Comparing two techniques for rapid assessment of brown bear abundance in Romania

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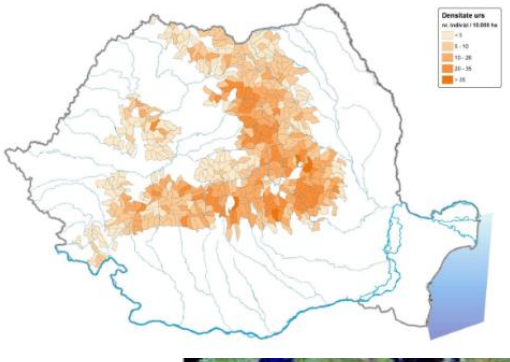
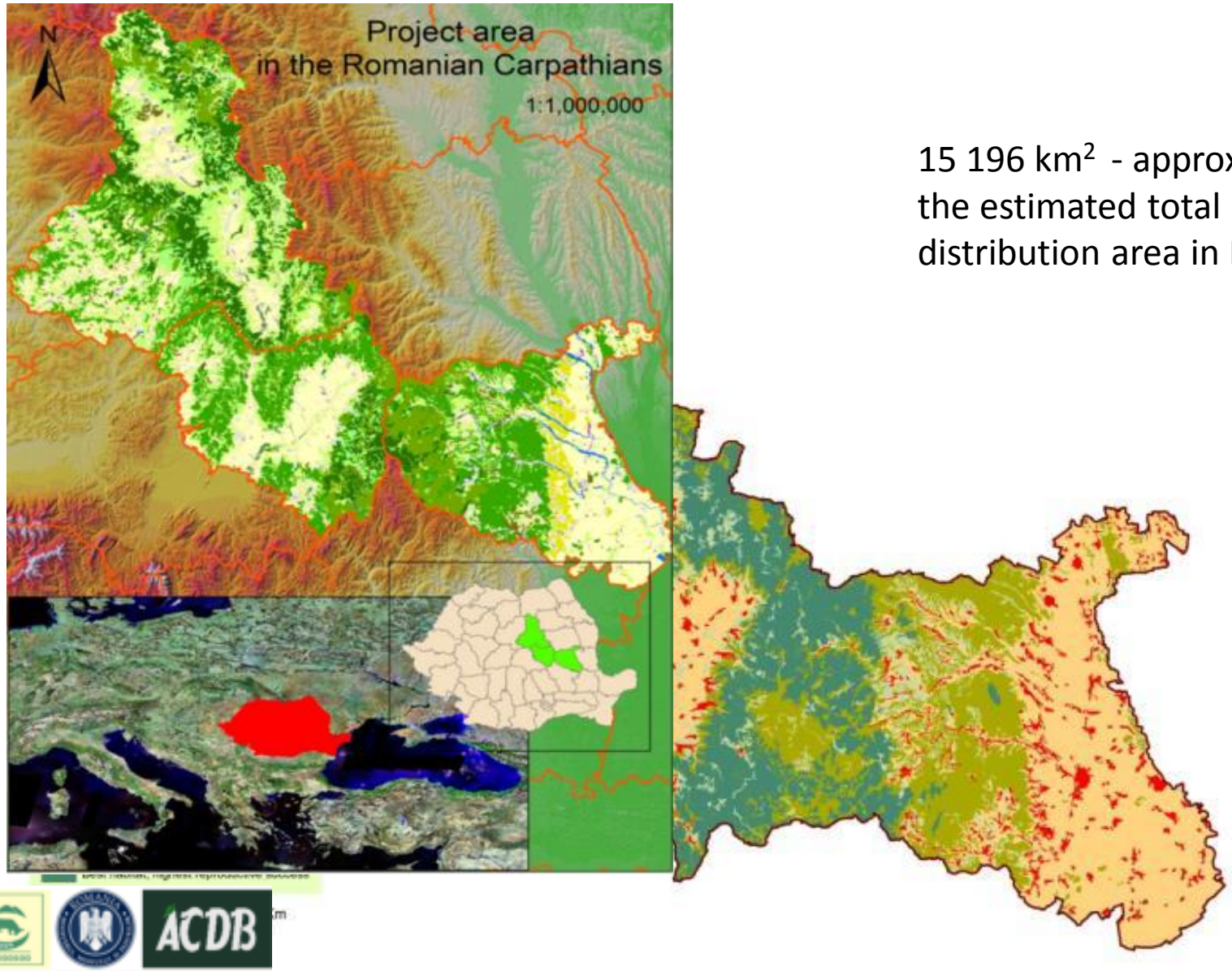
Bears in Romania

- Species: Brown bear (*Ursus arctos*)
- Distribution area: approx. 69 000 km2
- Population size: approx. 6 000 individuals
- Legal status: protected (since 1997)
- Conservation status: LC (IUCN)



Study Area



15 196 km^2 - approx. 20% of the estimated total bear distribution area in Romania

Context of the study

- high uncertainty around brown bear (*Ursus arctos*) abundance in the Romanian Carpathians,
- current estimations of abundance do not rely on modern statistical techniques, and lack uncertainty estimates.

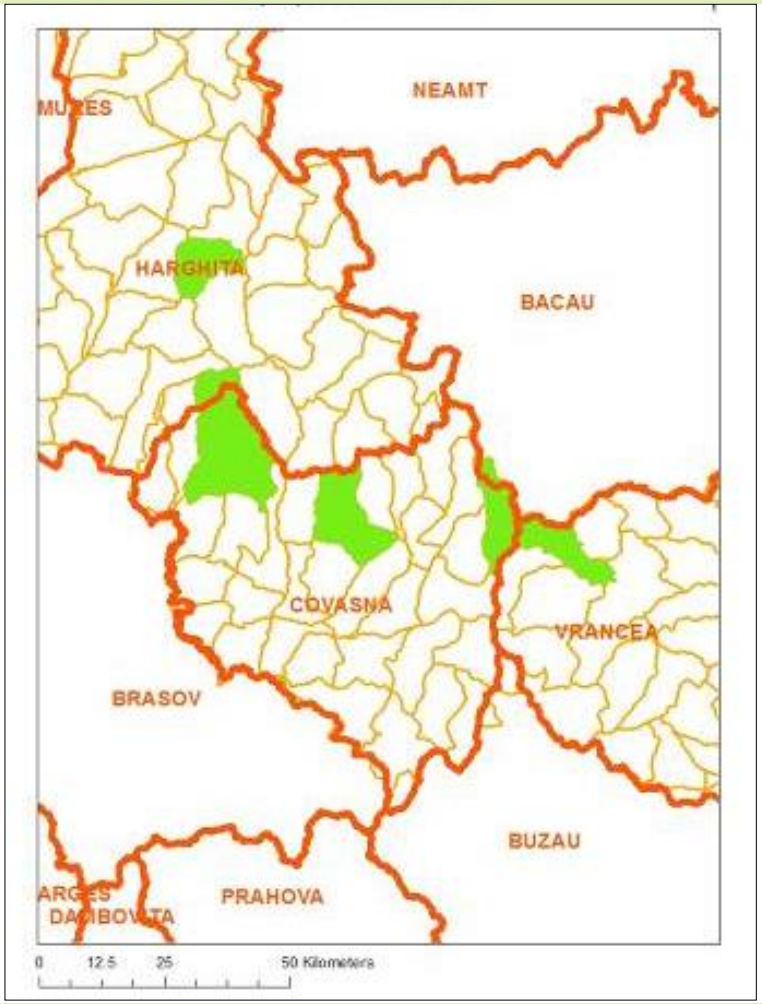
Goal of the study

To test the use of two cost-effective sampling techniques for estimating brown bear abundance from unmarked individuals in an occupancy framework.

Study period and Pilot sites

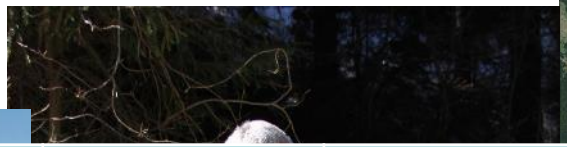
Total surface of the pilot sites 446 sqkm

Season 1 -Spring 2011
Season 2 - Fall 2011
Season 3 - Spring 2012

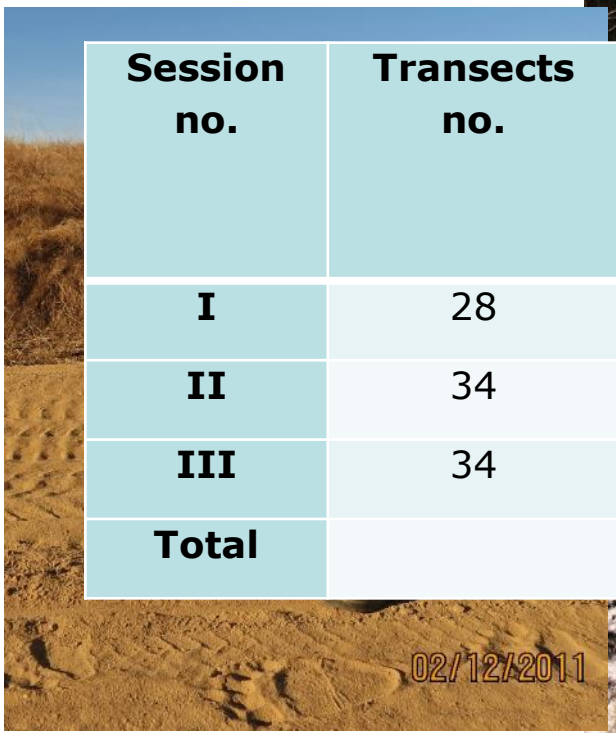


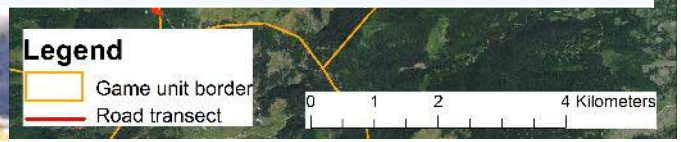
Methodology

(1) Track Counts on 2-km forest road segments



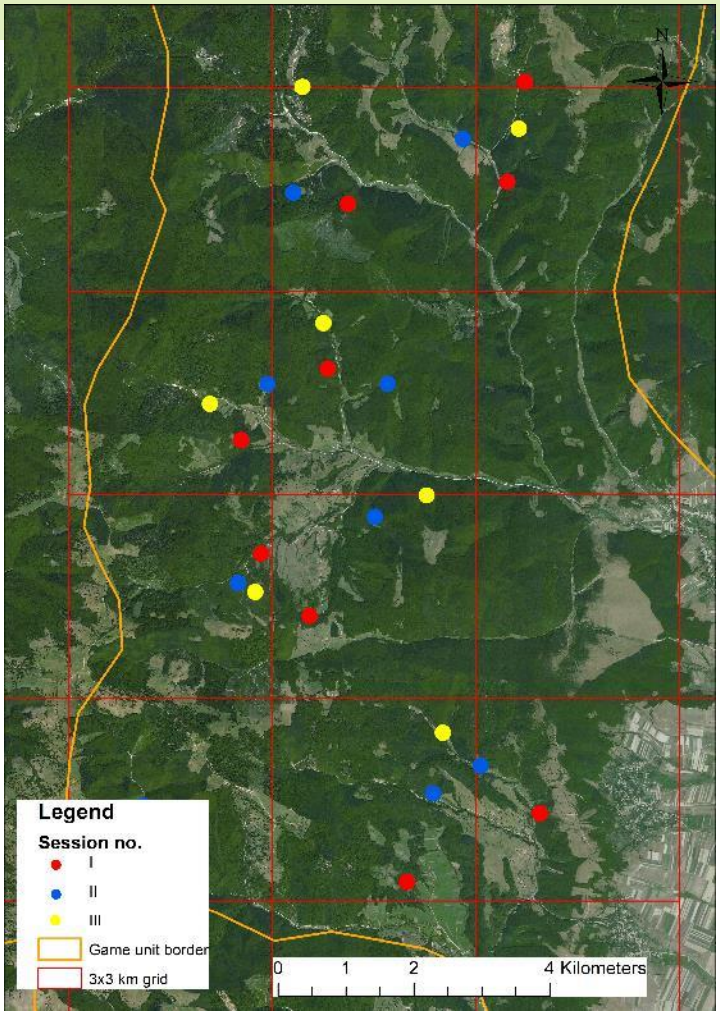
Session no.	Transects no.	Visit no./session	Number of total visits	Transect lenght	Km.
I	28	3	84	2	168
II	34	5	170	2	340
III	34	5	170	2	340
Total					848





Methodology

(2) <u>Detection/Non-detection</u> at camera traps within 3x3 km grids



Data Analysis

R 2.15.2 program, package *unmarked*

- **Road transect** data - "Royle Biometrics" models for count data (Function *pcount*).
- **Camera trap** data - "Royle-Nichols" models for binomial data (Function *occuRN)*

Variables for modeling abundance		**Variables for modeling detection**	
Hunting Management Unit		**Julian Day**	Day since January 1st
Altitude		**Substrate** (RT only)	(mud, snow, dry)
Forest Type		**Snow Depth** (RT only)	
Percent agricultural lands (CT only)		**Forest Type** (CT only)	
Percent pasture (CT only)		**Slope** (CT only)	

Detection history

Method		Sampling occasions		
		Season 1 - Spring	Season 2 - Autumn	Season 3 - Spring
Camera Traps	# Detections	15	22	25
	# Non-Detections	105	98	94
	Detections %	**12.5%**	**18.3%**	**21.0%**
Road transects	# Detections	55	41	87
	# Non-Detections	25	96	94
	Detections %	**68.7%**	**29.9%**	**48.1%**

Results

Variables used to model abundance had low explanatory power.

Example: Transect data Season 2

Model	K	ΔAIC	AICwt	CumAICWt	R-squared
Abund(ForestType), p(SnowDepth)	**5**	**0.00**	**0.4908**	**0.49**	**0.133**
Abund(1), p(SnowDepth)	3	1.11	0.2817	0.77	0.000
Abund(MgtUnit), p(SnowDepth)	5	1.77	0.2027	0.98	0.089
Abund(Altitude), p(SnowDepth)	4	7.25	0.0130	0.99	0.000
Abund(Altitude+ForestType), p(SnowDepth)	6	8.14	0.0084	1.00	0.000
Abund(MgtUnit+Altitude), p(SnowDepth)	6	9.93	0.0034	1.00	0.000

Bear abundance per transect/camera trap grid

		Spring 2011	Fall/Winter 2011	Spring 2012
Camera Trap data	Mean abundance per camera station	-	**1.29**	**2.78**
	90% Credible Interval	-	0.40 – 2.97	0.74 – 5.41
Transect data	Mean abundance per transect	**1.34**	**1.65**	**1.43**
	90% Credible Interval	0.96 – 2.44	0.75 – 3.30	0.88 – 2.56

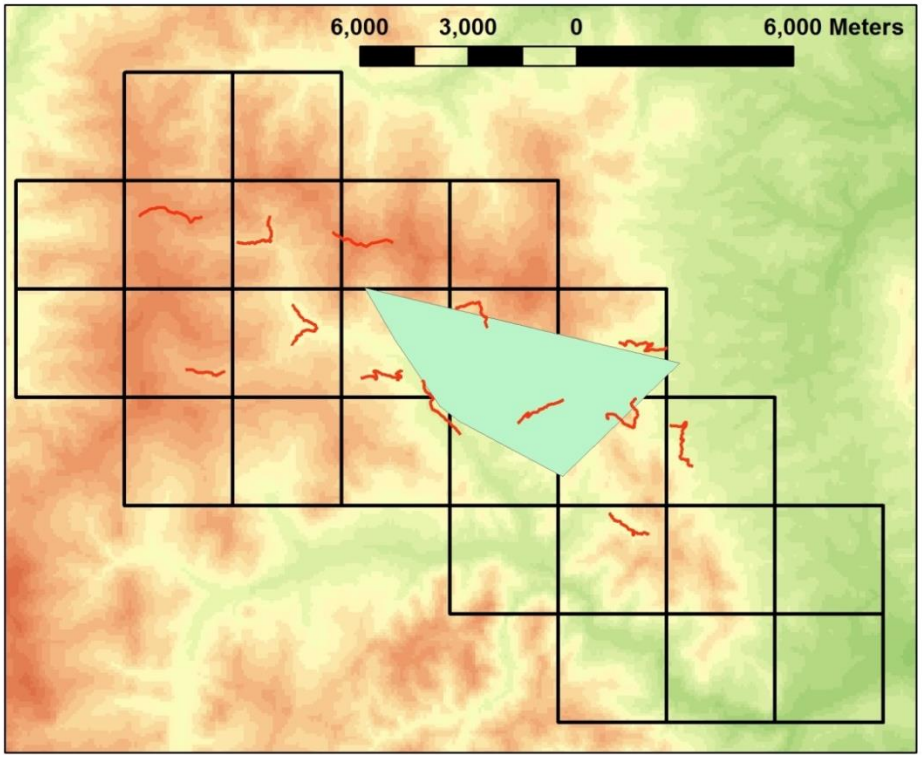
Inferring bear densities from transect data

Effective sampling area of each transect unknown, BUT we estimated *post hoc:*

- Seasonal Home Range size from an independent telemetry dataset (10 bears) = **14 ± 2.1 km^2 (95% CI = 10 – 18 km^2)** → **<u>1 – 2 grid cells</u>**

- There is home range overlap (estimated >1 individual per transect),

- **<u>Thus, ADDING UP ABUNDANCES PER TRANSECT IS WRONG</u>**



ASSUMPTION

***Effective sampling area* = mean home range size (14 km²)**

	Season 1	Season 2	Season 3
Mean abundance per transect (and 90% CI)	1.34 0.96 – 2.44	1.65 0.75 – 3.30	1.43 0.88 – 2.56
	↓	↓	↓
Density per 100 km²	10 7 – 17	12 5 – 23	10 6 – 18

Conclusion

Preliminary results as a first step

The following step – DNA methods

Thank you!

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