterministic monitoring of Eurasian lynx

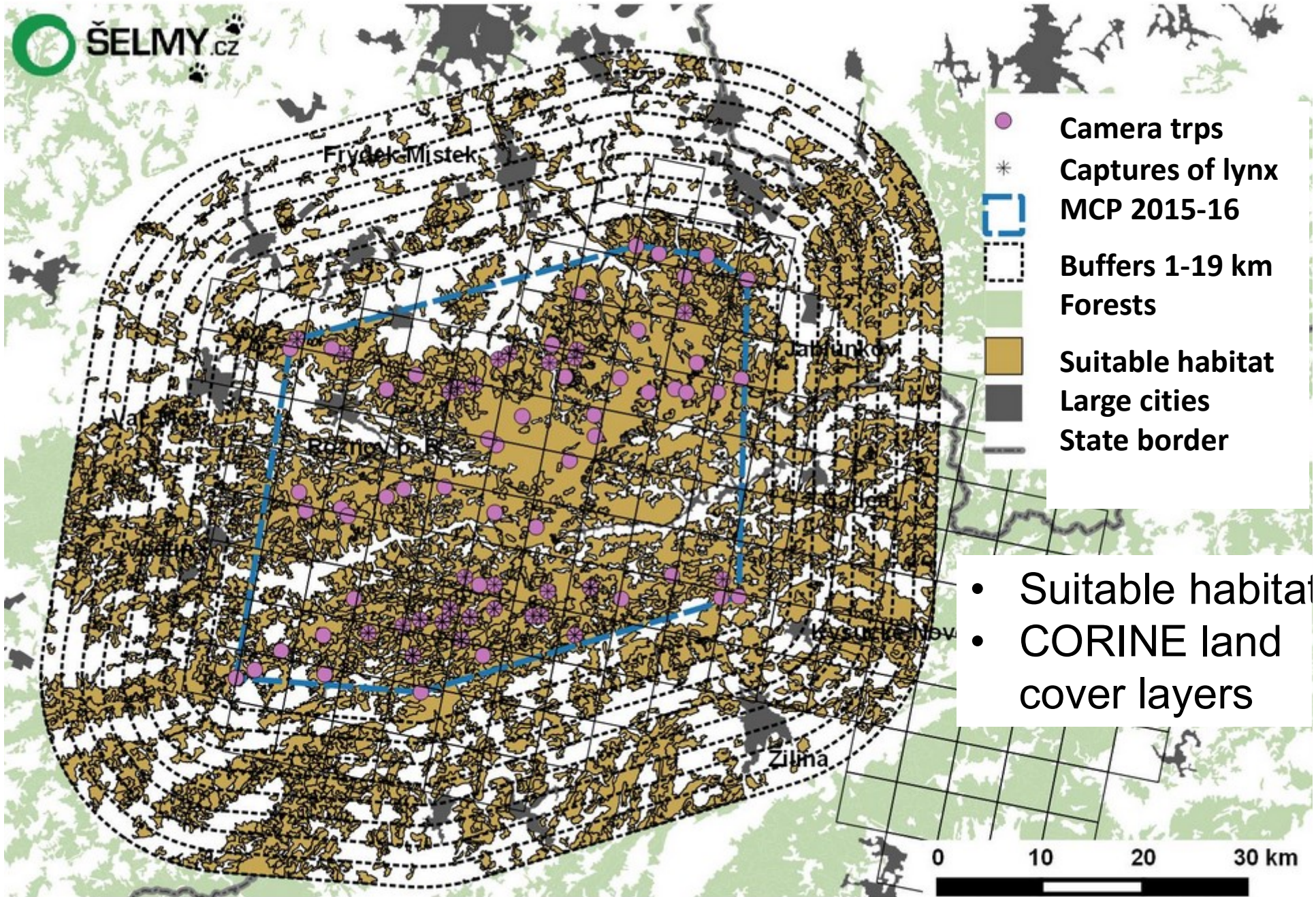
- White flash camera traps for individual identification
- 80 day period (1.11.2015-19.1.2016) < closed population
- accurate estimation of abundance and population density
- Photographic capture-mark-recapture





- 77 locations
- 5766 trap nights (93,6%)
- 88 visits of lynx
- 10 individuals

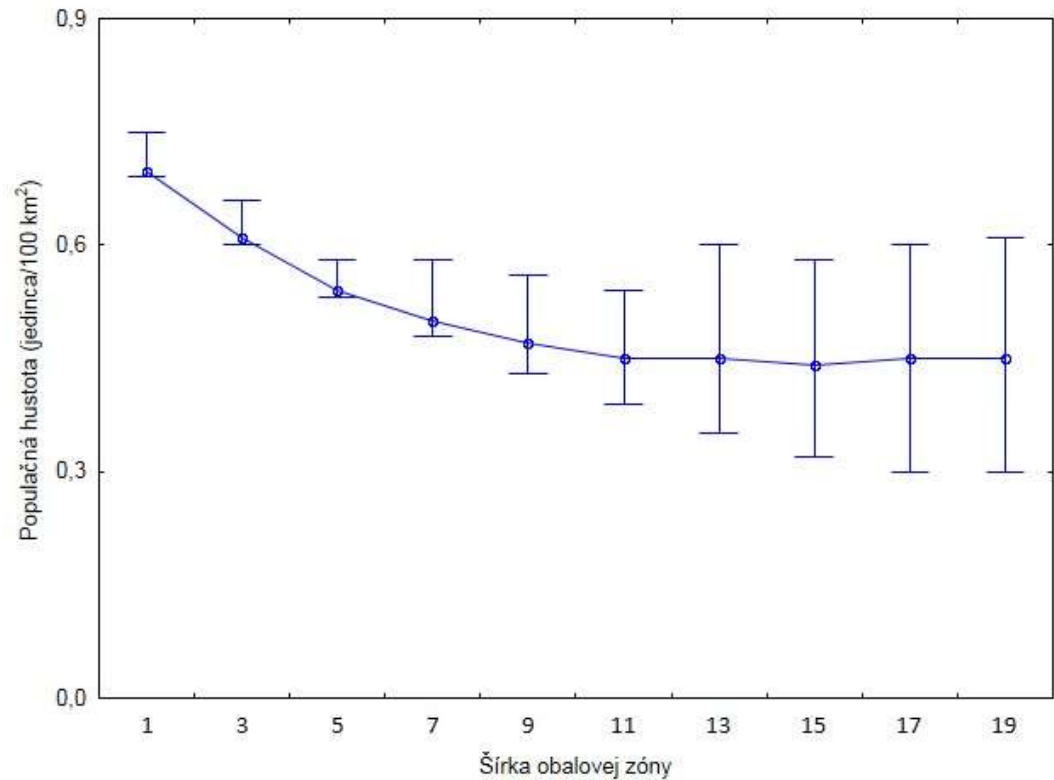




Results

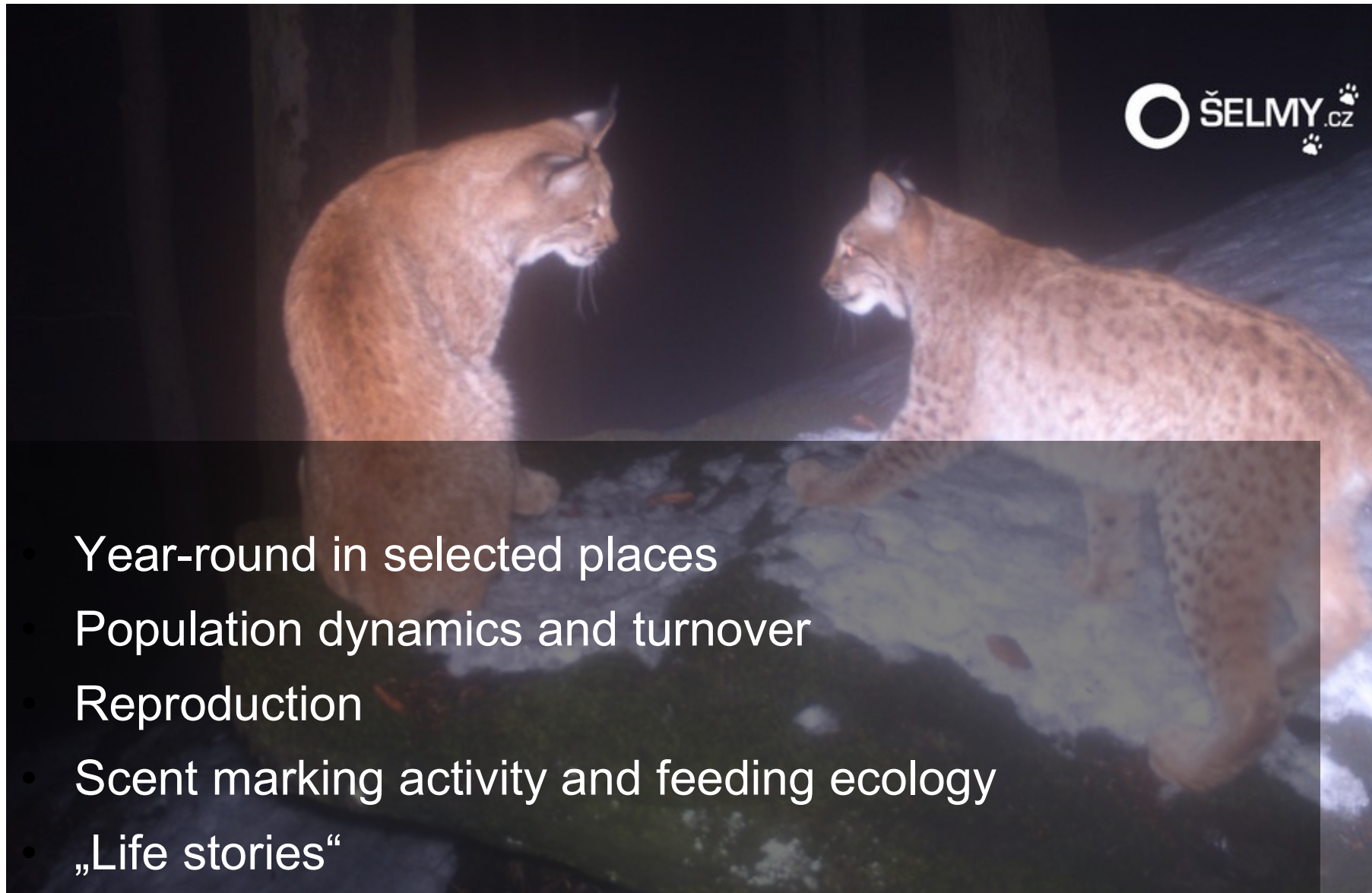
- SPACECAP 

buffer	estimate	minIS	maxIS
1	0,697	0,69	0,75
3	0,61	0,6	0,66
5	0,54	0,53	0,58
7	0,5	0,48	0,58
9	0,47	0,43	0,56
11	0,45	0,39	0,54
13	0,45	0,35	0,6
15	0,44	0,32	0,58
17	0,45	0,3	0,6
19	0,45	0,3	0,61



- **0,45 ind./100 km²** (November-Januray, 16 occasions =80 days)

Opportunistic camera trapping



- Year-round in selected places
- Population dynamics and turnover
- Reproduction
- Scent marking activity and feeding ecology
- „Life stories“

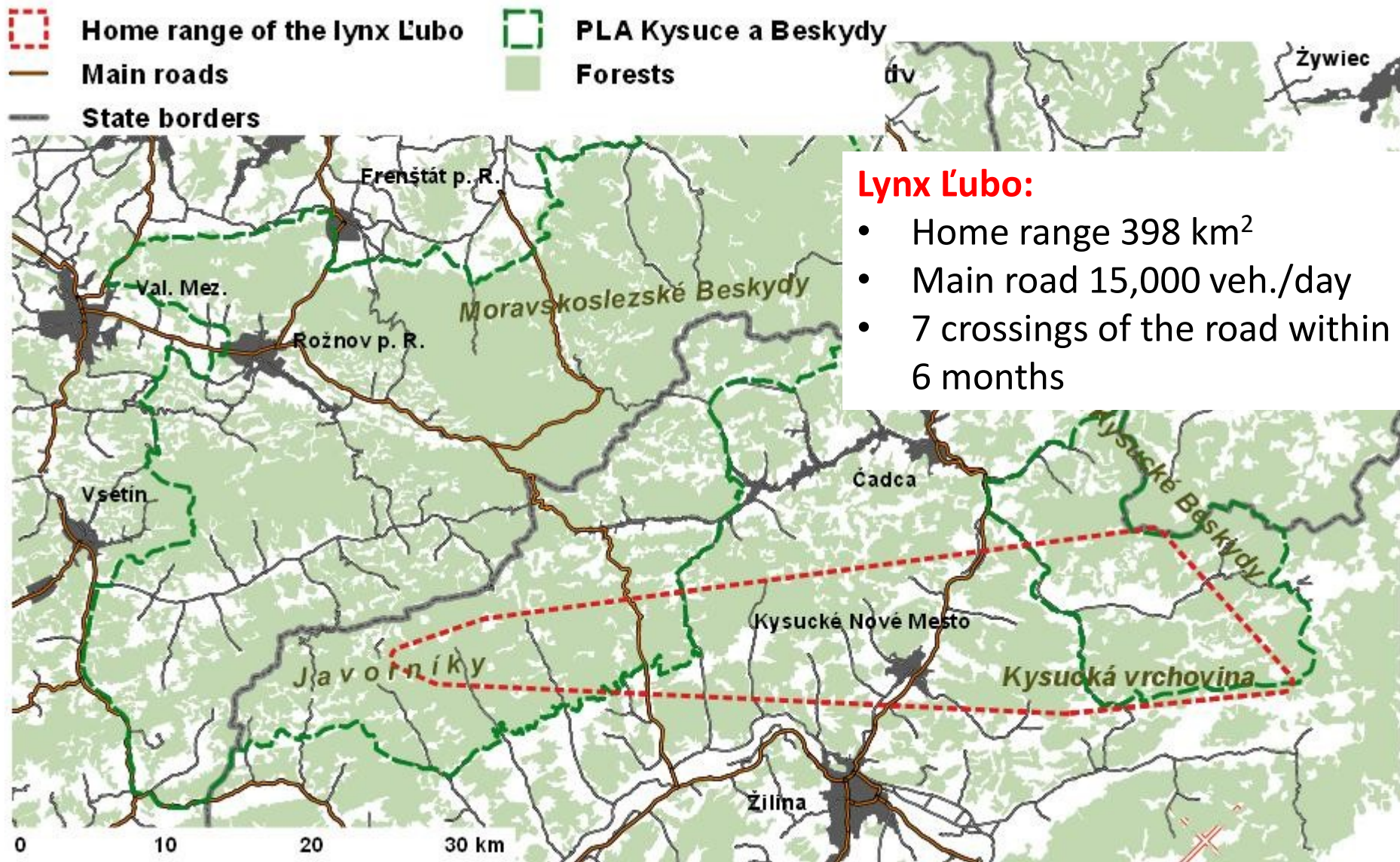
Opportunistic camera trapping

- **Reproduction in 2015/2016:**
 - 5 family groups, but two females probably killed
 - 11 cubs, including 4 killed



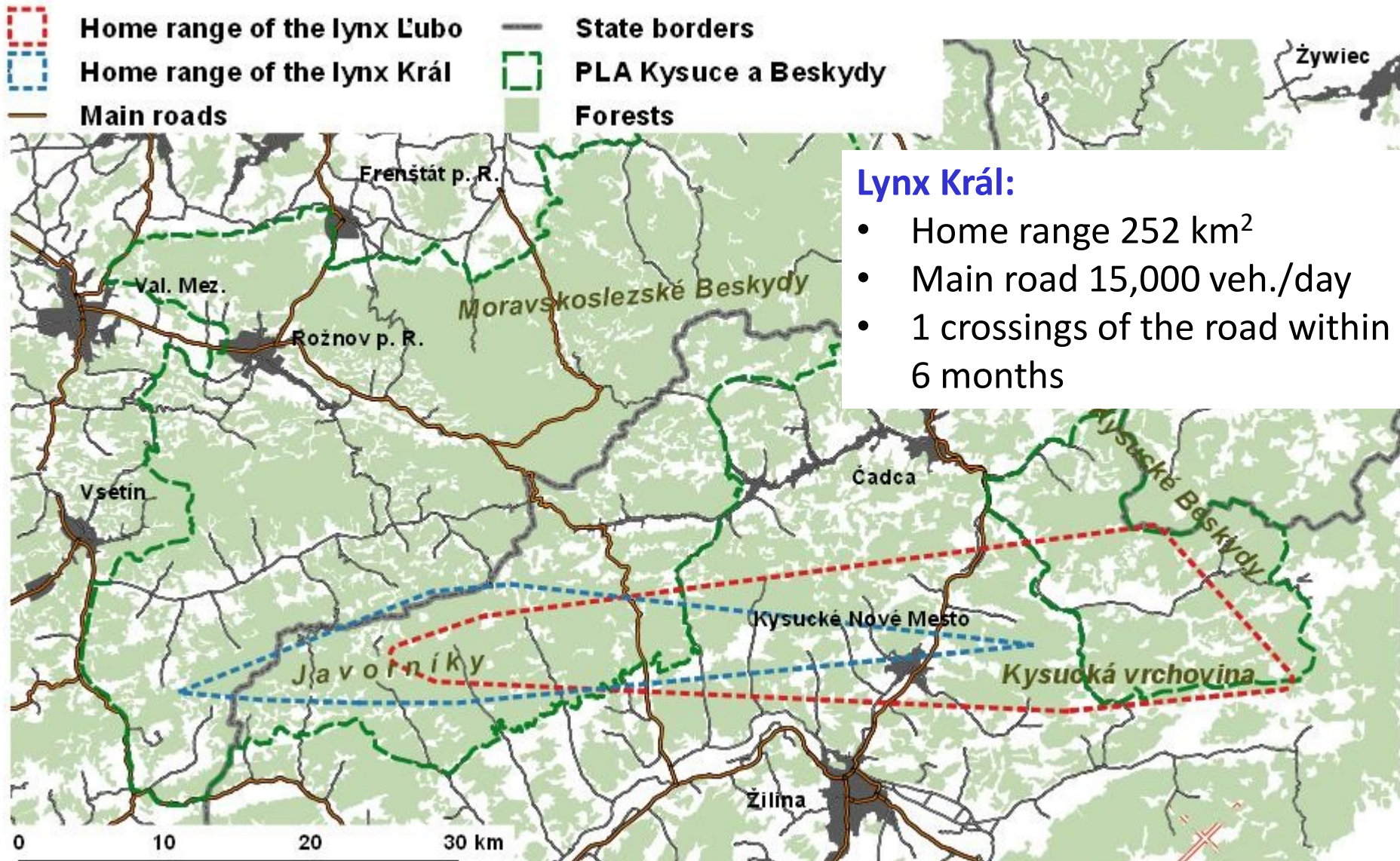
Opportunistic camera trapping

- Movement activity of lynx in the West Carpathians



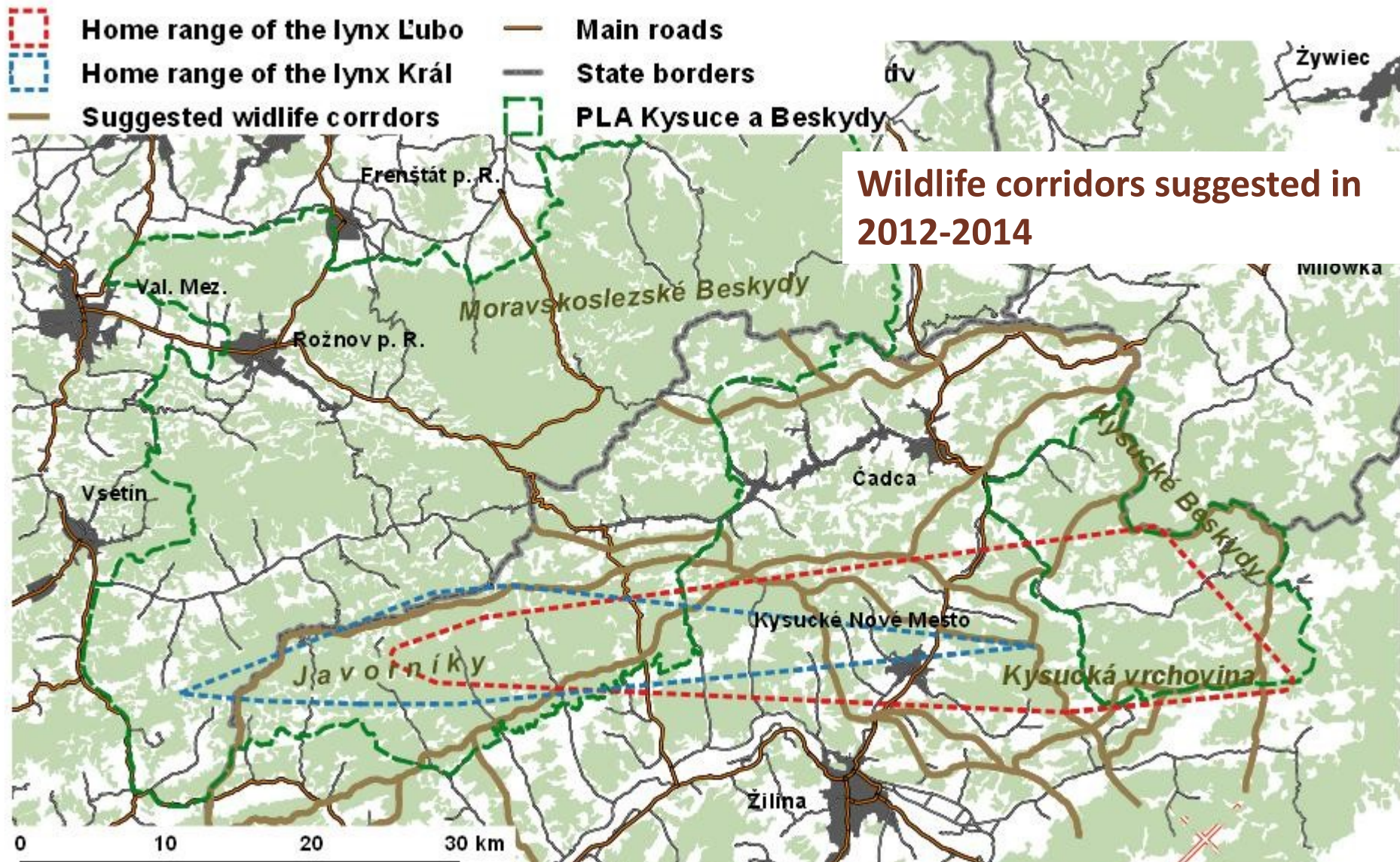
Opportunistic camera trapping

- Movement activity of lynx in the West Carpathians



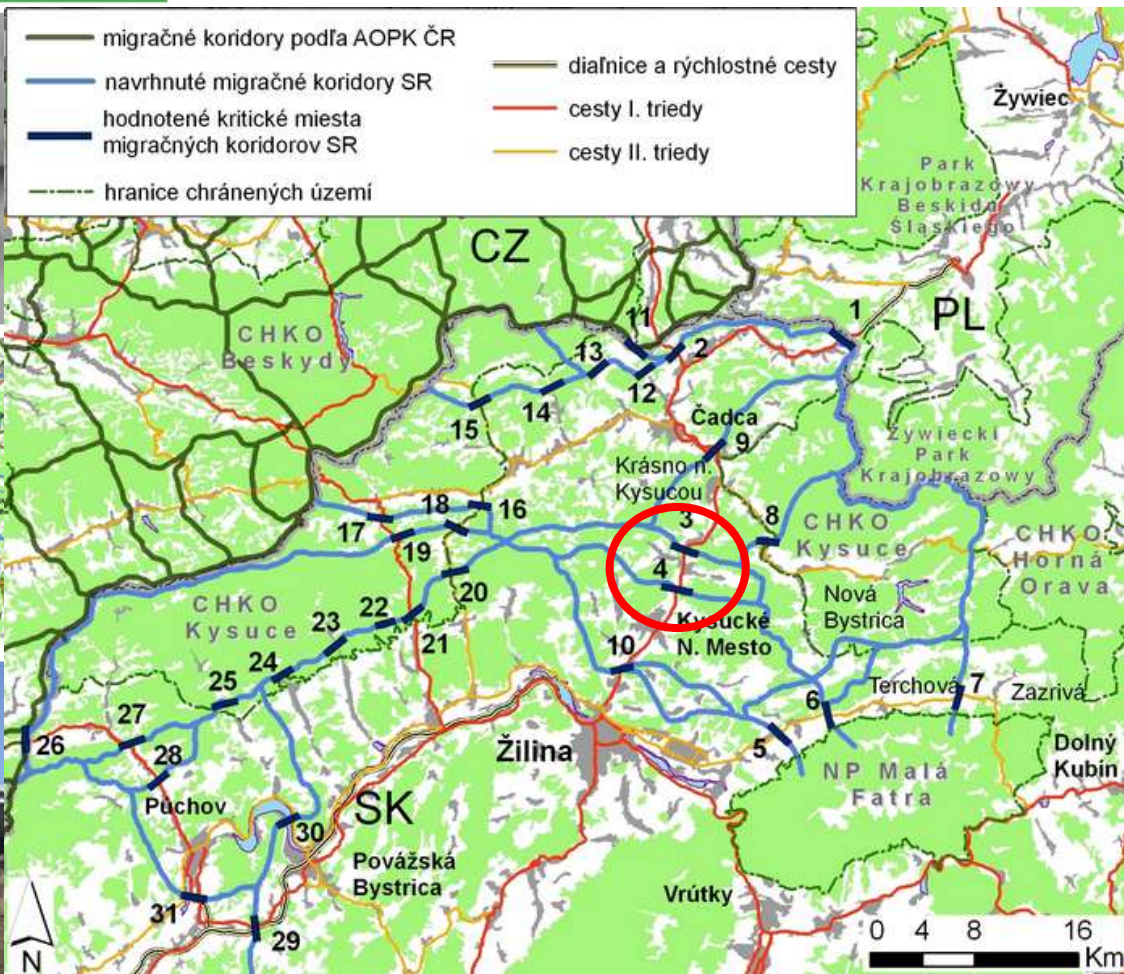
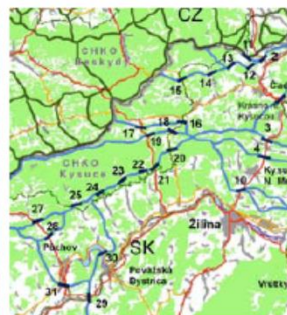
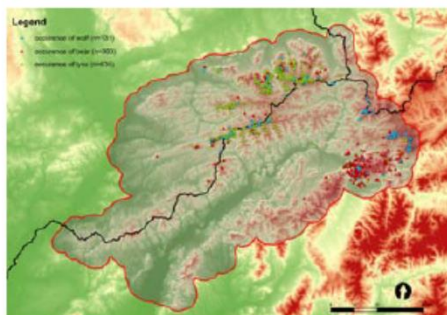
Opportunistic camera trapping

- Movement activity of lynx in the West Carpathians



Analýza výskytu velkých šelem a průchodnosti krajiny v Západních Karpatech

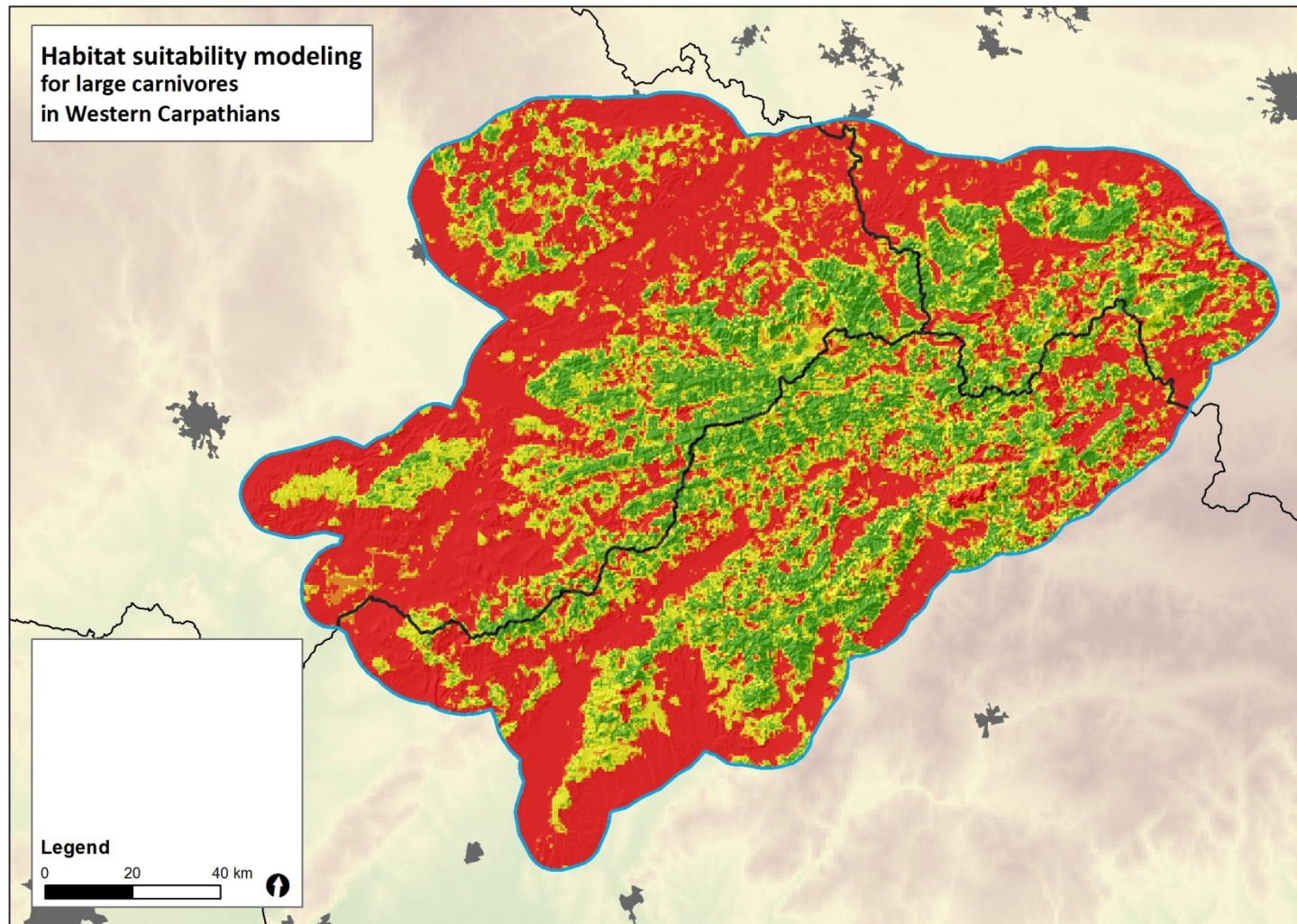
Lesnická a dřevařská fakulta Mendelova univerzita v Brně



Habitat suitability modeling

Lynx habitat model for the West Carpathians

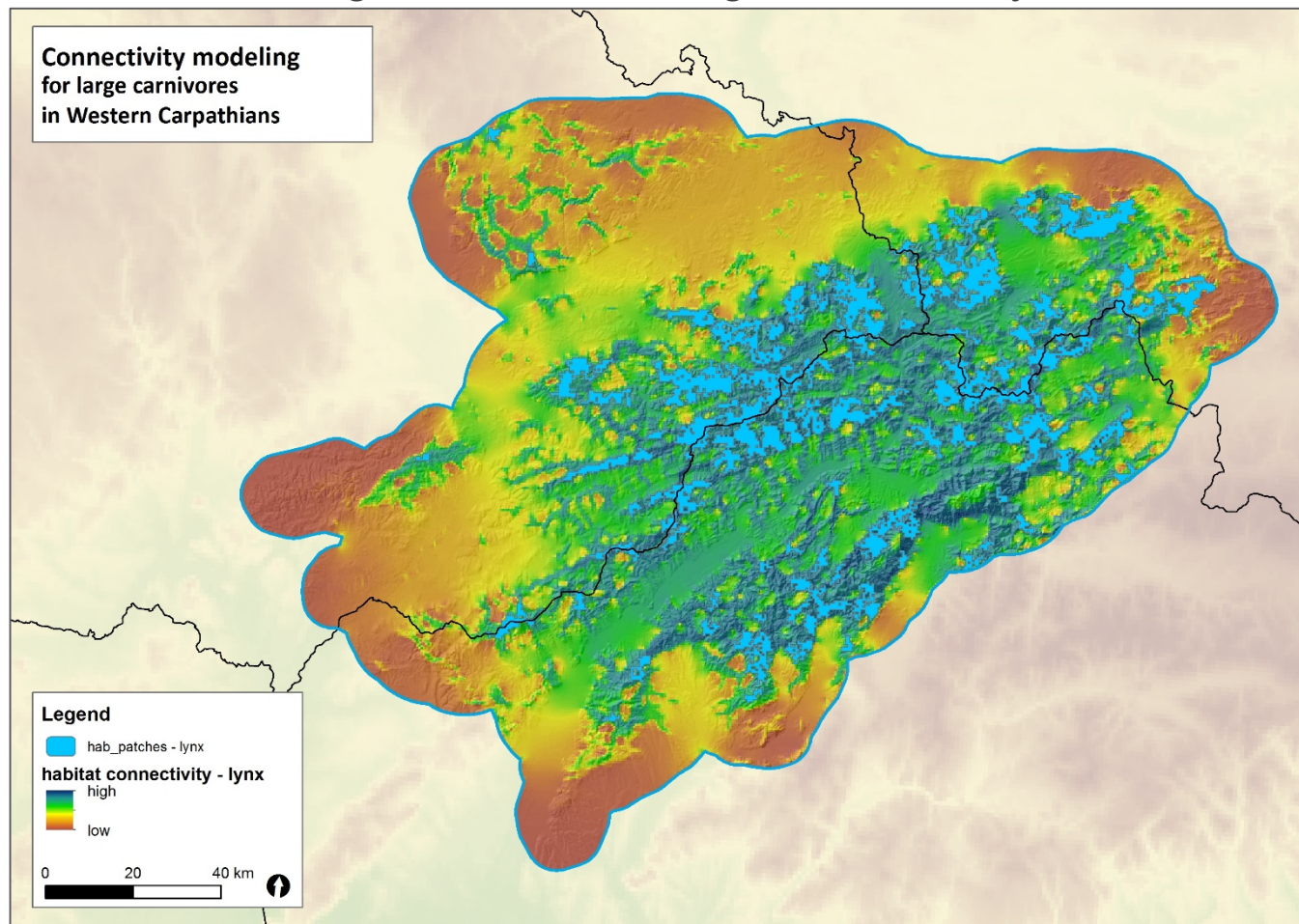
(based on data of FoE CZ, SdN „WILK“, Fatranský spolok)



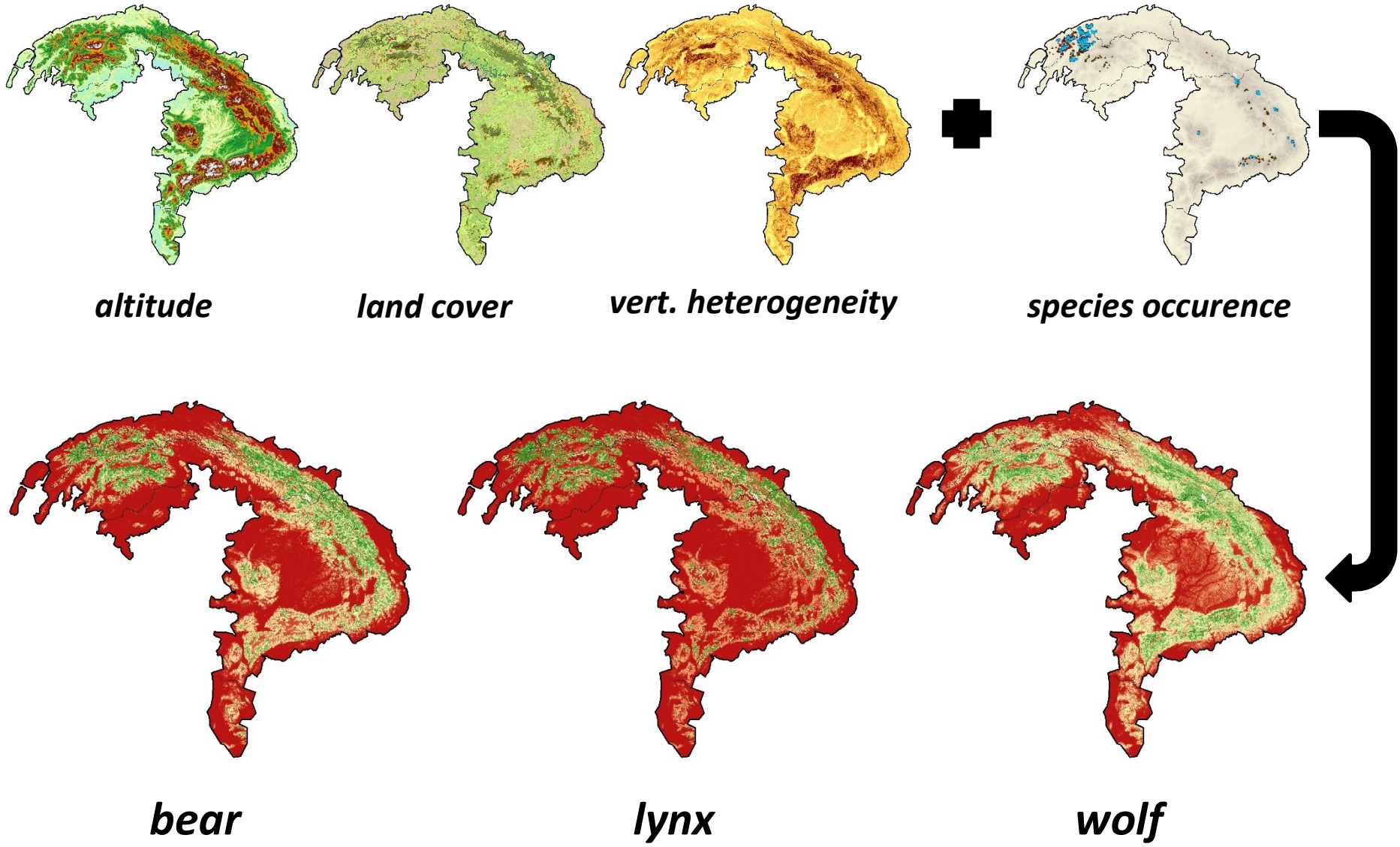
Ecological network modeling

- migration zones & corridors delineation

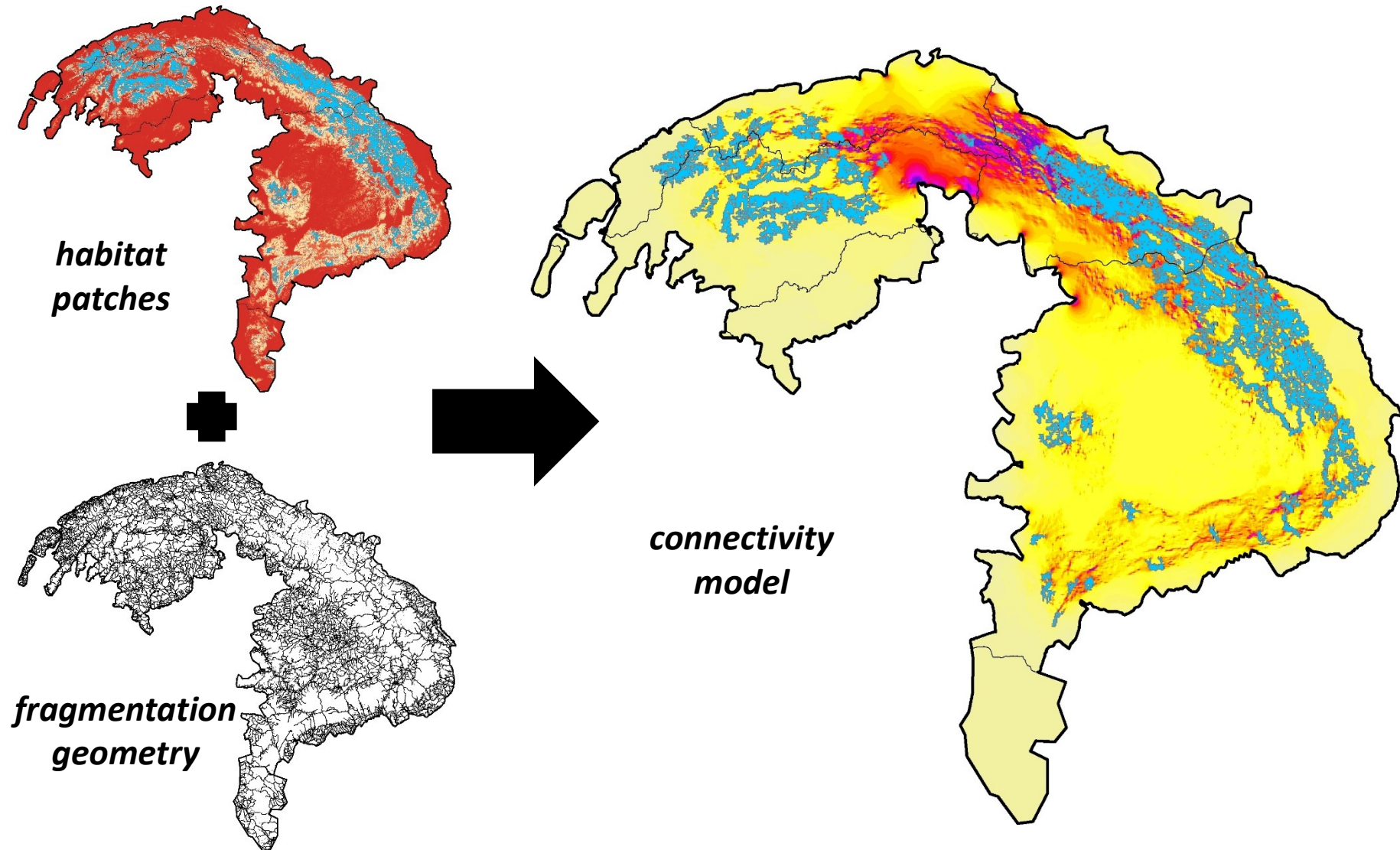
- spatial requirements & dispersal ability of lynx were set according to **telemetry studies**
- delineation of migration zones using Circuit theory (*McRae et al. 2008*)



Extension across the Carpathians

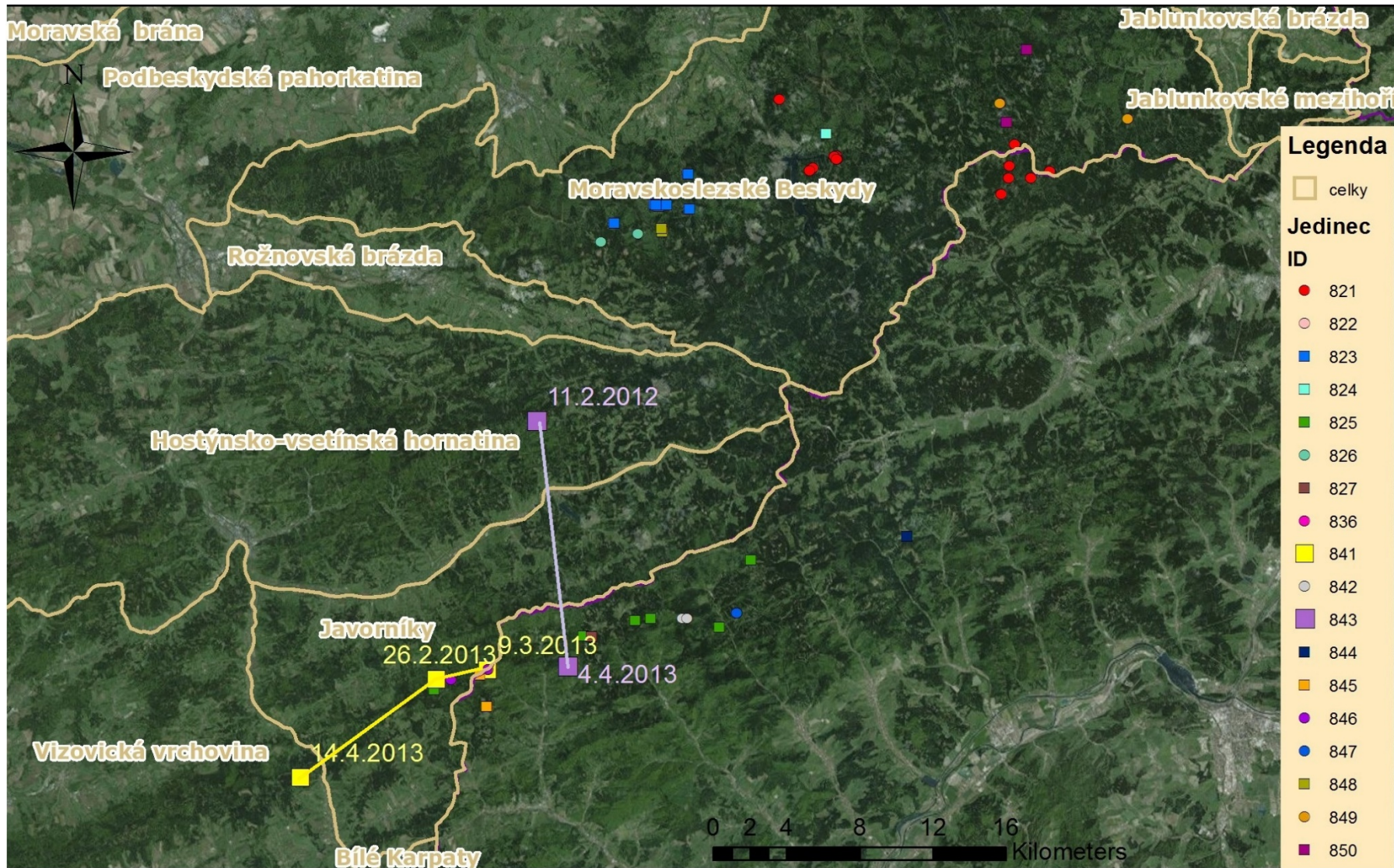


Extension across the Carpathians



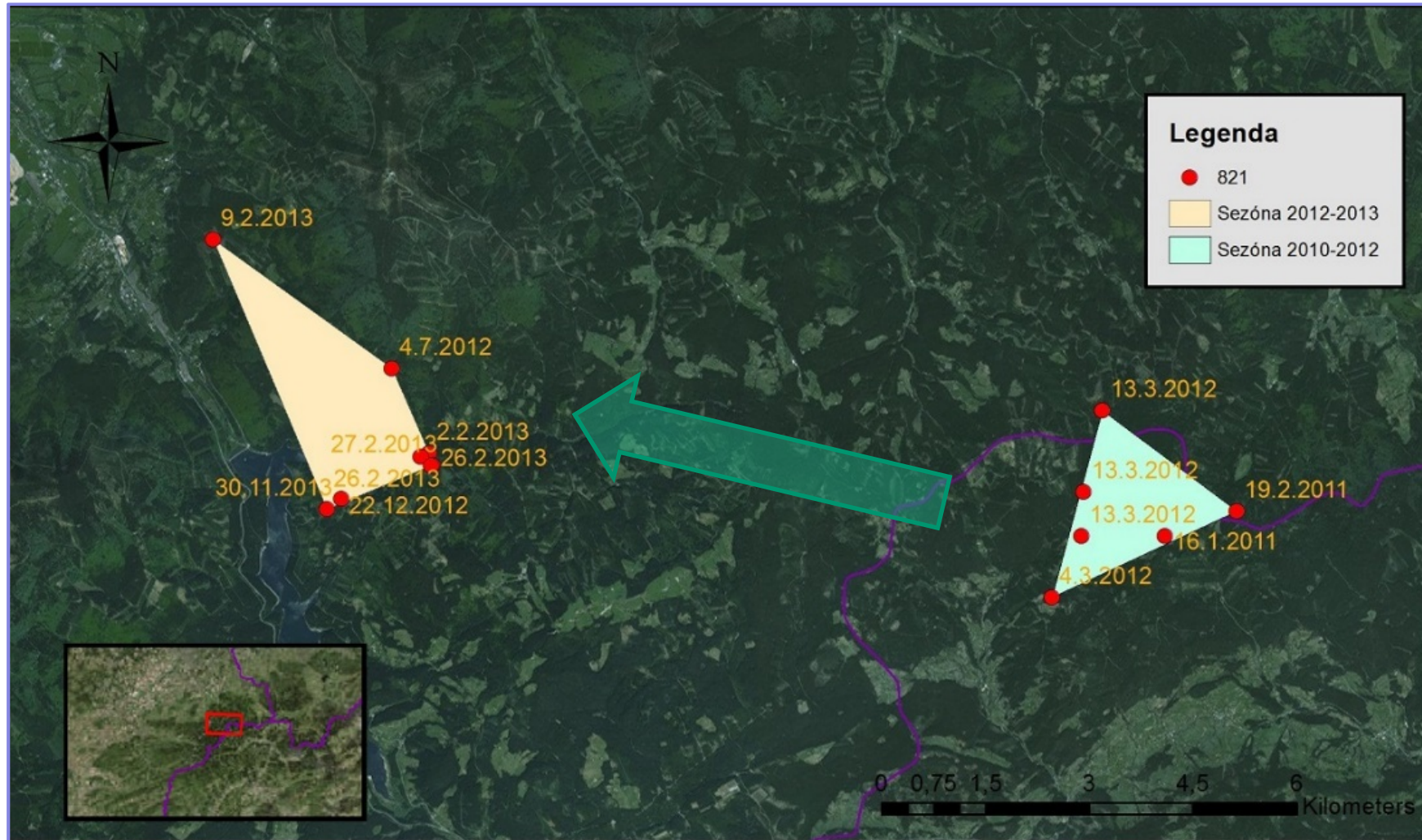
Genetic monitoring

- Movement across different mountain ranges



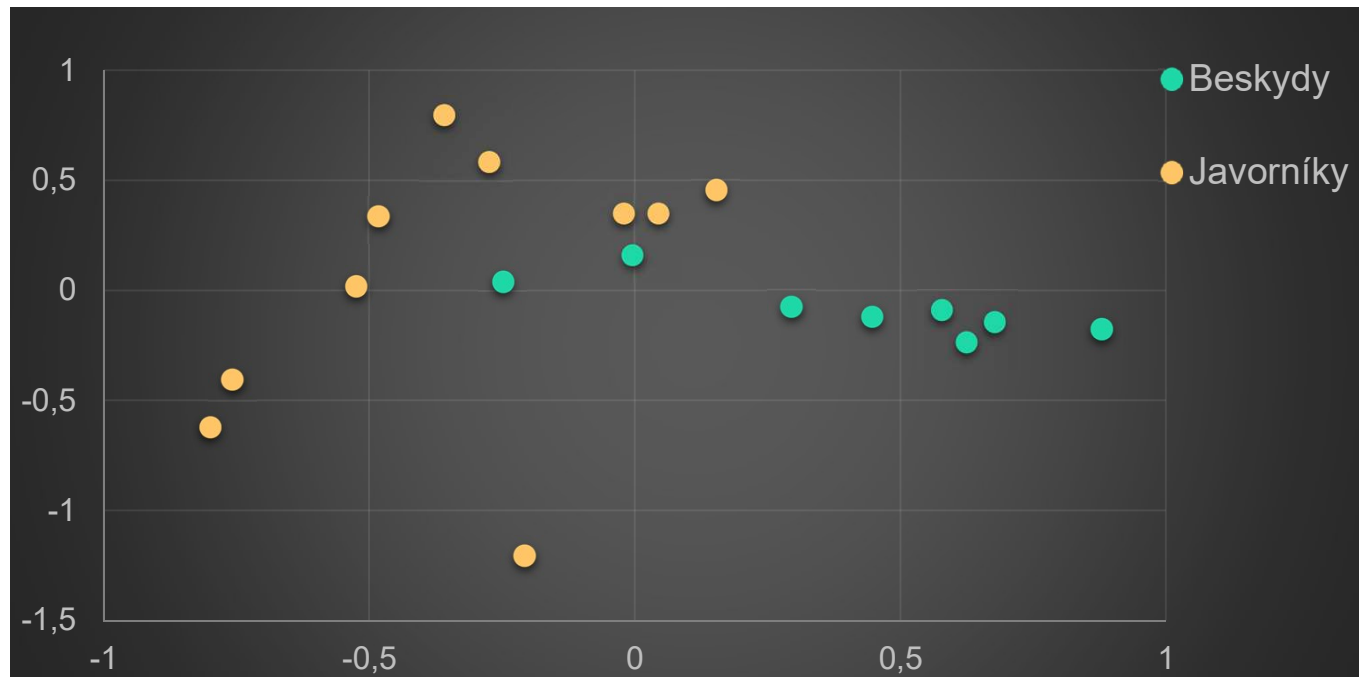
Genetic monitoring

- Change of home range: 2010-2013?



Genetic monitoring

- **Weak structure between two mountain ranges – two family groups**



Non-invasive genetics of the Eurasian lynx of the Western Carpathians

Barbora Turbaková^{1,2}, Tomáš Skrbínšek³, Maja Jelenčič³, Miroslav Kutal^{4,5}

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² University of Ostrava, Faculty of Science, Department of Biology and Ecology, Chittussiho 10, 71000 Ostrava, Czech Republic
³ University of Ljubljana, Biotechnical Faculty, Jamnikarjeva 101, 1000 Ljubljana, Slovenia
⁴ Mendel University in Brno, Faculty of Forestry and Wood Technology, Institut of forest ecology, Zemědělská 3, 61300 Brno, Czech Republic
⁵ Friends of the Earth Czech Republic, Olomouc branch, Dolní Náměstí 38, 77900 Olomouc, Czech Republic

INTRODUCTION

After the long persecution during the last centuries in Europe [1], the Eurasian lynx (*Lynx lynx*) have begun to return slowly to our landscape. In the Czech Republic, in the Moravian-Silesian Beskids and the Javorníky mountains, there is the edge of the species distribution in the Carpathians. This population is the only autochthonous population of lynx in the Czech Republic and although it is connected with the main source population in the Carpathians, its size is low and fluctuating. Therefore, it is important to monitor the population and study factors which threaten it the most, i.e. poaching, migration barriers and habitat fragmentation. The main aim of this study was to describe genetic variability and structure of the study population, estimate the population size and reveal the spatial activity and kinship of individuals.

MATERIALS AND METHODS

A total of 156 of scat, hair and urine samples were collected in the study area during snow-tracking sessions between 2009–2013. DNA from the samples was extracted using commercial kits (GeneElute Mammalian Genomic DNA Miniprep Kit, Sigma; QIAmp TM DNA Stool Mini Kit, Qiagen) and we followed protocols recommended by the manufacturer with extended steps [2]. As genetic markers we applied in total 19 microsatellite loci and the sex specific marker SRY.

CONCLUSION

We couldn't detect any significant deviations from Hardy-Weinberg expectations, however the number of individuals included in the study was low.

Genetic diversity of the West-Carpathian population is higher than the genetic diversity of the Dinaric population (which is reintroduced and severely inbred), although the West-Carpathian population occurs only on the edge of the species distribution in the Carpathians.

The West-Carpathian population is slightly structured into two groups, what can be explained by presence of two „family“ groups – the first one in the Javorníky mountains and the second one in the Moravian-Silesian Beskids.

REFERENCES

- [1] Schmidt K., Ratkiewicz M., Konopinski M. K. 2011: The importance of genetic variability and population differentiation in the Eurasian lynx *Lynx lynx* for conservation, in the context of habitat and climate change. *Mammal Rev* 41:112–124.
- [2] Skrbínšek T., Jelenčič M., Waits L., Kos I. & Trontelj P. 2009: Highly efficient multiplex PCR of noninvasive DNA does not require pre-amplification. *Mol Ecol Res* 10: 495–501.
- [3] Kalinowski S. T., Taper M. L. & Marshall T. C. 2007: Revising how the computer program CERUS accommodates genotyping error increases success in paternity assignment. *Molecular Ecology* 16: 1099–1106.
- [4] Sindičič M., Polanc P., Gomerčič T., Jelenčič M., Huber D., Trontelj P. & Skrbínšek T. 2013: Genetic data confirm critical status of the reintroduced Dinaric population of Eurasian lynx. *Conservation Genetics* 14(5): 1009–1018.

RESULTS

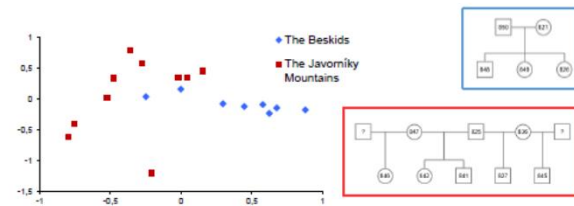
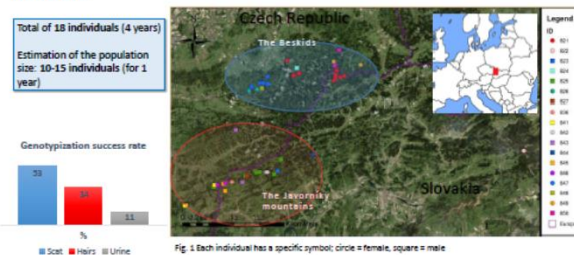


Fig. 2 Factorial correspondence analysis indicates a weak structure of West-Carpathian population: the first axis explains 17.26 % and the second 15.44 % of genetic variability. There does not seem to be any differentiation on the Y axis, and the X axis probably shows the family structure (one family in the Javorníky Mountains, one in the Beskids). The fixation index also indicates weak population structuring ($F_{st} = 0.096$, $P = 0.00167$).

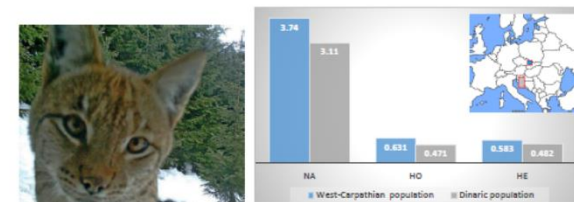


Fig. 3 Connection of kinship analysis based on genetic data processed in Cervus software [3] and outputs from the genetic camera trap survey and snow-tracking enabled to create the two pedigrees. In the blue frame there is the Beskids' „family“ and in the red one there is the Javorníky mountains' „family“.

Fig. 4 Picture obtained during camera trap survey (Friends of the Earth Czech Republic, Olomouc branch)

Fig. 5 Genetic diversity of the West-Carpathian (blue) and Dinaric (grey) population: (N_A) = number of alleles per locus, H_o = observed heterozygosity, H_e = expected heterozygosity. Genetic diversity of the West-Carpathian population is higher despite the fact that it is calculated just from the dataset of 17 individuals (one individual from distant area was omitted from the analysis) in contrast to the dataset of 90 individuals from Dinaric population.

Wolf monitoring

- Signs of wolf occurrence and snow-tracking
- Camera trapping
- Simulated howling
- Pack localization, reproduction status
- Genetics
- Diet and parasitology analyses



Wolf in Bohemia (West Czechia)

- **Reproduction confirmed every year since 2014**
- **2015–2016: pack with >7 wolves**
- **Summer 2016: > 10 wolves**



Foto: Hnutí DUHA Olomouc

Wolf in Bohemia (West Czechia)

- **Sumer 2016: 3 confirmed reproductions**

Doksy area

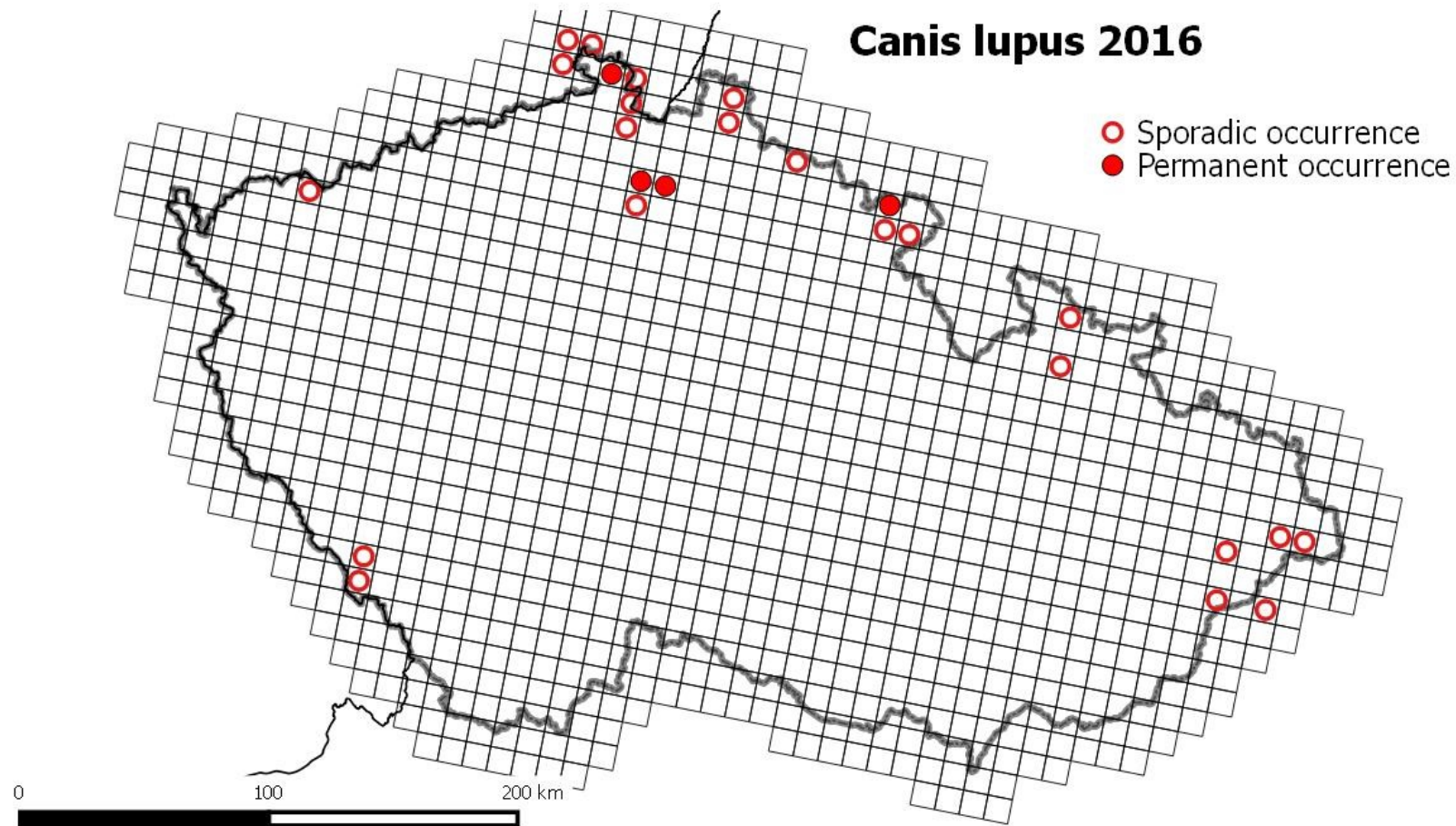


Photo: Friends of the Earth

PLA Broumovsko



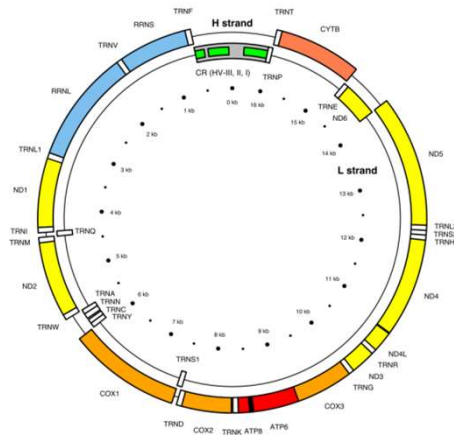
Current occurrence of wolf in the Czech Republic



Wolf genetics

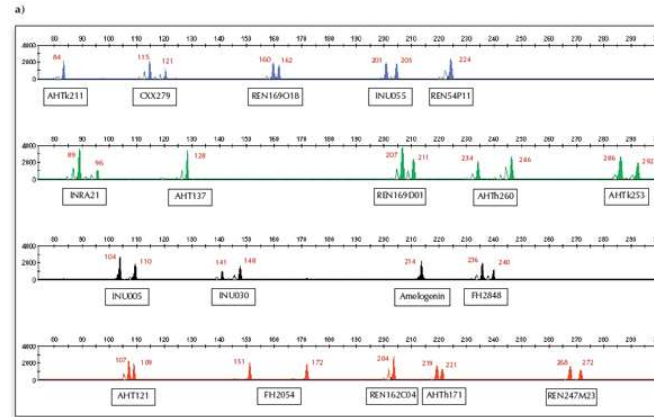


mtDNA control region



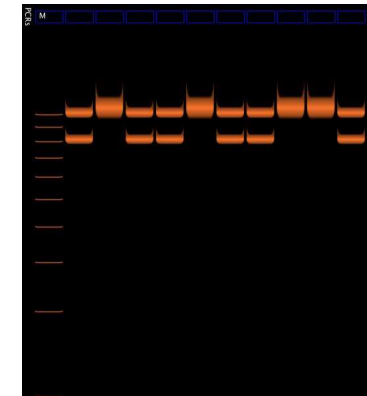
matrilinear structure

18 nuclear microsatellites



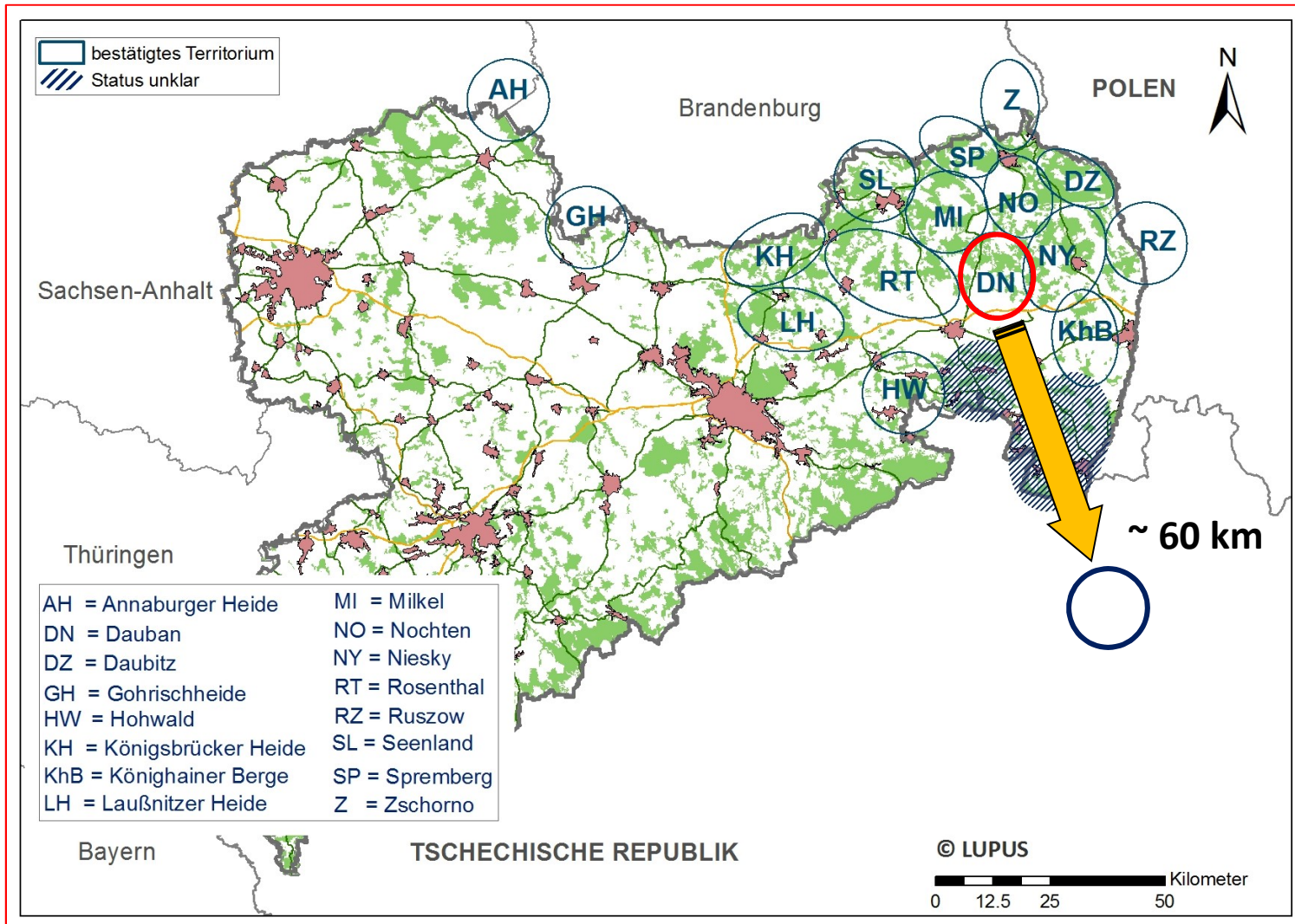
population structure

amelogenin



sex determination

Origin of wolves from Doksy area



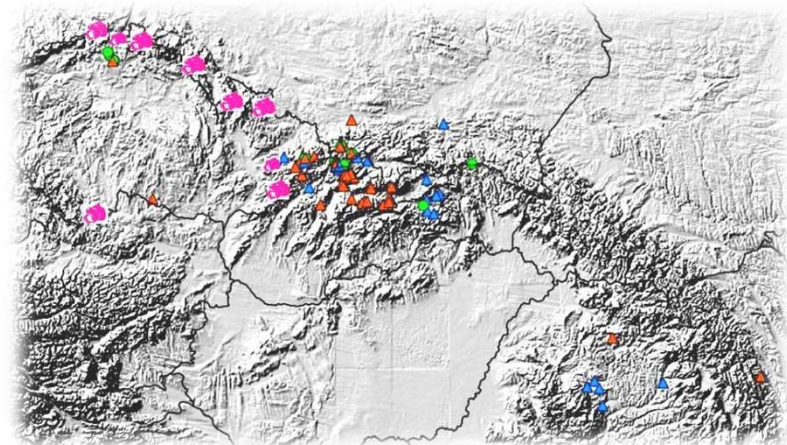
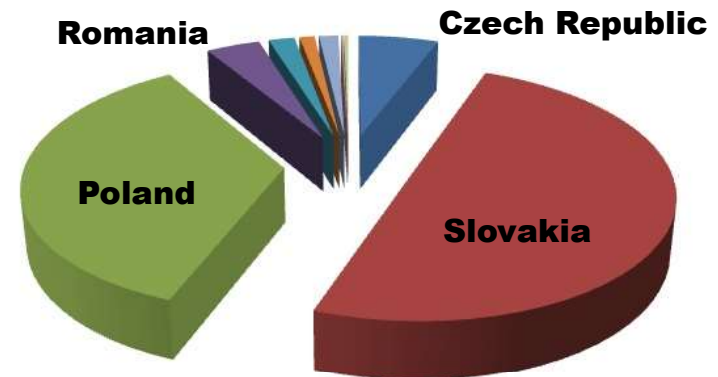
genetics:



More than 700 samples from Central Europe, Carpathians and adjacent regions

Details about occurrence of wolf in Czech Republic (Sudetic and Beskydy mountains)

Landscape genetic approach, details about wolf population structure at contact of Carpathian and Central European populations



Summary

- **Stratified monitoring and data validation > reliable distribution maps**
- **Permanent lynx occurrence is limited to Carpathian area (and population density remains low – about 0,45 ind./km²)**
- **Wolf permanently occurs out of the Carpathian range (3 confirmed packs in West Czechia)**
- **Landscape in the West Carpathians is highly fragmented, but so far still permeable for large carnivores.**

Thanks for you attention

Acknowledgements

Supported by a grant from Island Lichtenstein and Norway and EuroNatur Foundation.

Volunteers of Wolf Patrols

Institute of Vertebrate Biology

More information:

www.selmy.cz

www.carnivores.cz



Ministerstvo životního prostředí



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