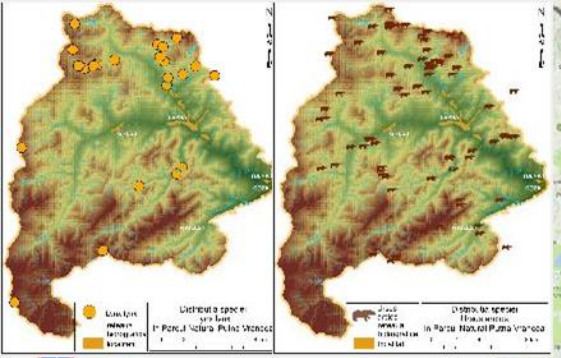
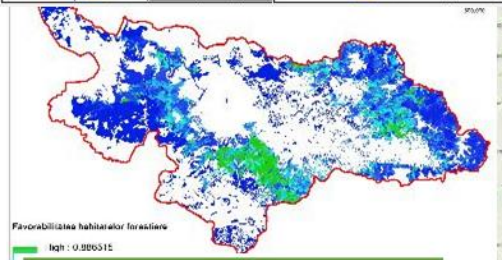
Large carnivores monitoring methods suitable for Romania developed in the framework of LIFE Nature projects

Mihai Pop, Teodora Sin, Andrea Gazolla, Viorel Popescu





Journal of Applied Ecology

Standard Paper

Assessing biological realism of wildlife population estimates in data-poor systems

Viorel D. Popescu, Kyle A. Artelle, Mihai I. Pop, Steluta Manolache, Laurentiu Rozylowicz

Procedia Environmental Sciences

Volume 14, 2012, Pages 111-122

open access

Land use and Behavioral Patterns of Brown Bears in the South-Eastern Romanian Carpathian Mountains: A Case Study of Relocated and Rehabilitated Individuals

Ioan Mihai Pop, Alexandra Sallay, Leonardo Bereczky, Silviu Chiriac

LIFE WOLF

ACDB Action for wildlife

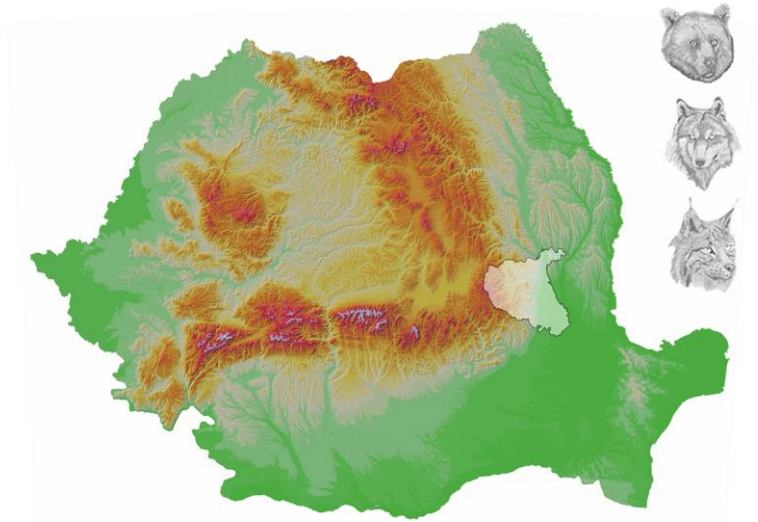
CÂINII HOINARI

Amenințare pentru oameni și natură

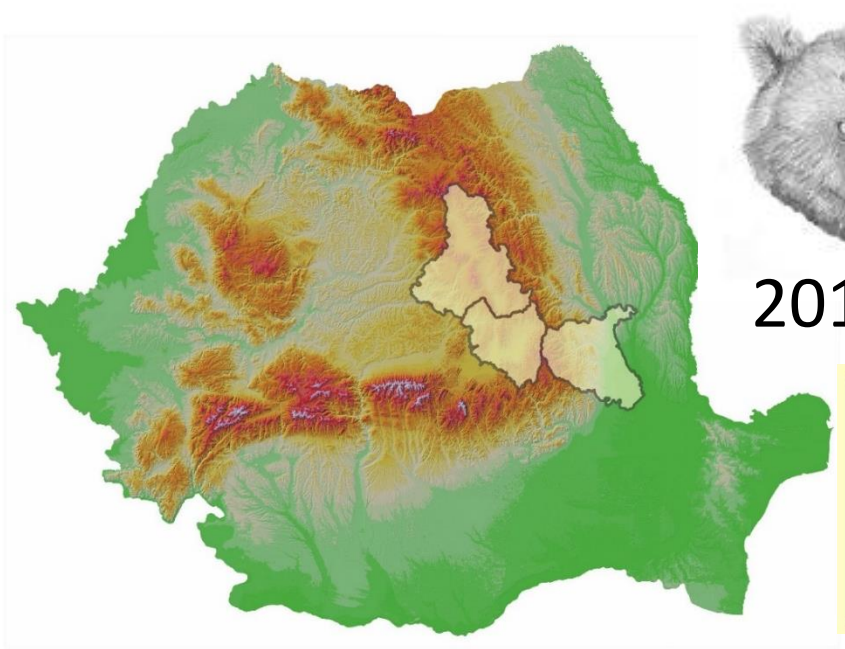
Focșani 2016

ACDB Action for wildlife

MINISTERUL MEDIULUI

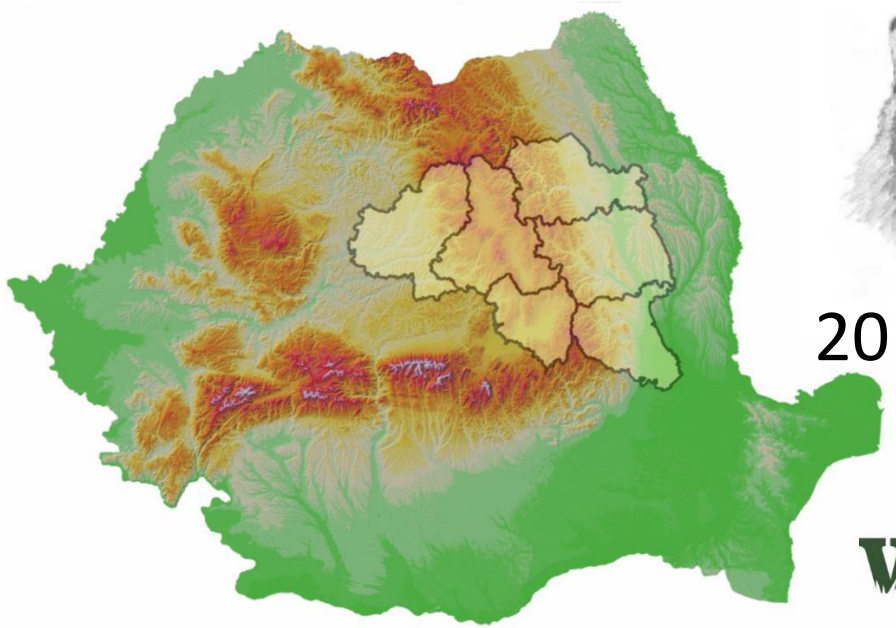


2002-2005;2005-2009



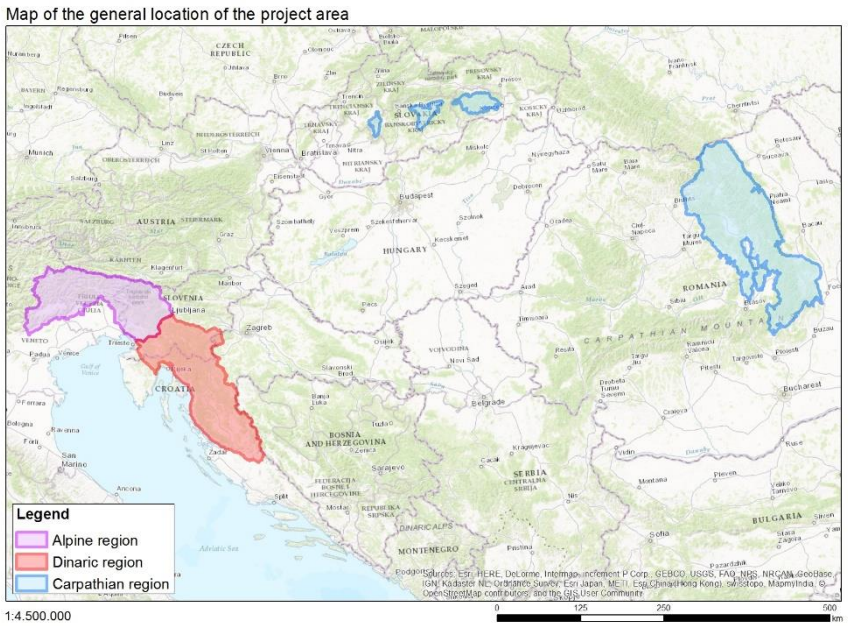
2010-2013

LIFE08NAT/RO000500



2014-2019

LIFE WOLF
LIFE13 NAT/RO/000205



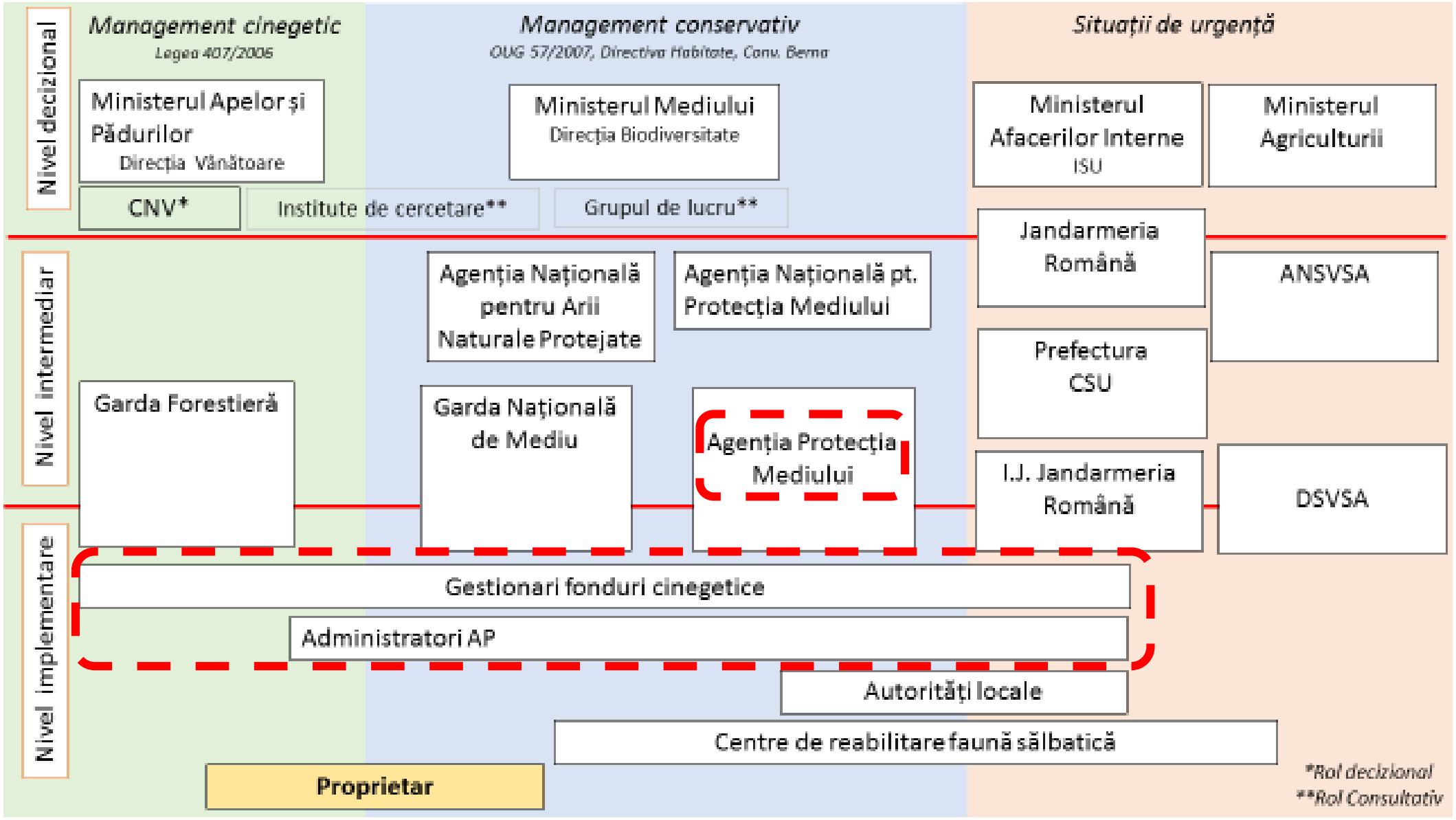
2017-2024

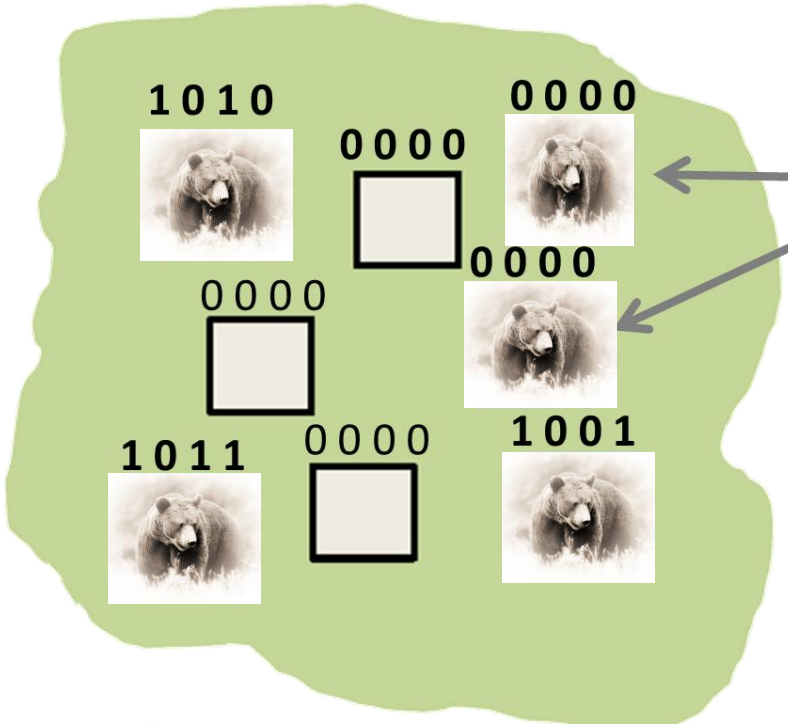
LIFE Lynx

Methods tested	Brown Bear	Wolf	Lynx
Transects (snow+mud)	X	X	
Snow tracking		X	X
Scent stations	X		
Scent stations+Camera trap	X		X
Camera trap	X	X	X
Howling survey		X	
Genetic samples (hair traps)	X		
Genetic samples (scats, urine, blood)	X	X	X
Reproductive units count	X		
Finnish Triangles	X		

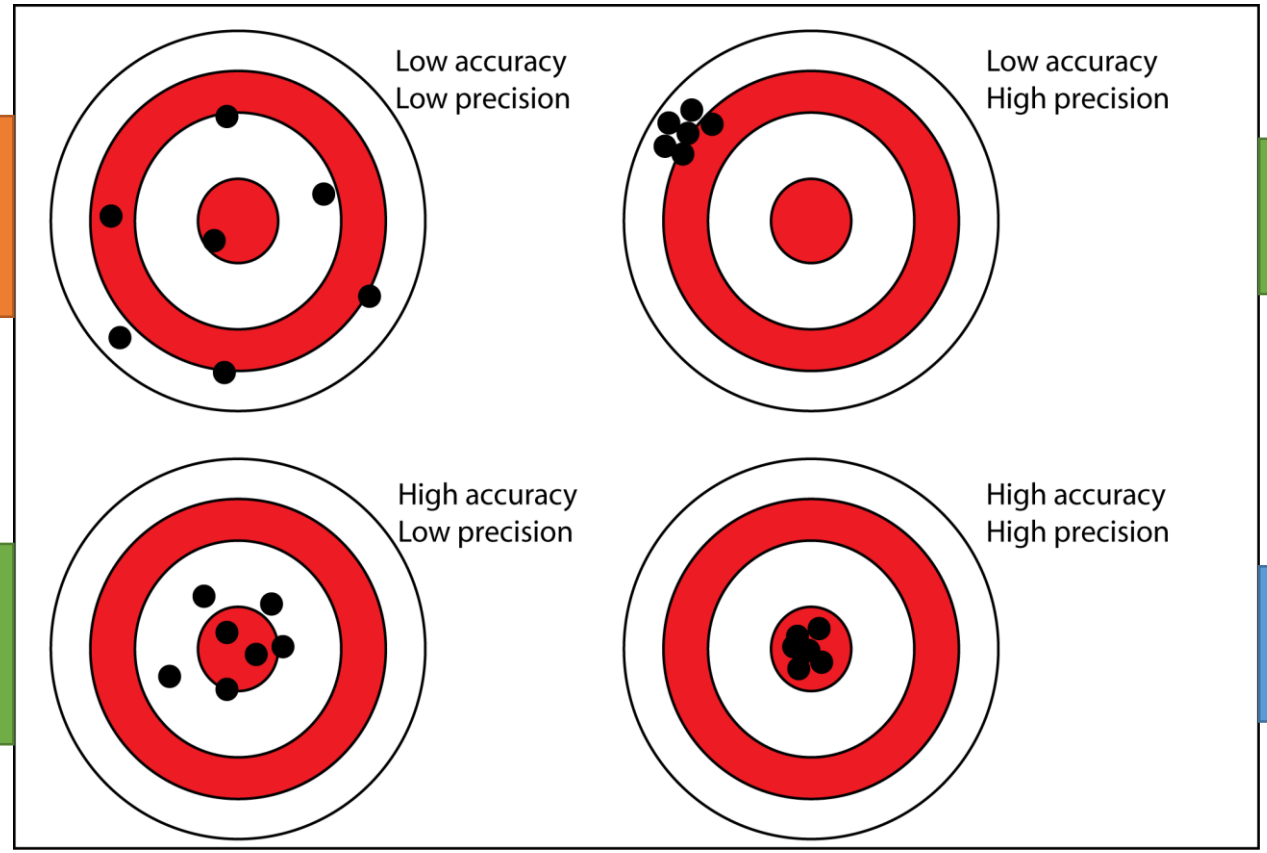
Methods tested	Brown Bear	Wolf	Lynx
Transects (snow+mud)	X	X	
Snow tracking		X	X
Scent stations	X		
Scent stations+Camera trap	X		X
Camera trap	X	X	X
Howling survey		X	
Genetic samples (hair traps)	X		
Genetic samples (scats, urine, blood)	X	X	X
Reproductive units count	X		
Finnish Triangles	X		

Administrative framework




1010
0000
0000
0000
0000
1011
0000
1001
Situri problema?
1 – animal detectat
0 – animal nedetectat

Low effort, design could be good or bad



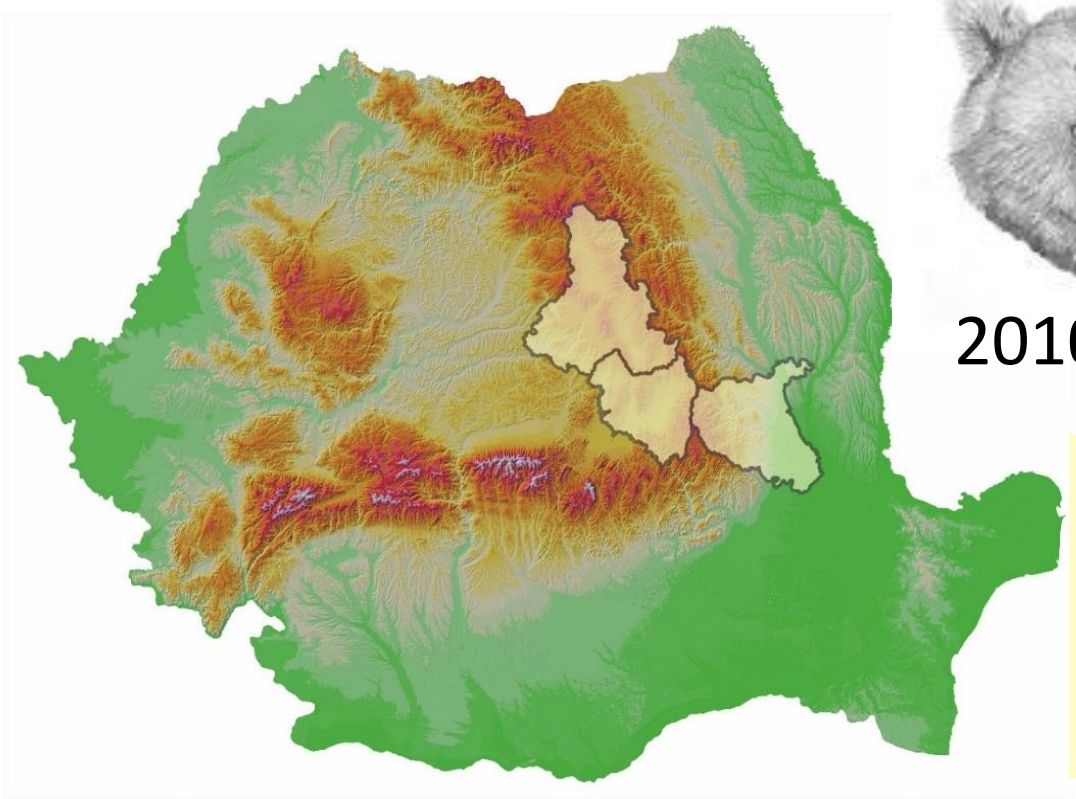
Likely high effort, but bad design

Not high enough effort, good design

High enough effort, good design

- ✓ **Costs : need to be acceptable**
- ✓ **Institutional Capacity : low to moderate**
- ✓ **Administrative framework : based on game managers**

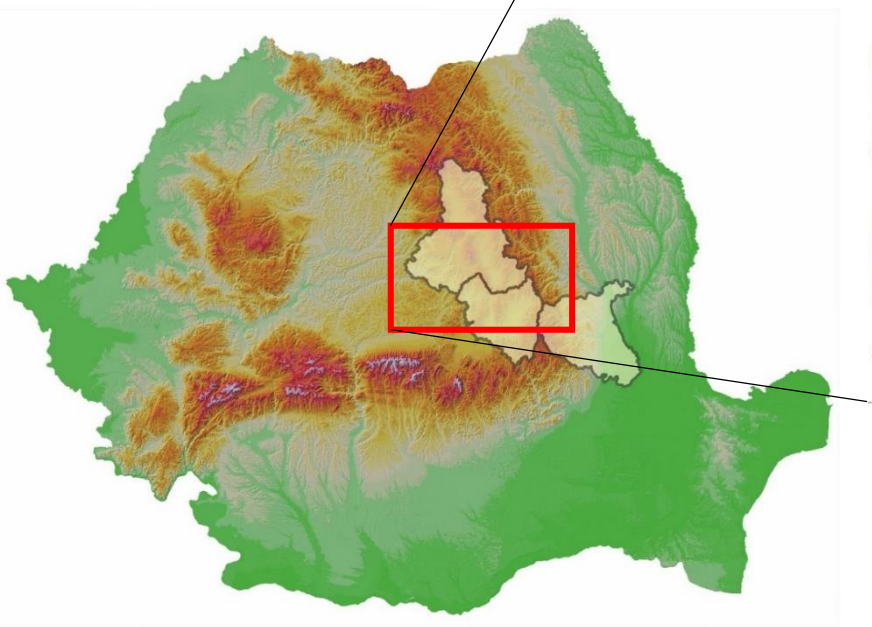
MINISTERUL MEDIULUI

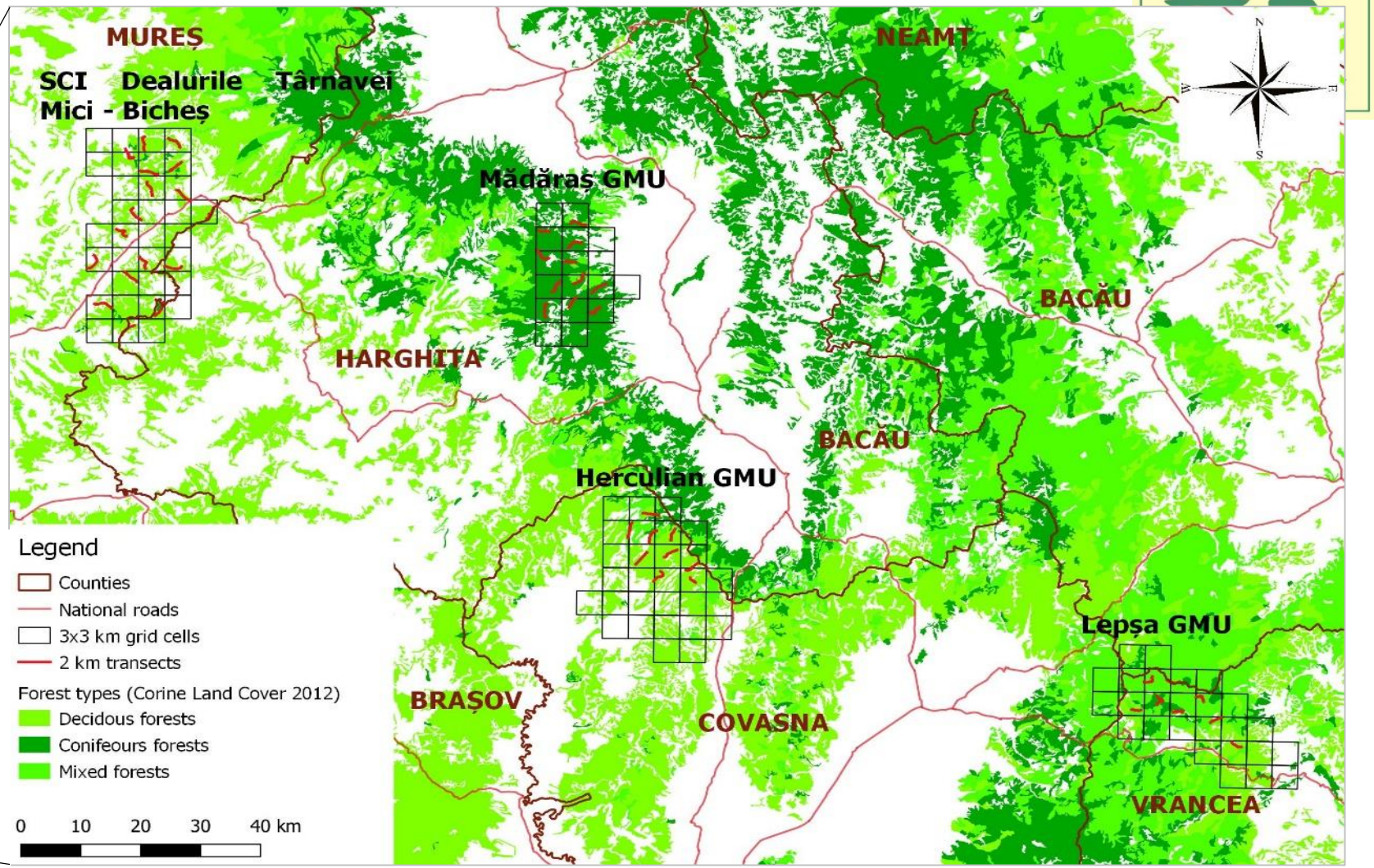


2010-2013

LIFEURSUS

LIFE08NAT/RO000500




MUREȘ
SCI Dealurile Târnavei Mici - Biches
Mădăraș GMU
HARGHITA
NEAMȚ
BACĂU
BACAU
Herculian GMU
Lepșa GMU
BRAȘOV
COVASNA
VRANCEA
Legend
Counties
National roads
3x3 km grid cells
2 km transects
Forest types (Corine Land Cover 2012)
Decidous forests
Conifeours forests
Mixed forests
0 10 20 30 40 km

Track data on transects

March-April 2011
27 transects

Nov.-Dec. 2011
36 transects

March-April 2012
49 transects

Raw track measurements

data vetting

No. of unique individuals

N-mixture models

Detection probabilities

Abundance estimates

Abundance per transect

GPS Telemetry data

Kernel density

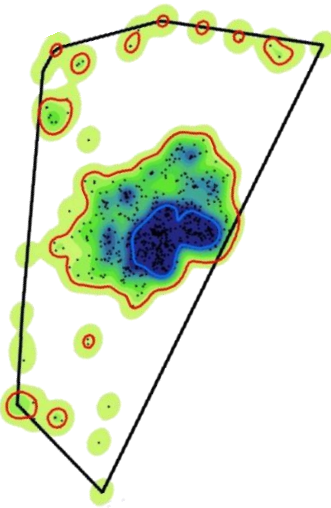
Core home ranges (50% isopleth)

Buffer around transects (equal to radius of median circular home range)

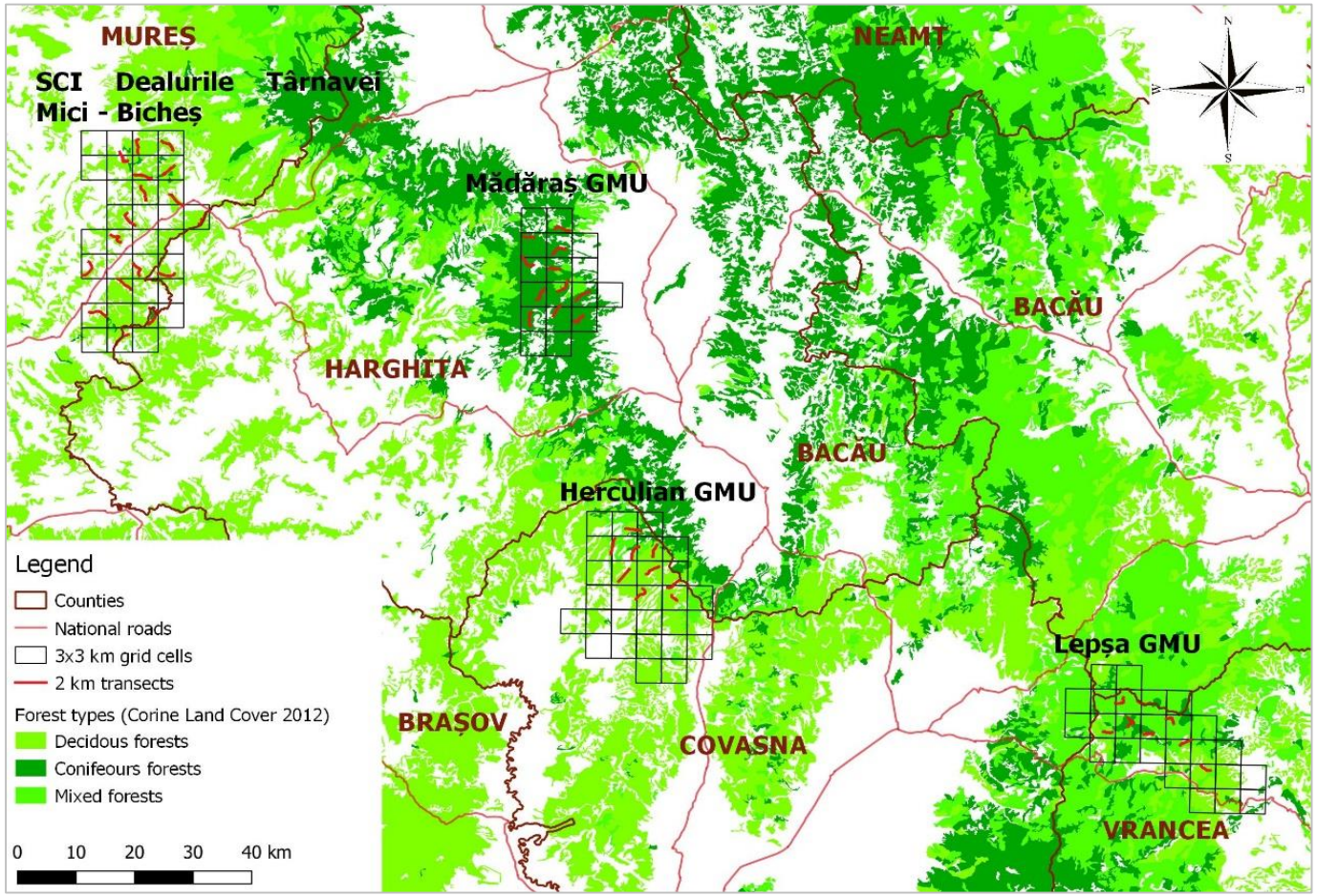
Effective sampling area

Integrate uncertainty estimates via Delta Method

Densities

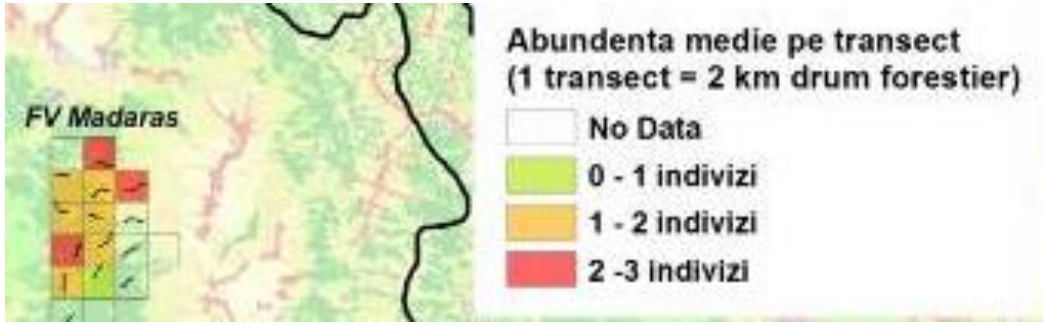


LIFEURSUS
LIFE08NAT/RO000500

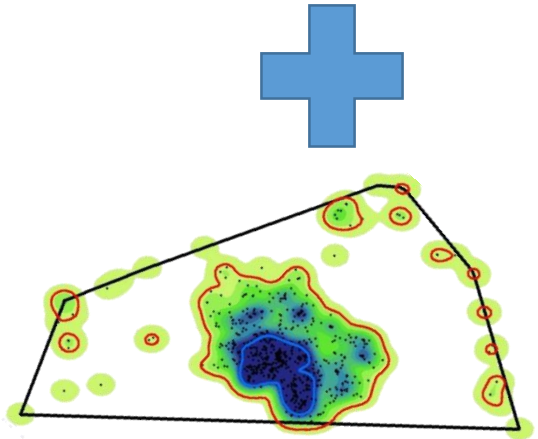


Site/GMU	Abundența medie
Herculian	**1.104** (SE=0.082) 95% CI = 0.943 - 1.265
Lepsa	**1.189** (SE=0.096) 95% CI = 0.999 - 1.378
Madaras	**1.487** (SE=0.112) 95% CI = 1.267 - 1.708
Tarnave SCI	**1.608** (SE=0.149)

Site/GMU	Mar-Apr 2011	Nov-Dec 2011	Mar-Apr 2012
Abundența medie	**1.264** (SE=0.094) 95% CI = 1.079 – 1.448	**1.235** (SE=0.117) 95% CI = 1.005 – 1.466	**1.363** (SE=0.069) 95% CI = 1.227 – 1.499



Zona pilot	Densitatea medie (urși/100 km^2)
Herculian	**10.1** (95% CI=6.8 - 13.4)
Lepșa	**10.8** (95% CI=7.2 - 14.5)
Mădăraș	**13.7** (95% CI=9.1 - 18.0)
Târnave SCI	**14.7** (95% CI=9.6 – 19.7)



HOME RANGE

	Mar-Apr 2011	Nov-Dec 2011	Mar-Apr 2012
Densitatea medie (urși/100 km^2)	**11.5** (95% CI=7.8 – 15.3)	**11.3** (95% CI=7.4 – 15.2)	**12.4** (95% CI=8.6 – 16.3)

Received: 29 December 2016 | Revised: 7 May 2017 | Accepted: 25 May 2017
DOI: 10.1002/ece3.3177

ORIGINAL RESEARCH

WILEY Ecology and Evolution Open Access

Integrating sign surveys and telemetry data for estimating brown bear (*Ursus arctos*) density in the Romanian Carpathians

Viorel D. Popescu[1,2] | Ruben Iosif[2] | Mihai I. Pop[2,3] | Silviu Chiriac[4] | George Bouroș[3] | Brett J. Furnas[5,6]

[1]Department of Biological Sciences, Ohio University, Athens, OH, USA

[2]Centre for Environmental Research (CCMESI), University of Bucharest, Bucharest, Romania

[3]Asociatia pentru Conservarea Diversitatii Biologice (ACDB), Focsani, Romania

[4]Vrancea Environmental Protection Agency, Focsani, Romania

[5]California Department of Fish and Wildlife, Wildlife Investigations Laboratory, Rancho Cordova, CA, USA

[6]Department of Environmental Science, Policy and Management, University of California, Berkeley, CA, USA

Correspondence
Ruben Iosif, Centre for Environmental Research (CCMESI), University of Bucharest, Bucharest, Romania.
Email: ruben.iosif@drd.unibuc.ro

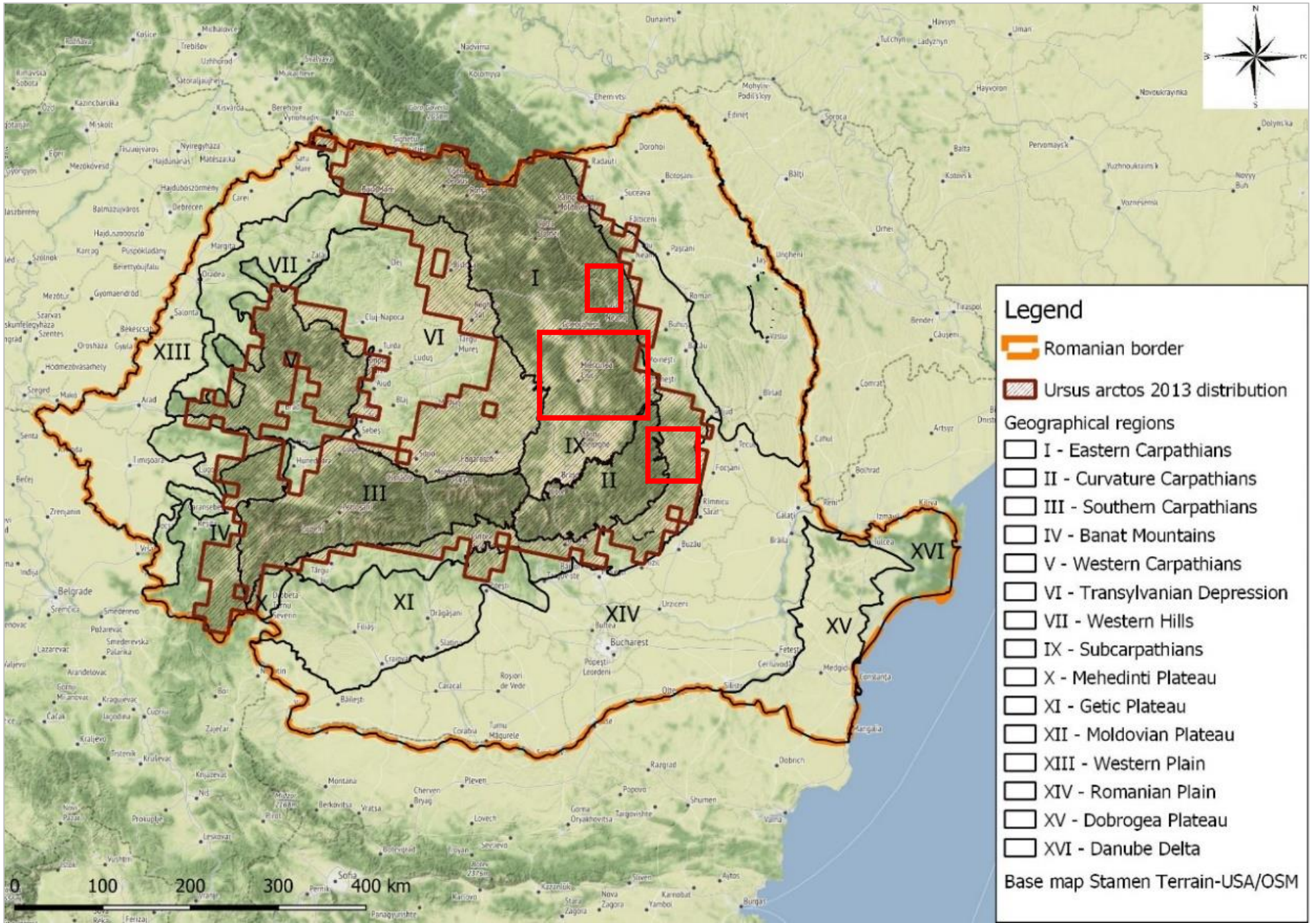
Funding information
Romanian National Authority for Scientific Research; CNCS–UEFISCDI, Grant/Award Number: PN-II-RU-TE-2014-4-0058; European Commission; LIFE NATURE, Grant/Award Number: LIFE08NAT/RO/000500

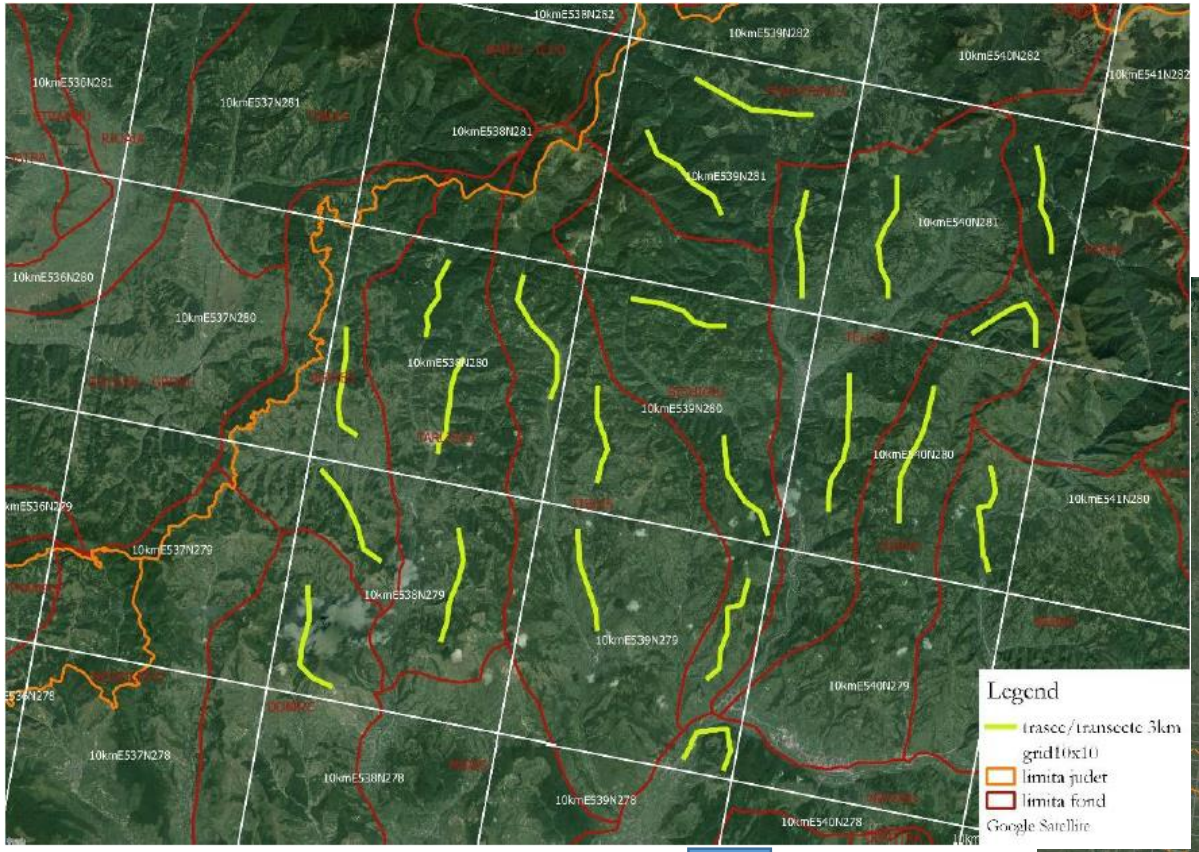
Abstract

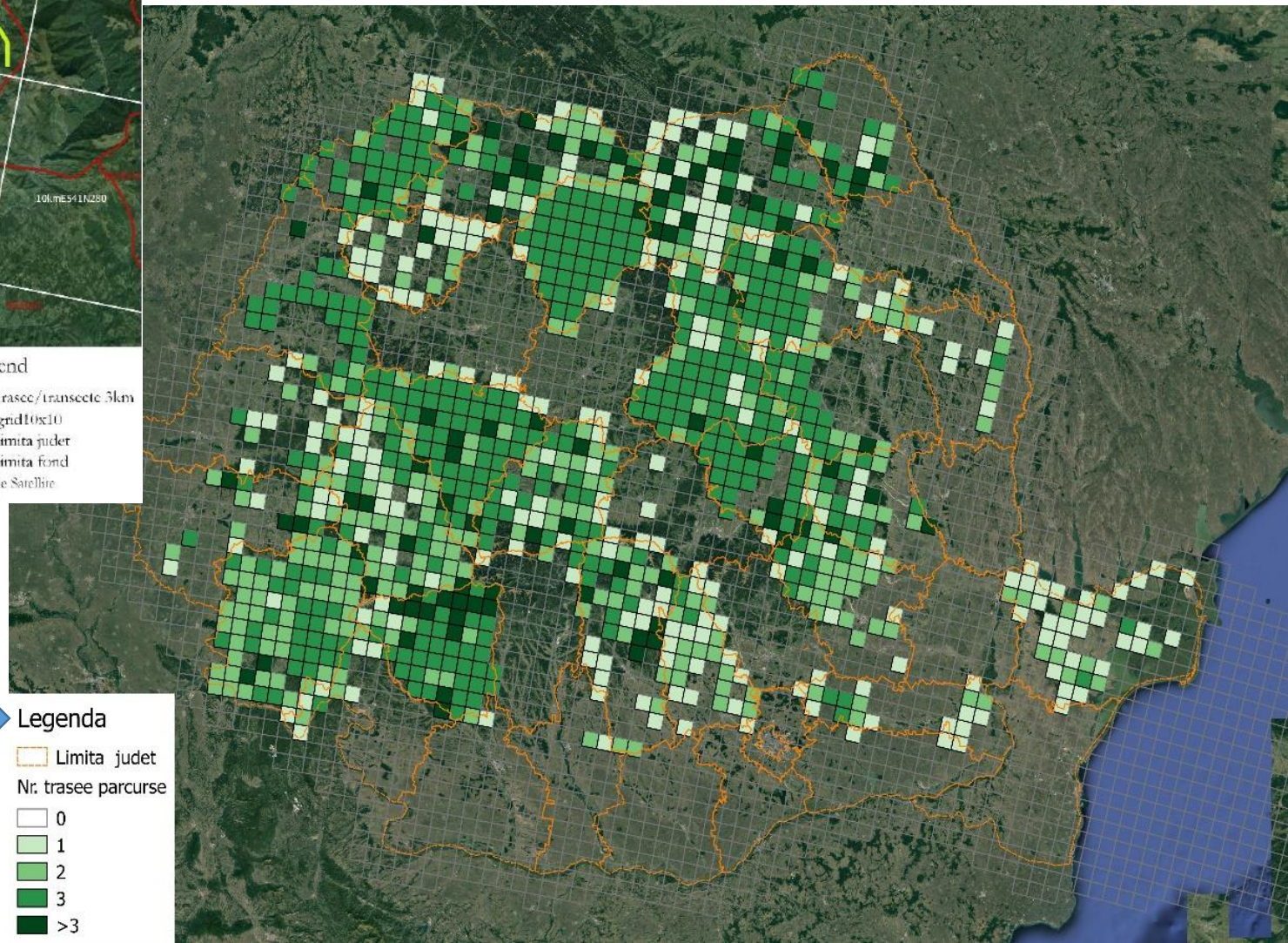
Accurate population size estimates are important information for sustainable wildlife management. The Romanian Carpathians harbor the largest brown bear (*Ursus arctos*) population in Europe, yet current management relies on estimates of density that lack statistical oversight and ignore uncertainty deriving from track surveys. In this study, we investigate an alternative approach to estimate brown bear density using sign surveys along transects within a novel integration of occupancy models and home range methods. We performed repeated surveys along 2-km segments of forest roads during three distinct seasons: spring 2011, fall-winter 2011, and spring 2012, within three game management units and a Natura 2000 site. We estimated bears abundances along transects using the number of unique tracks observed per survey occasion via N-mixture hierarchical models, which account for imperfect detection. To obtain brown bear densities, we combined these abundances with the effective sampling area of the transects, that is, estimated as a function of the median (± bootstrapped SE) of the core home range (5.58 ± 1.08 km²) based on telemetry data from 17 bears tracked for 1-month periods overlapping our surveys windows. Our analyses yielded average brown bear densities (and 95% confidence intervals) for the three seasons of: 11.5 (7.8–15.3), 11.3 (7.4–15.2), and 12.4 (8.6–16.3) individuals/100 km². Across game management units, mean densities ranged between 7.5 and 14.8 individuals/100 km². Our method incorporates multiple sources of uncertainty (e.g., effective sampling area, imperfect detection) to estimate brown bear density, but the inference fundamentally relies on unmarked individuals only. While useful as a temporary approach to monitor brown bears, we urge implementing DNA capture–recapture methods regionally to inform brown bear management and recommend increasing resources for GPS collars to improve estimates of effective sampling area.

KEYWORDS
Carpathians, N-mixture model, population density, Romania, track survey, *Ursus arctos*

LIFEURSUS
LIFE08NAT/RO000500


Legend
Romanian border
Ursus arctos 2013 distribution
Geographical regions
I - Eastern Carpathians
II - Curvature Carpathians
III - Southern Carpathians
IV - Banat Mountains
V - Western Carpathians
VI - Transylvanian Depression
VII - Western Hills
IX - Subcarpathians
X - Mehedinti Plateau
XI - Getic Plateau
XII - Moldovian Plateau
XIII - Western Plain
XIV - Romanian Plain
XV - Dobrogea Plateau
XVI - Danube Delta
Base map Stamen Terrain-USA/OSM
0
100
200
300
400 km
N
LIFEURSUS
LIFE08NAT/RO000500





LIFE08NAT/RO000500

Conclussions

Action plan:

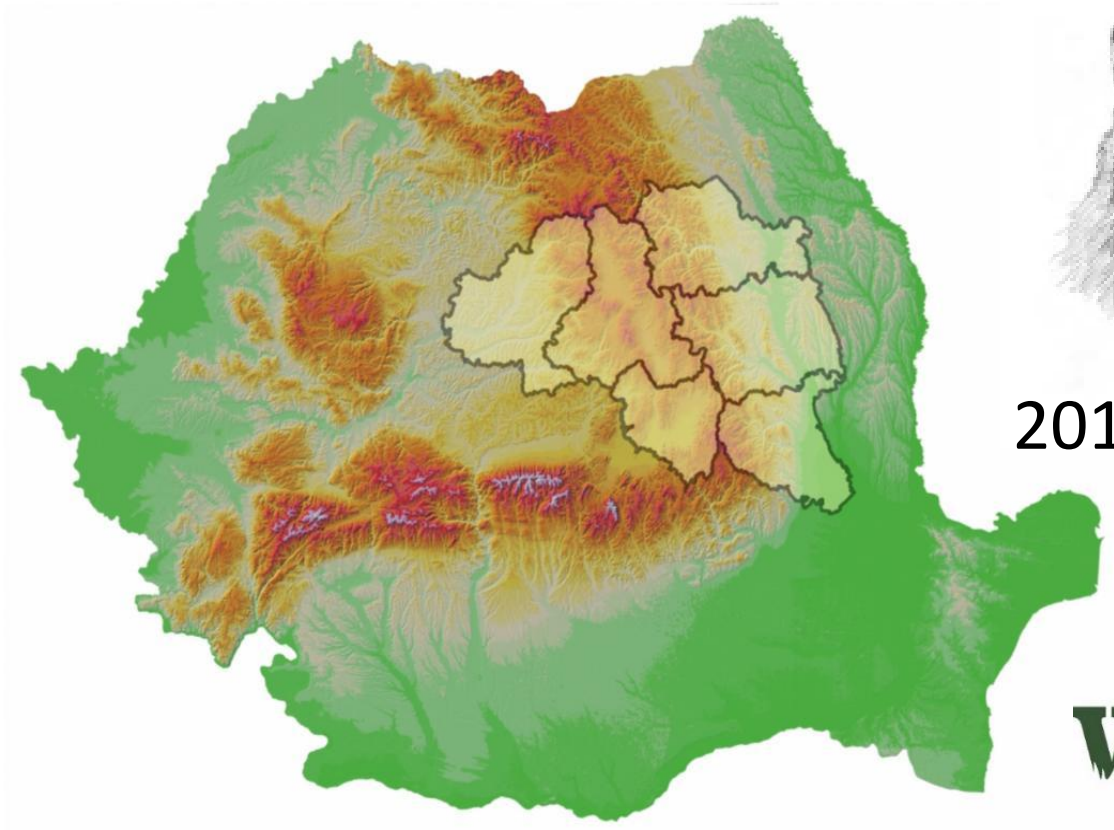
- ✓Genetic studies: 7 years, 10 years
- ✓Traditional methods: track census every year – potential for transect method (LIFEURSUS)

Key problems:

- ✓Genetic studies: High costs, sampling size
- ✓Traditional methods: effective sampling area, GPS use, common data base

- ✓One key condition: involvement of hunters/conservationist/volunteers

MINISTERUL MEDIULUI

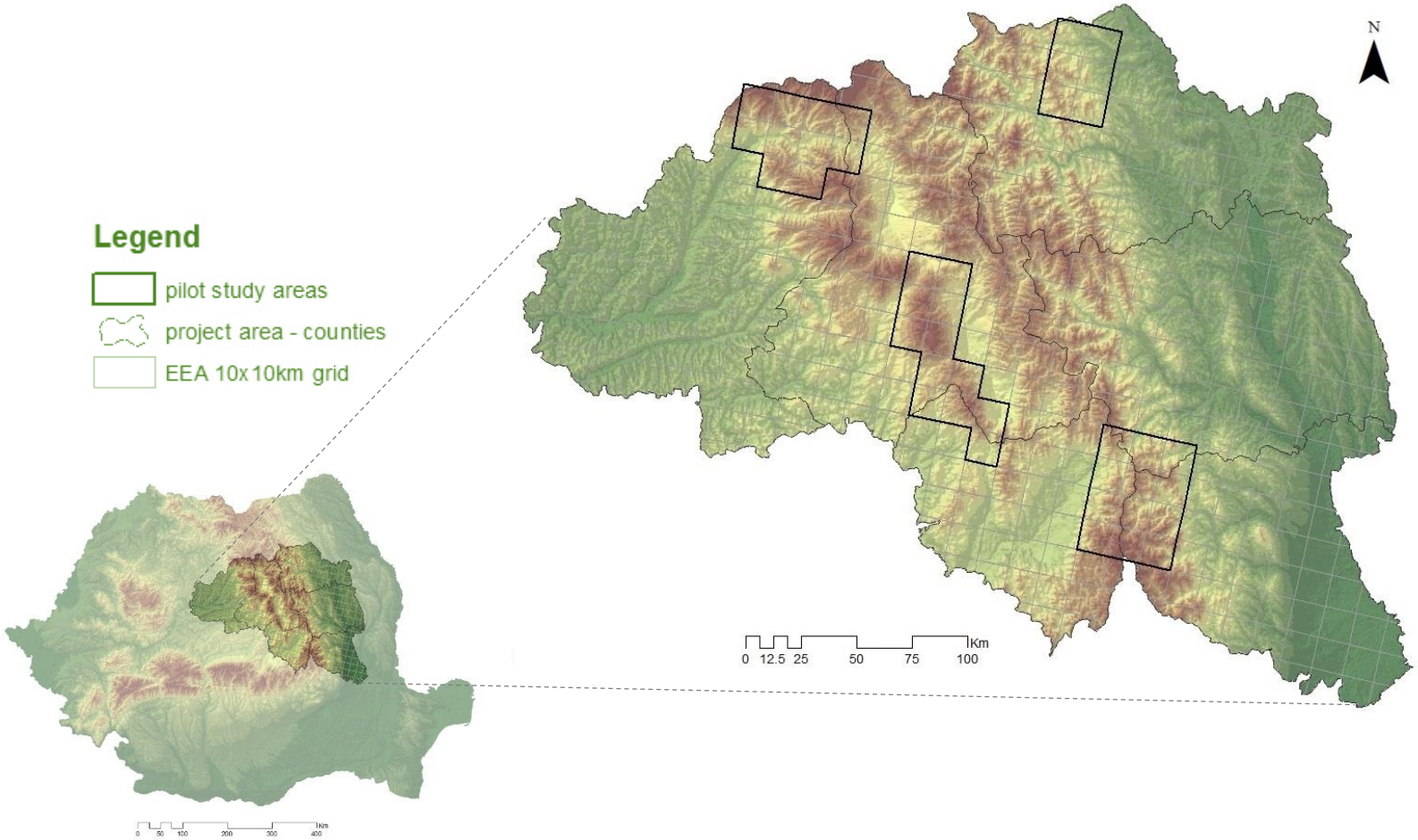


2014-2019

LIFE WOLF

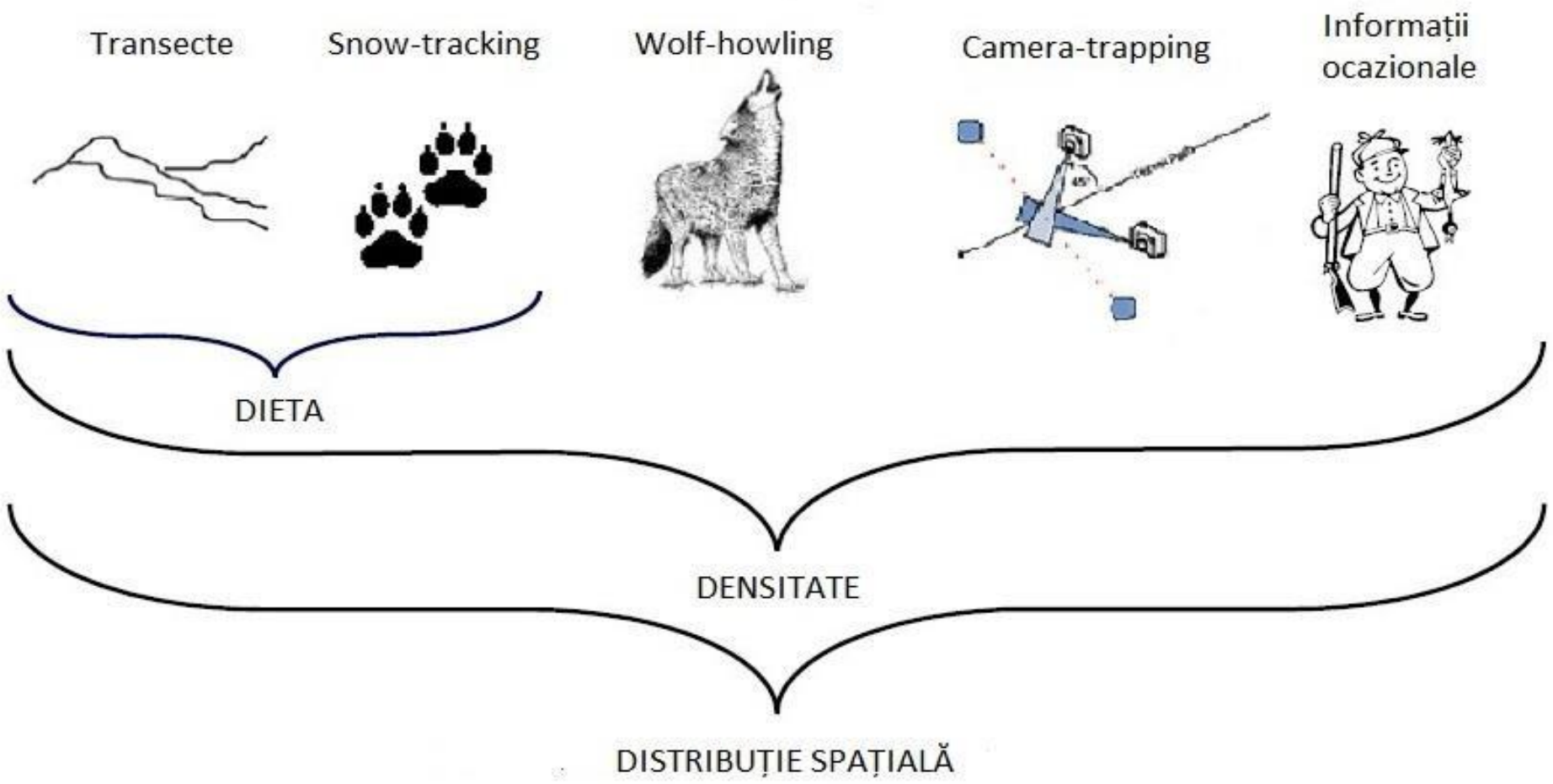
LIFE13 NAT/RO/000205

Study area (2014-2017)



- ✓ **4 pilot sites**: PVSO, HHM, Calimani, VNT
- ✓**4000 km²** (Nov. 2014 – Apr.2017)

Methods (2014-2017)



Adaptare dupa Capitani et al. 2006

Wolf samples

✓ Scats	159	+
✓ Urine	87	+
✓ Hair	28	+
✓ Tissue	5	+
✓ Saliva	1	=
Total	**280**	

- ✓ **Rate of succes for DNA extraction: 82%**
- ✓ **Individual genetic profiles: 75**
- ✓ **Rate of succes: 64%**

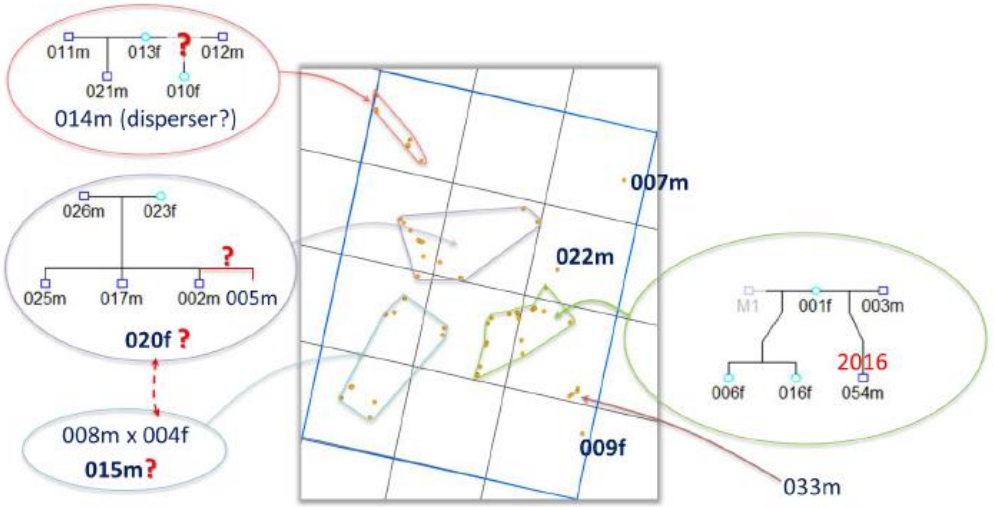
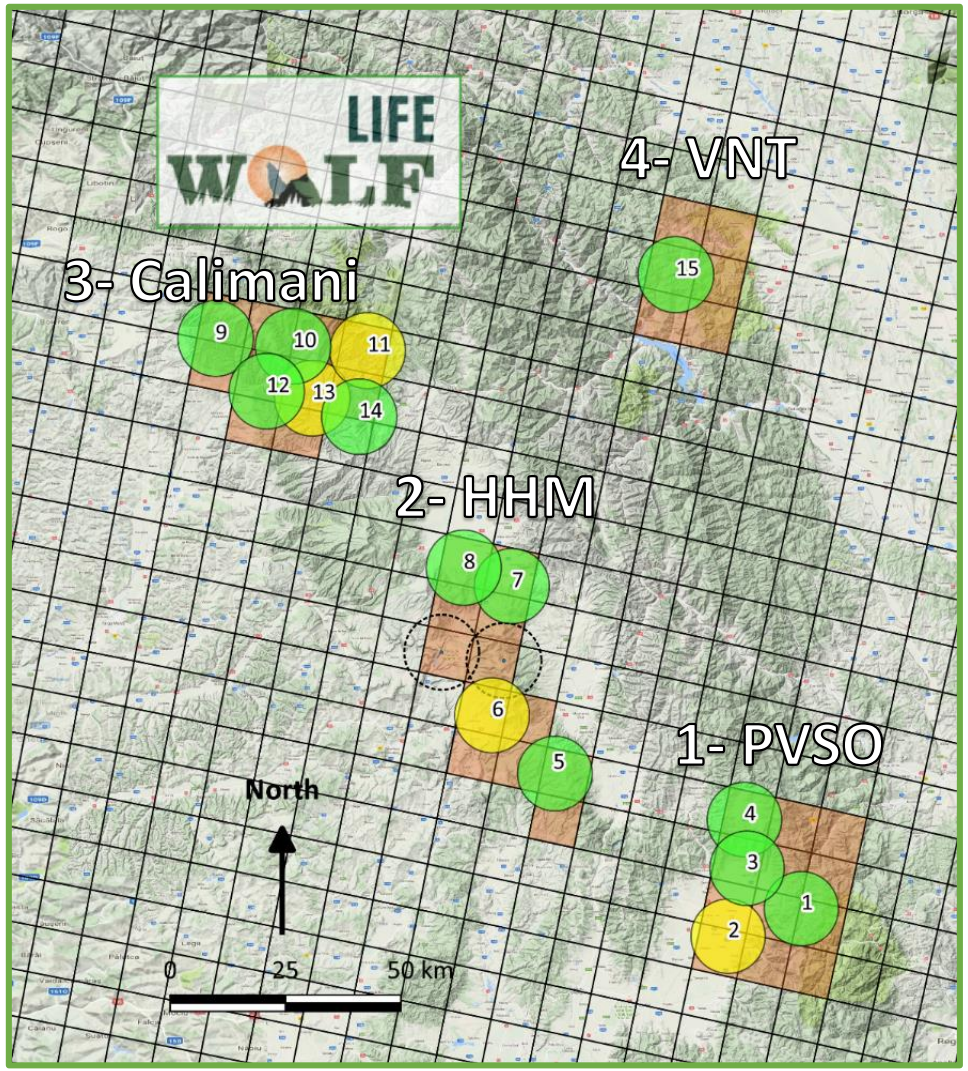


Figure 4: Distribution of 25 wolf individuals found in the study region 1 sampled in 2014/2015 (m = male; f = female). Circles mark the presence of potential wolf packs (they do not indicate territory sizes!).

Distribuția haitelor și perechilor (2014-2017)



pereche

probabil haită

haită

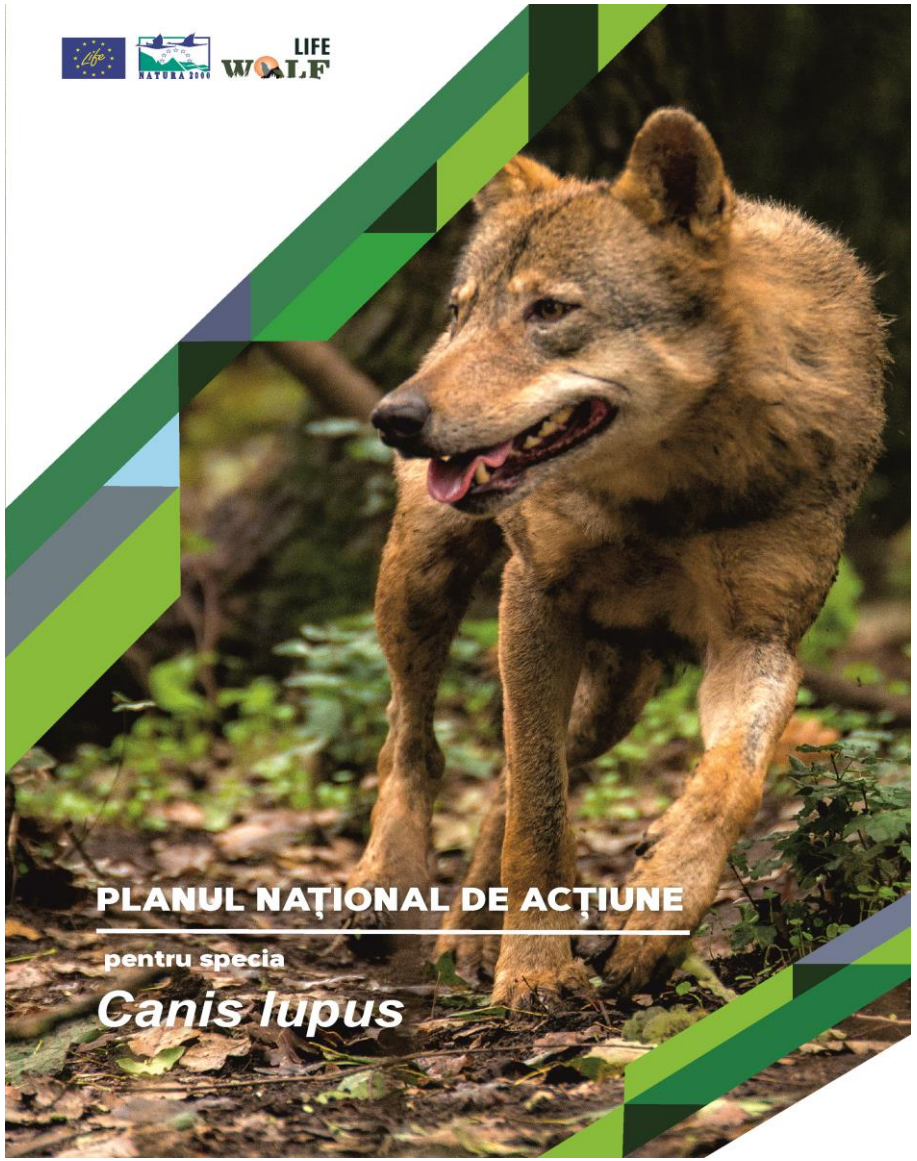
zona de studiu

Zona de studiu	Densitate lupi (nr./100km²)	Densitate haite (nr./1000km²)
1-PVSO	1.75	2.50
2-HHM	1.91	3.33
3-Călimani	2.80	4.00
4-VNT	1.00	1.66

Mărime haite: 3-9 lupi/haită

Densitate lupi: 1.95 lupi/100km²

Densitate haite: 3.00 haite/1000 km²



Andrea Gazzola | Teodora Sin | Ioan-Mihai Pop | Silviu Chiriac

Ghid privind implementarea metodelor de monitorizare şi evaluare a populaţiei de lup la nivel naţional

Editura Green Steps
Braşov, 2018

Conclussions

Action plan:

- ✓Genetic studies: 5-6 years
- ✓”Traditional” methods: every year based on WOLFLIFE protocols

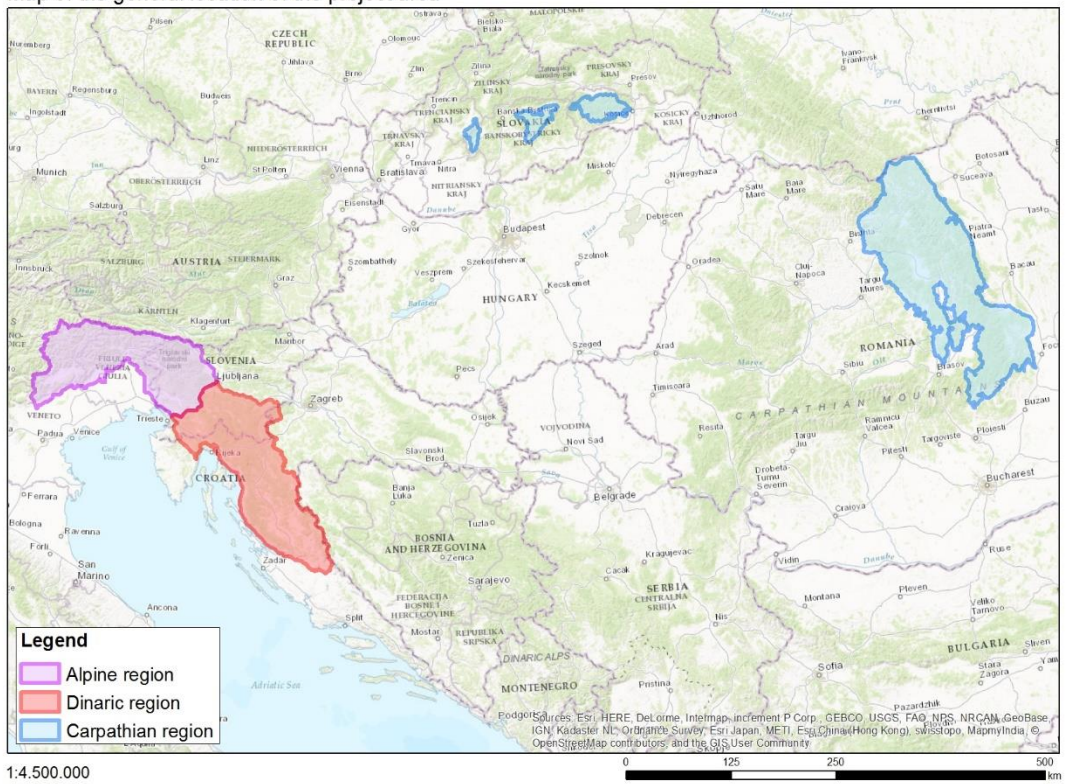
Key problems:

- ✓Genetic studies: High costs, sampling size and sample collection protocol is the key to succes
- ✓”Traditional” methods: GPS use, common data base, number of camera traps, lack of knowledge about method

- ✓One key condition: involvement of hunters/conservationist/volunteers

MINISTERUL MEDIULUI

Map of the general location of the project area



2017-2024

LIFE Lynx

LIFE Lynx

Preventing the extinction of the Dinaric-SE Alpine lynx population through reinforcement and long-term conservation

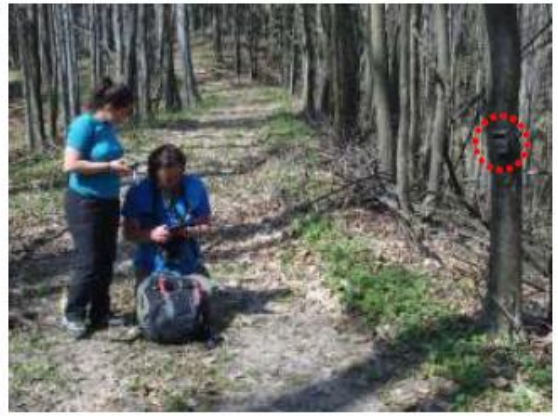
Monitoring protocol for the Romanian source of Eurasian lynx population

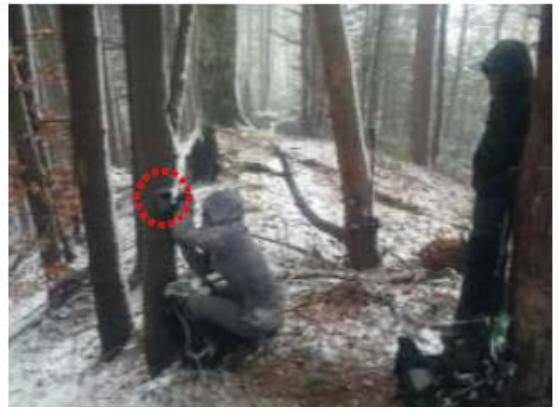
A2. Assessment and selection of sites, and lynx, for live-capture from the Carpathian source population in Romania

Authors: Gazzola A., Sin T., Oliveira T., Willett M., Pop I.M.

Focşani, September 2018

ACDB
Action for wildlife



LIFE Lynx

The definition of the three categories are reported here below as described in Molinari-Jobin et al. (2012):

C1: Confirmed "hard facts", verified and undisputable records of lynx presence such as (1) dead lynx, (2) captured lynx, (3) good quality and georeferenced lynx photos (e.g., from camera traps), and (4) samples (e.g. excrements, hair) attributed to lynx by means of a scientifically reliable analysis.

C2: Records confirmed by a lynx expert (e.g. trained member of the network) such as (1) killed livestock or (2) wild prey, and (3) lynx tracks or other assessable field signs.

C3: Unconfirmed category 2 observations (kills, tracks, other field signs too old or badly documented, where however the description conforms to a lynx sign) and all observations such as sightings and calls, which by their nature cannot be verified.

Conclussions

- ✓Camera trapping seems to be the best alternative (allowing mark recapture)
- ✓Snow tracking usefull to colect suplimentary data (marking points, kill sites, etc.)
- ✓Genetic studies: highly required but …

Conclussions based on our projects activities

- ✓Officializing the protocols is not a guarantee of implementation
- ✓Until genetic studies (Holy Grail!!!) can be implemented we need other solutions
- ✓There is a lack of trust of authorities/game managers toward changing the method (standardization seems to be the problem)
- ✓Required resources: a good planning can keep the cost at a reasonable level
- ✓Genetic studies: highly required but … implemented without a clear protocol and superficial, genetic studies might not give the expected precission
- ✓No matter the method if not agreed between stakeholders … conflicts will remain opened.

ORIGINAL RESEARCH

WILEY Ecology and Evolution Open Access

Integrating sign surveys and telemetry data for estimating brown bear (*Ursus arctos*) density in the Romanian Carpathians

Viorel D. Popescu[1,2] | Ruben Iosif[2] | Mihai I. Pop[2,3] | Silviu Chiriac[4] | George Bouroş[3] | Brett J. Furnas[5,6]

Nature Conservation 26: 15–31 (2018)
doi: 10.3897/natureconservation.26.22955
http://natureconservation.pensoft.net

RESEARCH ARTICLE

A peer-reviewed open-access journal
Nature Conservation
Launched to accelerate biodiversity conservation

Movement ecology of brown bears (*Ursus arctos*) in the Romanian Eastern Carpathians

Ioan Mihai Pop[1,2], Leonardo Bereczky[2], Silviu Chiriac[3], Ruben Iosif[2], Andreea Nita[1], Viorel Dan Popescu[1,4], Laurenţiu Rozylowicz[1]

PLOS ONE

Romanian carnivores at a crossroads

In October 2016, in an unexpected move, the Romanian government provisionally suspended the hunting of brown bears and wolves, shaking the decades-old wildlife management system of regulated hunting (*1, 2*). This decision provided an opportunity to reset Romanian wildlife management and conservation and to implement science-based
year later, a new manage
implemented, allowing o
of problem animals at th
human-wildlife conflict,
by-case approval process
there is increasing pressu
politically charged climat
campaign focused on wil
to substantially reduce th
of large carnivores (*4, 5*).
scientific evidence is still
the discussions about pr

RESEARCH ARTICLE

Wolf diet and prey selection in the South-Eastern Carpathian Mountains, Romania

Teodora Sin[1,2]*, Andrea Gazzola[2], Silviu Chiriac[3], Geta Rîşnoveanu[1]*

1 Department of Systems Ecology and Sustainability, Faculty of Biology, University of Bucharest, Bucharest, Romania, **2** Association for the Conservation of Biological Diversity, Focşani, Vrancea County, Romania, **3** Environmental Protection Agency, Focşani, Vrancea County, Romania

Animal Conservation

ZSL LET'S WORK FOR WILDLIFE

Animal Conservation. Print ISSN 1367-9430

Combining resource selection functions and home-range data to identify habitat conservation priorities for brown bears

M. I. Pop[1,2,*], R. Iosif[1,*], I. V. Miu[1], L. Rozylowicz[1] & V. D. Popescu[1,3]

1 Centre for Environmental Research (CCMESI), University of Bucharest, Bucharest, Romania
2 Asociatia pentru Conservarea Diversitatii Biologice (ACDB), Focsani, Romania
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Thank you for your attention!!!

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