Use of camera traps as a biodiversity measurement tool in Gorce National Park, southern Poland

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Abstract

The non-invasive methods, which do not need direct access and harassment of animals, are essential for biodiversity monitoring. For mammals, analyses of scats and hair samples, tracking and recording by remote cameras are among the most commonly used. The study aimed to verify the current status of animal populations using camera traps in Gorce National Park (GNP), located in the Polish Carpathians covered with the natural beech and spruce mountain forests. On average, 35 passive infra-red camera traps annually were deployed in GNP. The archived data from the period of December 2013 to December 2017 was processed. In total, there were 21087 recordings of animals with 23 different taxa of mammals including 17 large and medium-sized species. Shannon's diversity index was H′= 1.908. Among ungulates, the most commonly observed species were red deer (*Cervus elaphus*; n=7898), followed wild boar (*Sus scrofa*; n=526) and roe deer (*Capreolus capreolus*; n=482). Three large carnivores i.e., grey wolf (*Canis lupus*), Eurasian lynx (*Lynx lynx*) and brown bear (*Ursus arctos*) were all regularly observed, though they belong to rare species in Poland and other neighbouring countries. The use of camera traps allowed us to distinguish lynx individuals and estimate the size of its local population. The European wildcat (*Felis silvestris*) which was not observed in GNP since the 90s, was surprisingly recorded by camera traps in 2015 and 2016. Additionally, we registered raccoon (*Procyon lotor*), an invasive alien species in Poland, which can pose a potential threat to local fauna. Similarly, domestic dogs (*Canis lupus familiaris*) and cats (*Felis catus*) were free-ranging in GNP without any confinement and far from the nearest human settlements. The collected information helped to improve management and conservation measures by GNP. We showed that this non-invasive method is particularly useful for the monitoring of elusive and individually recognizable animal species.

Keywords: carnivora, non-invasive method, Shannon's index, the Carpathians mountains

Introduction

What are non-invasive methods?

- no direct access and harassment of animals

Why non - invasive methods?

- do not alter behaviour or cause injury to studied animals

Examples

hair collection

scats collection

tracking

camera - tracking

Introduction

- Camera traps – use in research
  - species richness
    - habitat occupancy
      - population density
        - activity patterns

Introduction

Camera traps – use in research

Journal of Applied Ecology

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REVIEW

Wildlife camera trapping: a review and recommendations for linking surveys to ecological processes

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Towards more compassionate wildlife research through the 3Rs principles: moving from invasive to non-invasive methods

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RESEARCH ARTICLE

Camera Traps on Wildlife Crossing Structures as a Tool in Gray Wolf (*Canis lupus*) Management - Five-Years Monitoring of Wolf Abundance Trends in Croatia

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Tools and Technology Article

Evaluation of Camera Trapping for Estimating Red Fox Abundance

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ABSTRACT The nature reserve Serra da Malcata, Portugal, was recently considered a site for Iberian lynx (*Lynx pardinus*) reintroduction. Because of potential disease risk posed by red foxes (*Vulpes vulpes*) in the area, a reliable estimate of fox abundance was critical for a dependable reintroduction program. We adapted camera-trapping techniques for estimating red fox abundance in the reserve. From July 2005 to August 2007, we conducted 7 camera-trapping sessions, allowing for individual identification of foxes by physical characteristics. We estimated abundance using the heterogeneity (M_h) model of the software program CAPTURE. Estimated density ranged from 0.91 ± 0.12 foxes/km^2 to 0.74 ± 0.02 foxes/km^2. By estimating red fox density, it is possible to define the number of foxes that must be sampled to assess the presence of potential fox-transmitted diseases that may affect lynx reintroduction. (JOURNAL OF WILDLIFE MANAGEMENT 73(7):1207–1212; 2009)

DOI: 10.2193/2008-288

KEY WORDS camera trap, capture–mark–recapture, density estimate, Program CAPTURE, red fox, *Vulpes vulpes*.

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Aims of the study

verify the current status of animal populations

Gorce National Park

monitoring of large mammals to improve the management and conservation

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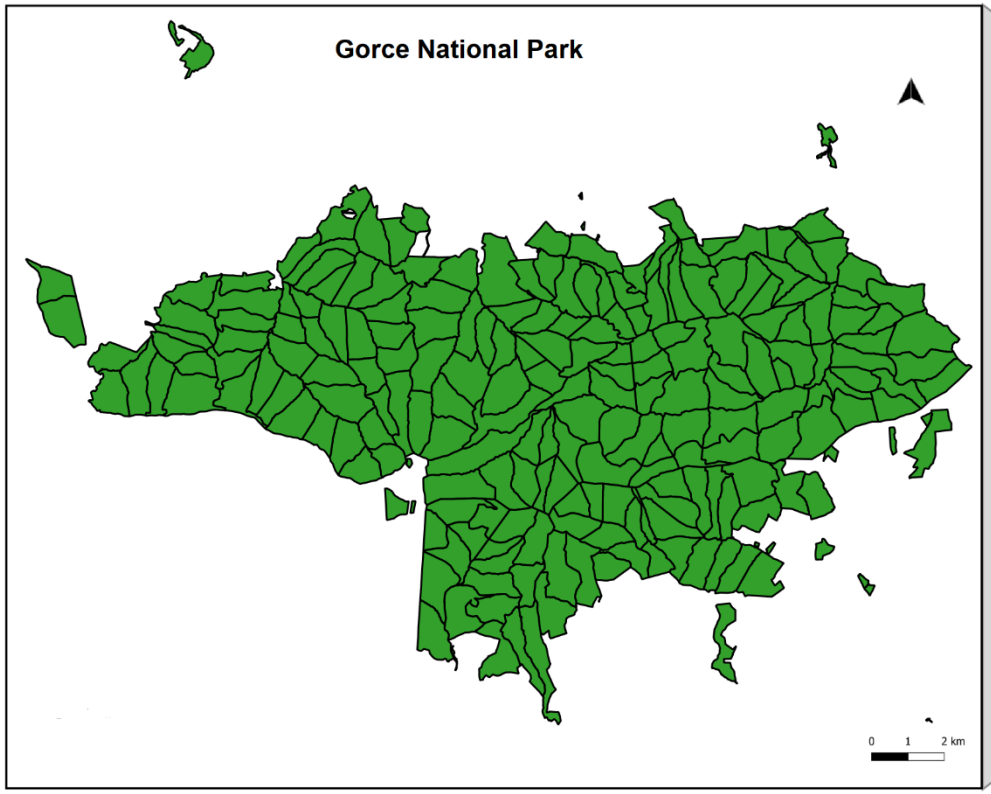
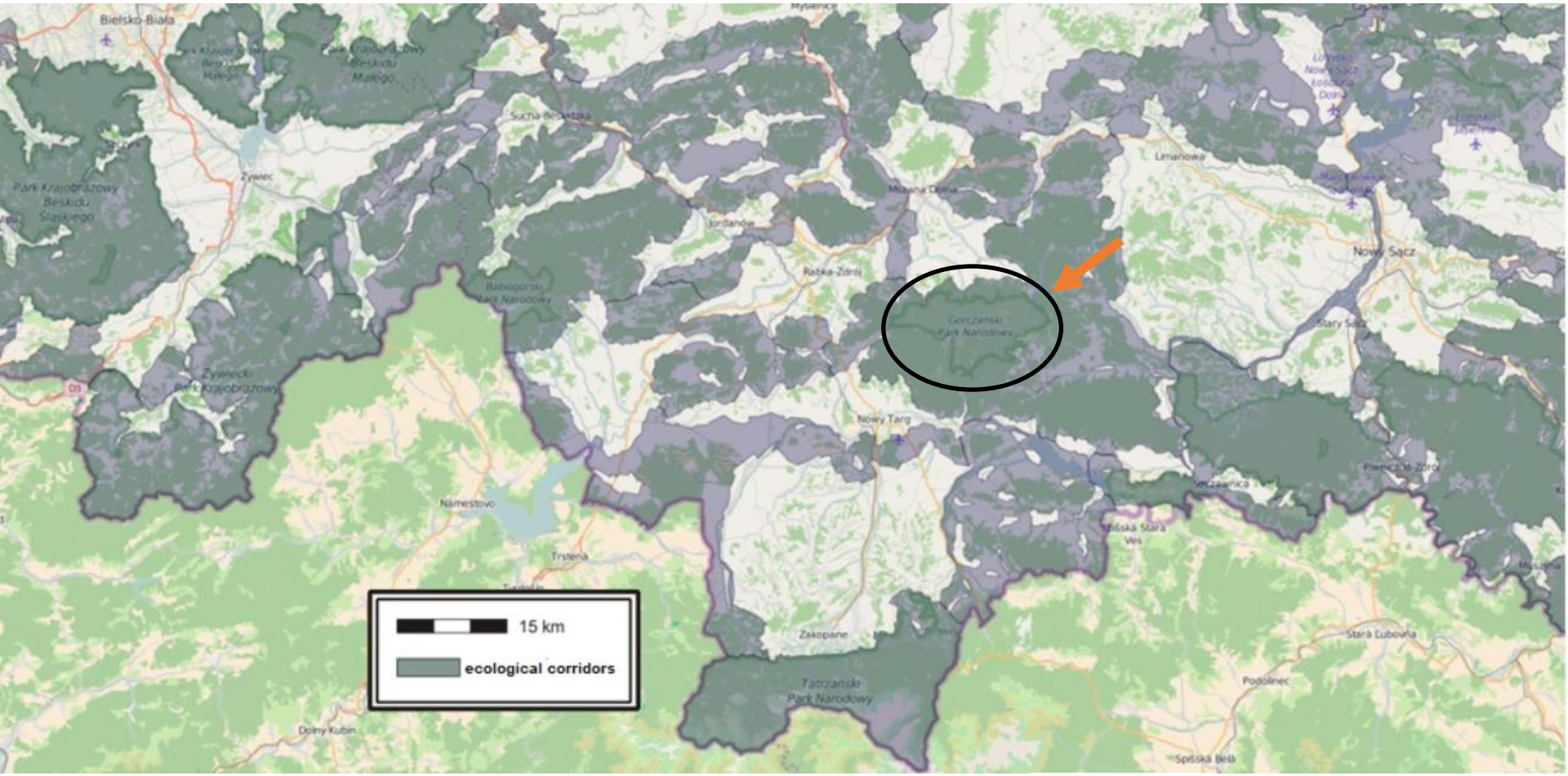
Study area - Gorce National Park (GNP)



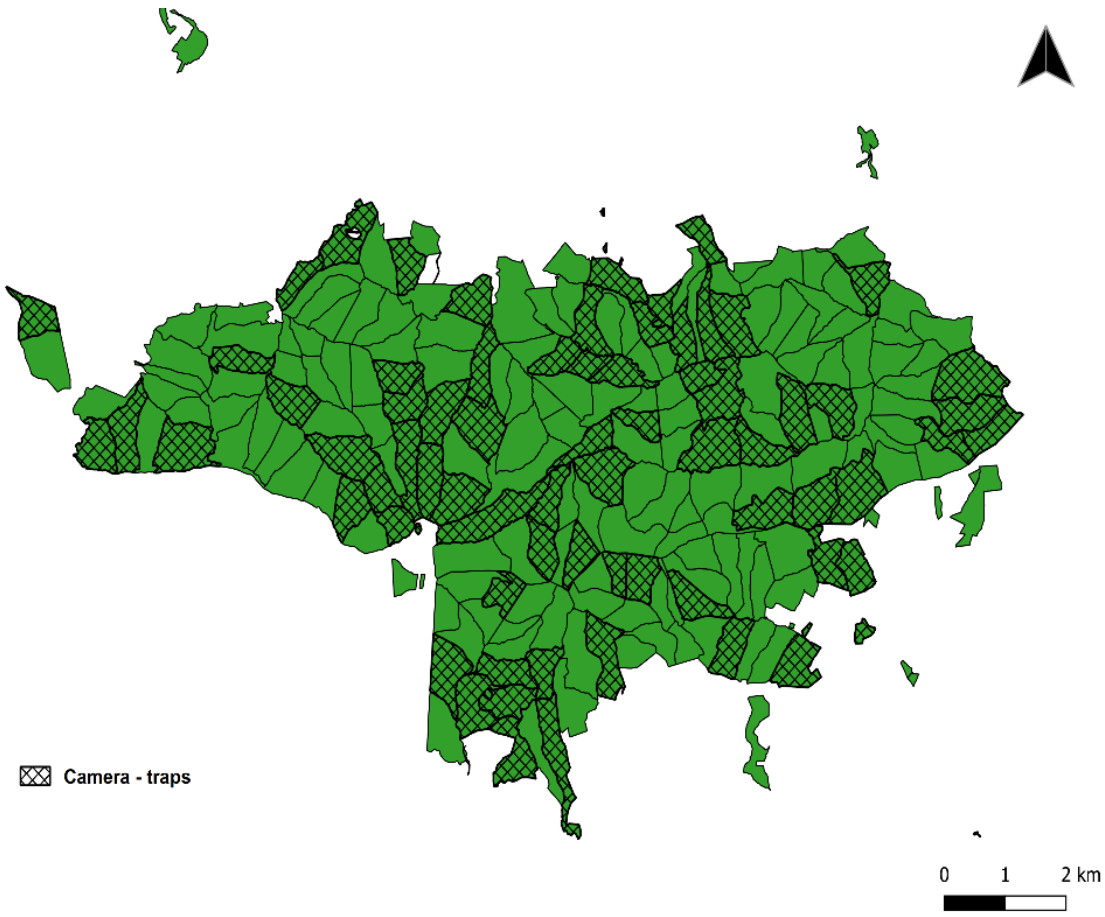
- Established in 1981
- GNP – area 70.3 km^2, plus buffer zone 167 km^2
- 94 % - forests: natural beech and spruce mountain forests
- 5.5% - meadows

Study area – Gorce National Park



- **The Polish Carpathians - Gorce Mountains**
- Natura 2000
- Special Bird Protection Area - Gorce (PLB12001) and a Special Area Habitats Protection - Ostoja Gorczańska (PLH120018) (Loch 2015)

Study area



- Location of camera – traps in the study area

- Picture of a camera trap deployed

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Materials and methods

Data collection

camera – traps

December 2013 to December 2017

Number of camera - traps			
2014	2015	2016	2017
29	29	52	34

Data processing

archived data were processed

observations of videos and photos

database in Excel

Presence
identification;
individual information

Absence

Data analysis

estimated number of taxa

temporal distribution

(Activity of the species)

biodiversity index - Shannon's index (H)

DF (detection factor)

Results

Categories of animals	Species	2014	2015	2016	2017	Total
Carnivora	Brown bear (*Ursus arctos*)	0	0	0	5	**5**
	Domestic cat (*Felis catus*)	0	12	2	5	**19**
	Domestic dog (*Canis lupus familliaris*)	1	14	53	8	**76**
	Eurasian lynx (*Lynx lynx*)	294	394	1259	311	**2258**
	European badger (*Meles meles*)	498	516	507	285	**1806**
	European Polecat (*Mustela putorius*)	0	1	1	0	**2**
	Grey wolf (*Canis lupus*)	26	53	105	70	**254**
	Least weasel (*Mustela nivalis*)	11	16	28	39	**94**
	Pine marten (*Martes martes*)	37	125	110	72	**344**
	Red fox (*Vulpes vulpes*)	74	353	217	1093	**1737**
	Stoat (*Mustela erminea*)	3	0	4	2	**9**
	Stone marten (*Martes foina*)	0	17	0	1	**18**
	Wild cat (*Felis silvestris*)	0	1	10	0	**11**
Ungulates	Cattle	0	3	0	0	**3**
	Red deer (*Cervus elaphus*)	1331	2674	2440	1453	**7898**
	Roe deer (*Capreolus capreolus*)	34	135	228	85	**482**
	Wild boar (*Sus scrofa*)	87	32	325	82	**526**
Others	Bats (Chiroptera)	3	54	392	46	**495**
	Brown hare (*Lepus europaeus*)	0	2	11	8	**21**
	European beaver (*Castor fiber*)	0	10	0	0	**10**
	Northern white-breasted hedgehog (*Erinaceus roumanicus*)	0	0	1	0	**1**
	Red squirrel (*Sciurus vulgaris*)	39	83	230	88	**440**
	Rodents (Rodentia)	58	456	632	622	**1768**
Total		**2496**	**4951**	**6555**	**4275**	**18277**


05/21/2017 02:14:13


29/08/2017 10:44:23


06/24/2017 06:46:07


12/21/2015 02:00:36

Results

Most frequently recorded species among ungulates

- red deer (n=7898)
- wild boar (n=526)
- roe deer (n=482)

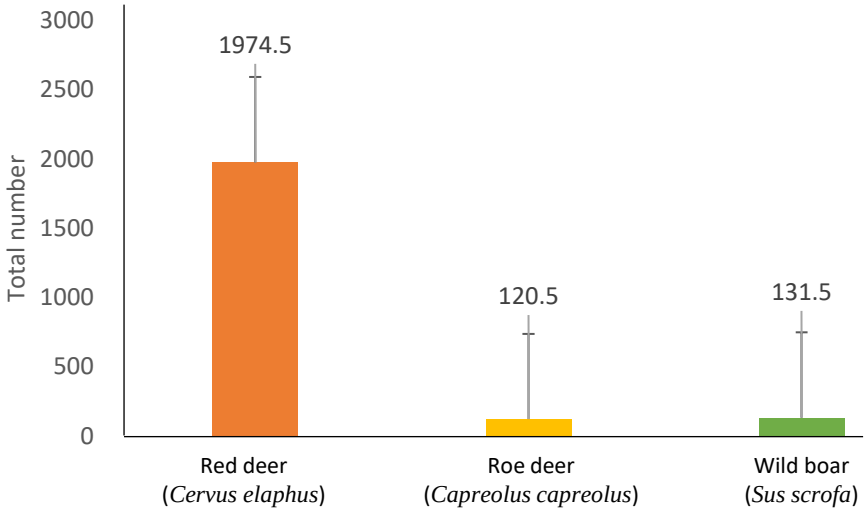

Fig. 1. Average numbers of ungulate spp. recorded by camera traps from December 2013 to December 2017 in GNP (±SE)

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Results

Most frequently recorded species among Carnivora

- Euroasian lynx (n=2258)
- European badger (n=1806)
- Red fox (n=1737)

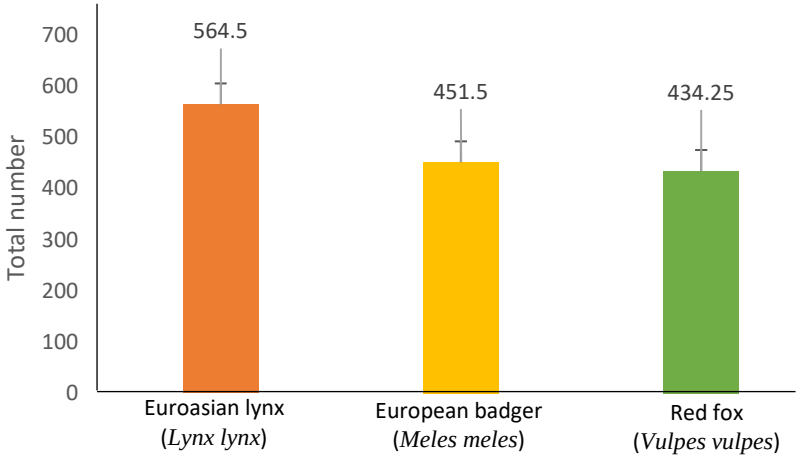

Fig. 2. Average numbers of Carnivora spp. recorded by camera traps from December 2013 to December 2017 in GNP (±SE)

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Results

Shannon's index (H)

$$H = -\sum_{i=1}^{s} p_i I_n p_i = 1.908$$

range: 1.5 to 3.5

Σ - sum of the calculations

s - number of taxa

p_i - the proportion (n/N) of individuals of one particular species found (n) divided by the total number of individuals found (N)

ln - natural log

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Results

Activity of the species

- The most frequently recorded species during the night was red fox (77.8%)
- The most frequently recorded species during the day was roe deer (71.2%)

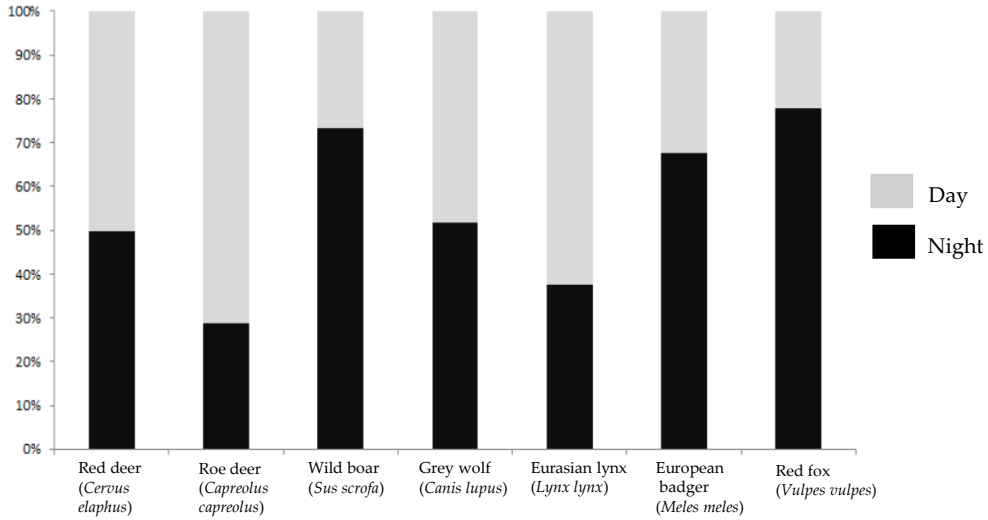

Fig. 3. Percentage of daily activity of selected mammalian species in GNP (Wawrzacz 2017)

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Results

WD (detection factor)

$$DW = \frac{A}{N}$$

A – number of recordings on which the presence of a given species was found
N – number of working days of the camera - trap

(Meek et al. 2012)

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the highest overall detection rate **- red deer (0.44 recordings/day)**

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the most frequently observed predator - **European badger (0.10 recordings/day)**

(Wawrzacz,. 2017)

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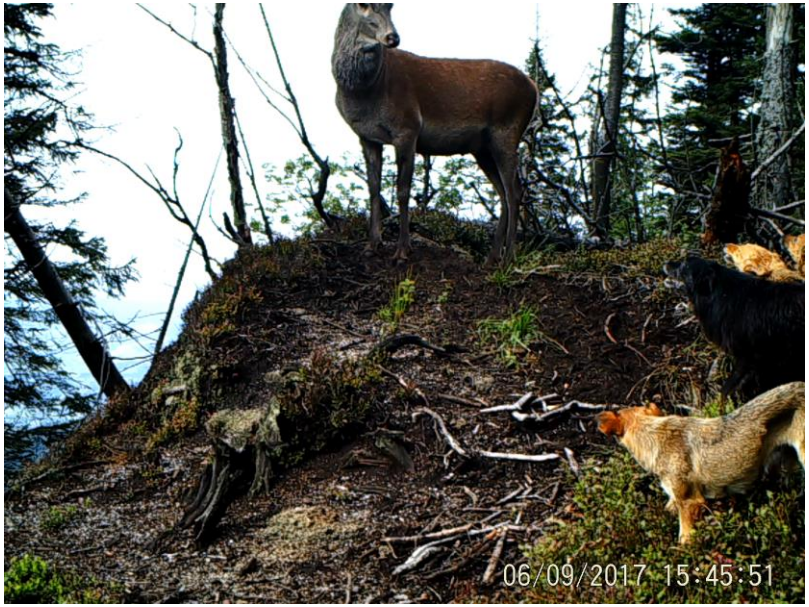
Results

Threats to the local biodiversity

- domestic dogs (n= 76) and cats (n=19) were free-ranging in GNP without any confinement and far from the nearest human settlements

- Invasive allien species: raccoon (*Procyon lotor*) was registered once



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Conclusions

The collected information helped to improve management and consersation measures within GNP area

Distinguish lynx individuals and estimate the size of its local population (Czarnota et al. 2019)

Yield better insight into the associative patterns between species (trophic overlap of carnivores) (Gaspar et al. 2018)

Identify potential threaths to local fauna (domestic dogs and cats, invasive allien species) (Hadala et al. 2020)

Study indicates the importance of continuing researches to ensure effective wildlife conservation

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