First online course on the use of camera trapping for monitoring wildlife and density estimation in the framework of the EOW

Camera trap methods for density estimation

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DENSITY

Number of animals per area (ind/km2)

Total counts

Distance sampling

Capture-recapture

Genetics

Drive counts

...

Camera traps

Camera traps

With individual identification

(Capture-recapture)

WithOUT individual identification

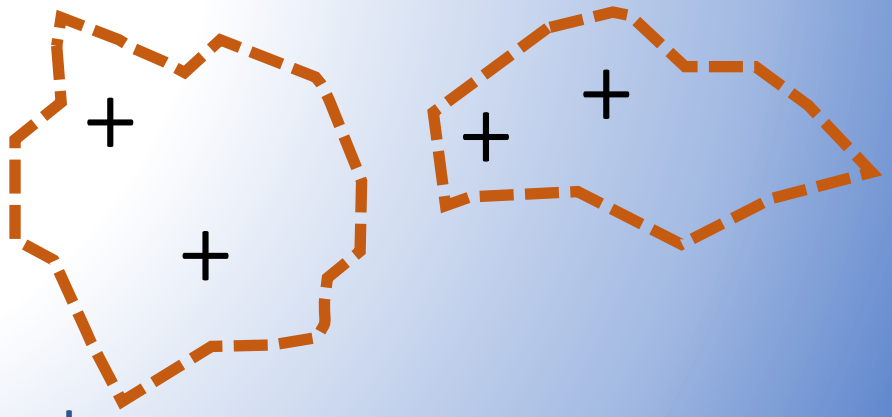
With individual identification (capture-recapture)

Species-ecology determines survey design

Why???

Each animal should have some probability of been capture in more than one camera

What does this mean???



We need to individually identify animals…

Same individual??

Nobody knows…

ENETWILD

European Observatory of Wildlife

Focused on mammals but looking to integrate other taxa and ecological variables and integrated monitoring (wildlife diseases).

Mammals, not only one species

A network of observation points to harmoniously monitor wildlife at European scale

Camera traps

With individual identification

(Capture-recapture)

WithOUT individual identification

Conservation Biology

Review

Abundance estimation of unmarked animals based on camera-trap data

Neil A. Gilbert,[1*] John D. J. Clare,[1] Jennifer L. Stenglein,[2] and Benjamin Zuckerberg[1]

[1]Department of Forest and Wildlife Ecology, University of Wisconsin-Madison, 1630 Linden Drive, Madison, WI, 53706, U.S.A.
[2]Wisconsin Department of Natural Resources, 2901 Progress Drive, Madison, WI, 53716, U.S.A.

Many "unmarked" methods, but:

- Similar assumptions (random design, certain detection within part of the area monitored…)
- Compatible experimental design

Discussed on my next talk
"Study design field protocol"

ENETWILD

eOW european observatory of wildlife

SPATIALLY EXPLICIT MODELS FOR INFERENCE ABOUT DENSITY IN UNMARKED OR PARTIALLY MARKED POPULATIONS

BY RICHARD B. CHANDLER[1] AND J. ANDREW ROYLE

Journal of Applied Ecology

British Ecological Society

Journal of Applied Ecology 2008 doi: 10.1111/j.1365-2664.2008.01473.x

Estimating animal density using camera traps without the need for individual recognition

J. Marcus Rowcliffe[1]*, Juliet Field[2], Samuel T. Turvey[1] and Chris Carbone[1]

[1]Institute of Zoology, Zoological Society of London, Regent's Park, London NW1 4RY, UK; and [2]Faculty of Biological Sciences, University of Leeds, Leeds LS2 9JT, UK

Methods in Ecology and Evolution

Methods in Ecology and Evolution 2017 doi: 10.11

Distance sampling with camera traps

Eric J. Howe*,[1], Stephen T. Buckland[1], Marie-Lyne Després-Einspenner[2] and Hjalmar S. Kühl[2,3]

ECOSPHERE

Three novel methods to estimate abundance of unmarked animals using remote cameras

ANNA K. MOELLER,[1,]† PAUL M. LUKACS,[1] AND JON S. HORNE[2]

Department of Ecosystem and Conservation Sciences, W.A. Franke College of Forestry and Conservation, University of Montana, Missoula, Montana 59812 USA
[2]Idaho Department of Fish and Game, Lewiston, Idaho 83501 USA

P. M. Lukacs, and J. S. Horne. 2018. Three novel methods to estimate abundance of unmarked
heras. Ecosphere 9(8):e02331. 10.1002/ecs2.2331

RESEARCH ARTICLE

Journal of Applied Ecology BRITISH ECOLOGICAL SOCIETY

Estimating animal density without individual recognition using information derivable exclusively from camera traps

Yoshihiro Nakashima[1] | Keita Fukasawa[2] | Hiromitsu Samejima[3]

Further discussion: three methods applied with the same design

Received: 17 September 2020 | Accepted: 6 May 2021
DOI: 10.1111/1365-2664.13913

RESEARCH ARTICLE

Journal of Applied Ecology

Assessing the camera trap methodologies used to estimate density of unmarked populations

Pablo Palencia[1] | J. Marcus Rowcliffe[2] | Joaquín Vicente[1] | Pelayo Acevedo[1]

[1]Instituto de Investigación en Recursos Cinegéticos (IREC) CSIC-UCLM-JCCM, Ciudad Real, Spain
[2]Institute of Zoology, Zoological Society of London (IoZ-ZSL), London, UK

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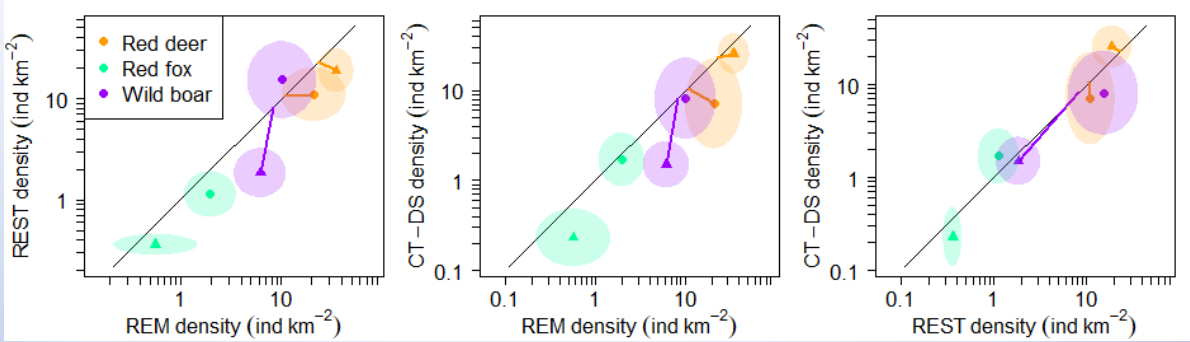
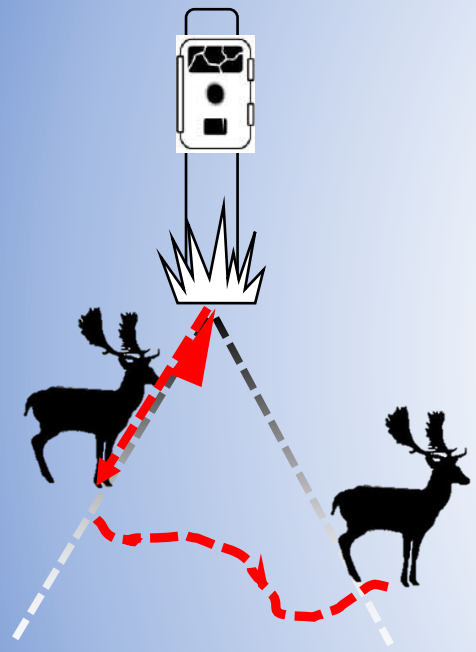
Abstract

1. Population density estimations are essential for wildlife management and conservation. Camera traps have become a promising cost-effective tool, for which several methods have been described to estimate population density when individuals are unrecognizable (i.e. unmarked populations). However, comparative tests of their applicability and performance are scarce.



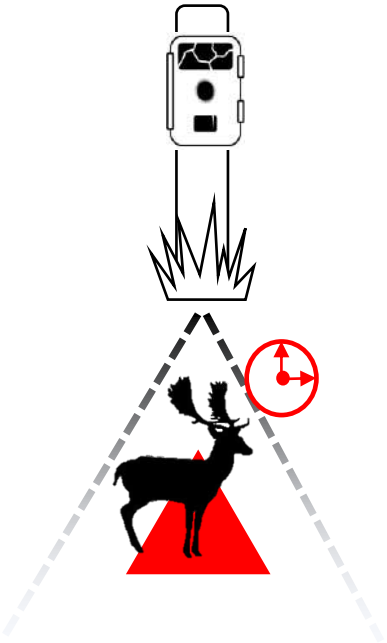
REM



$$D = \frac{Y}{H} \cdot \frac{\pi}{v \cdot r \cdot (2+\theta)}$$

Rowcliffe *et al.*, 2008 – J. Appl. Ecol.

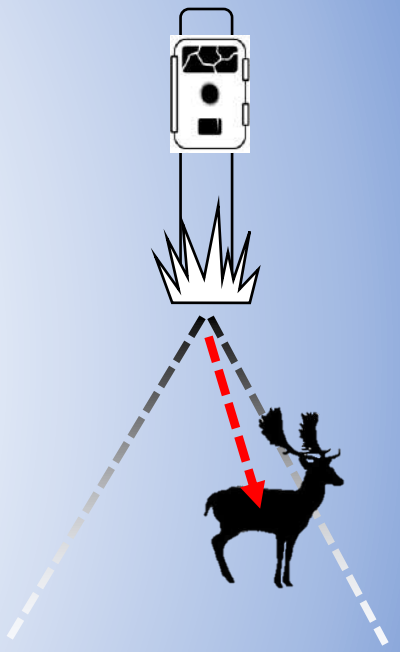
REST



$$D = \frac{Y \cdot T}{s \cdot H}$$

Nakashima *et al.*, 2018 – J. Appl. Ecol.

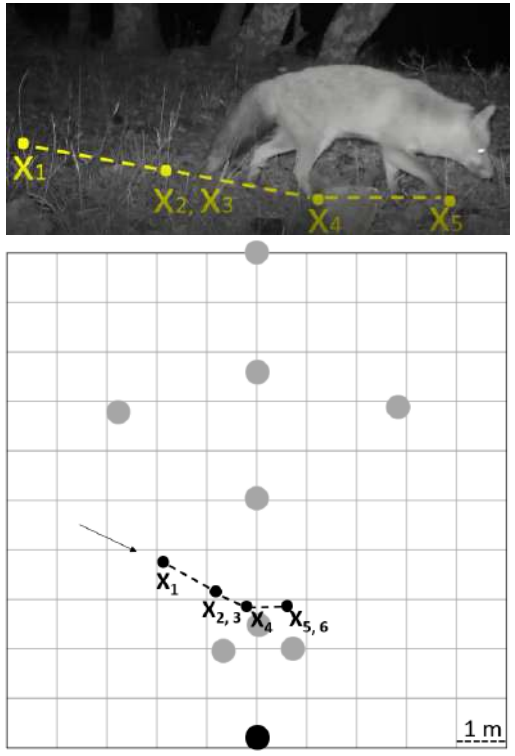
CT-DS



$$D = \frac{Y}{\pi \cdot w^2 \cdot e \cdot P}$$

Howe *et al.*, 2017 – Methods Ecol. Evol.

For most of the unmarked camera trap methods,
we need to locate animals in the field of view



Remember this, it is a key point that will be discussed this morning

Random Encounter Model (REM)

Journal of Applied Ecology

British Ecological Society

Journal of Applied Ecology 2008 doi: 10.1111/j.1365-2664.2008.01473.x

Estimating animal density using camera traps without the need for individual recognition

J. Marcus Rowcliffe[1]*, Juliet Field[2], Samuel T. Turvey[1] and Chris Carbone[1]

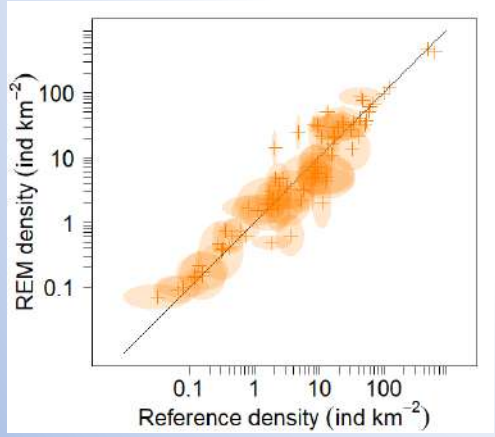
[1]*Institute of Zoology, Zoological Society of London, Regent's Park, London NW1 4RY, UK; and* [2]*Faculty of Biological Sciences, University of Leeds, Leeds LS2 9JT, UK*

Why REM?

Remote Sensing in Ecology and Conservation
Open Access
ZSL LET'S WORK FOR WILDLIFE

ORIGINAL RESEARCH

Random encounter model is a reliable method of estimating population density of multiple species using camera traps



Reviewed

- 34 studies
- 45 species
- 77 REM-reference method comparisons
- 13 populations sampled

Palencia *et al.*, 2022 – Remote Sensing in Ecology and Conservation – Accepted! DOI:10.1002/rse2.269

Encounter rate:
Number of animals detected per sampling unit (animals·(cam·day)$^{-1}$)

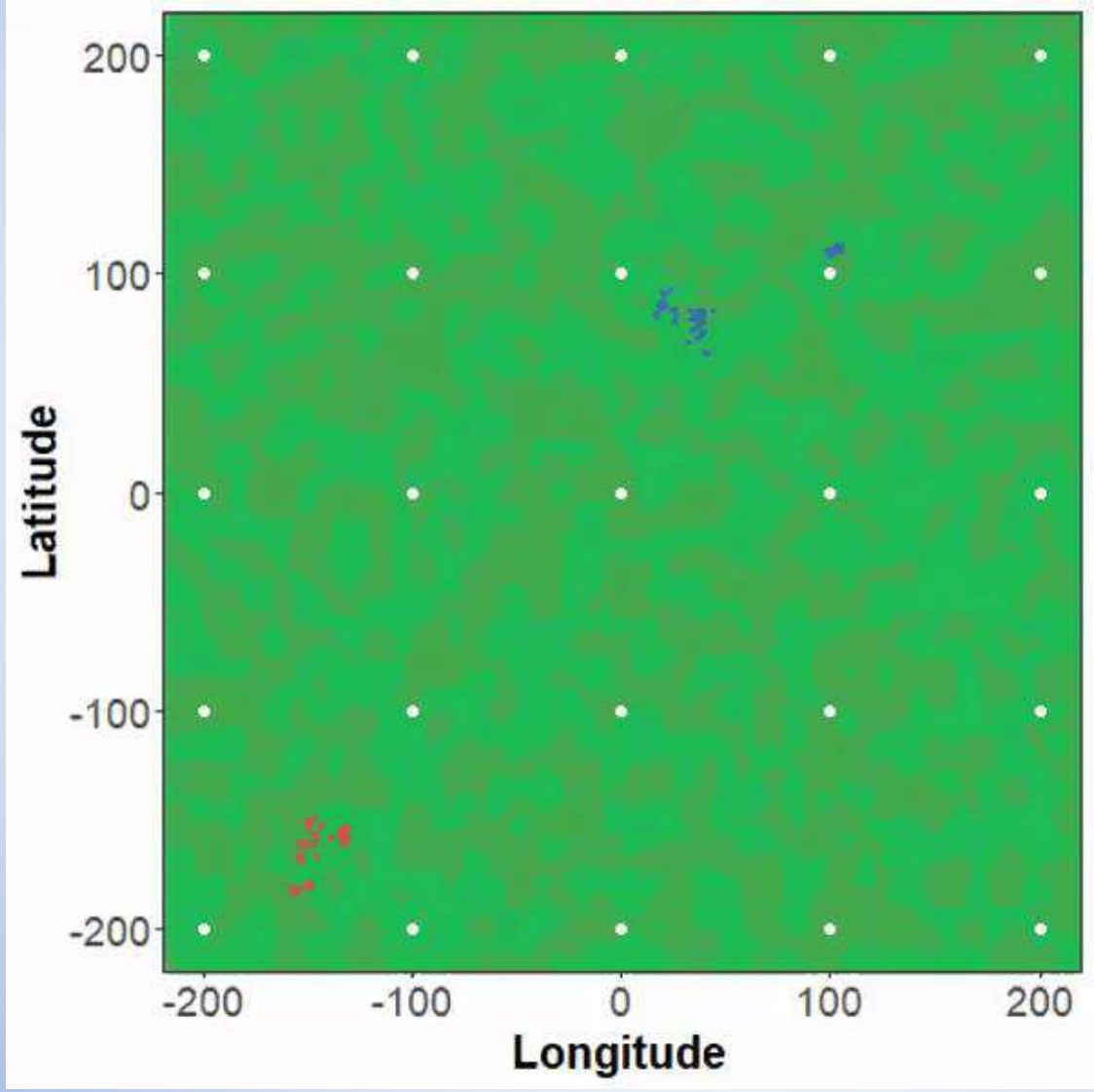
Density:
Number of individuals per unit area (individuals·km^{-2})

$$D = \frac{y}{t} \cdot \frac{\pi}{v \cdot r \cdot (2+\alpha)}$$

Day range:
distance travelled by an individual during the day (km·day^{-1})

Detection zone:
Area in which the cameras effectively detect animals. Radius (km) and angle (radians)

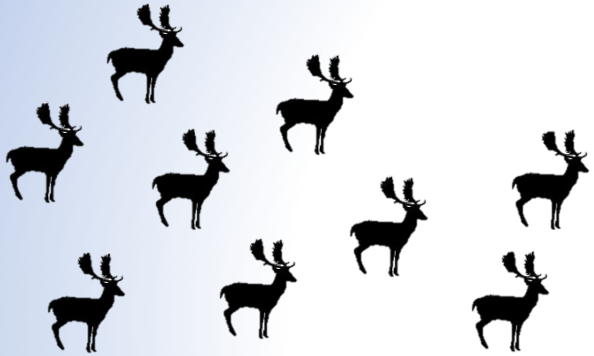
Rowcliffe *et al.*, 2008 – J. Appl. Ecol.

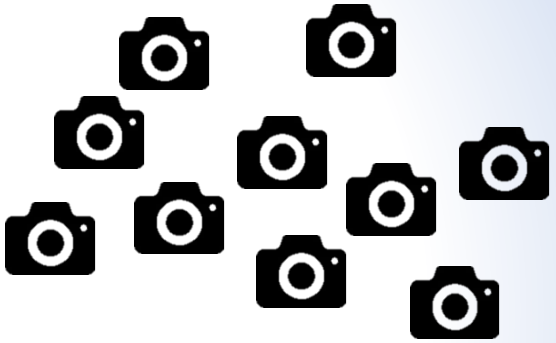


- Two animals (red & blue)
- Grid of cameras (white points)

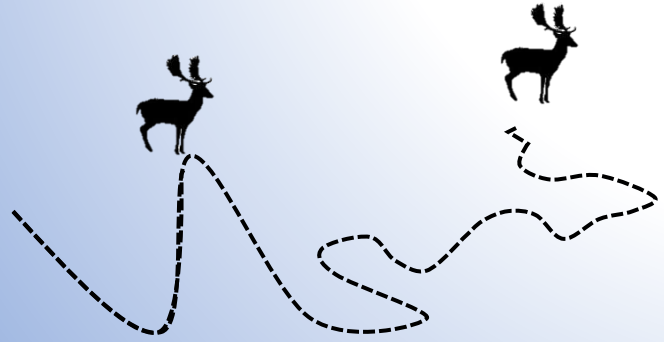
- One encounter (see flash)

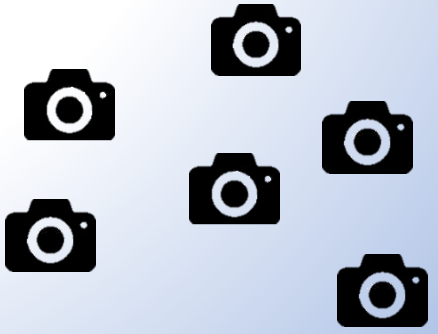
The more animals… the more photos





The more displacement… the more photos





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Area in which the cameras effectively detect animals. Radius (km) and angle (radians)

Rowcliffe *et al.*, 2008 – J. Appl. Ecol.

Clarifying Assumptions Behind the Estimation of Animal Density From Camera Trap Rates

J. MARCUS ROWCLIFFE,[1] *ZSL Institute of Zoology, Regent's Park, London NW 4RY, UK*

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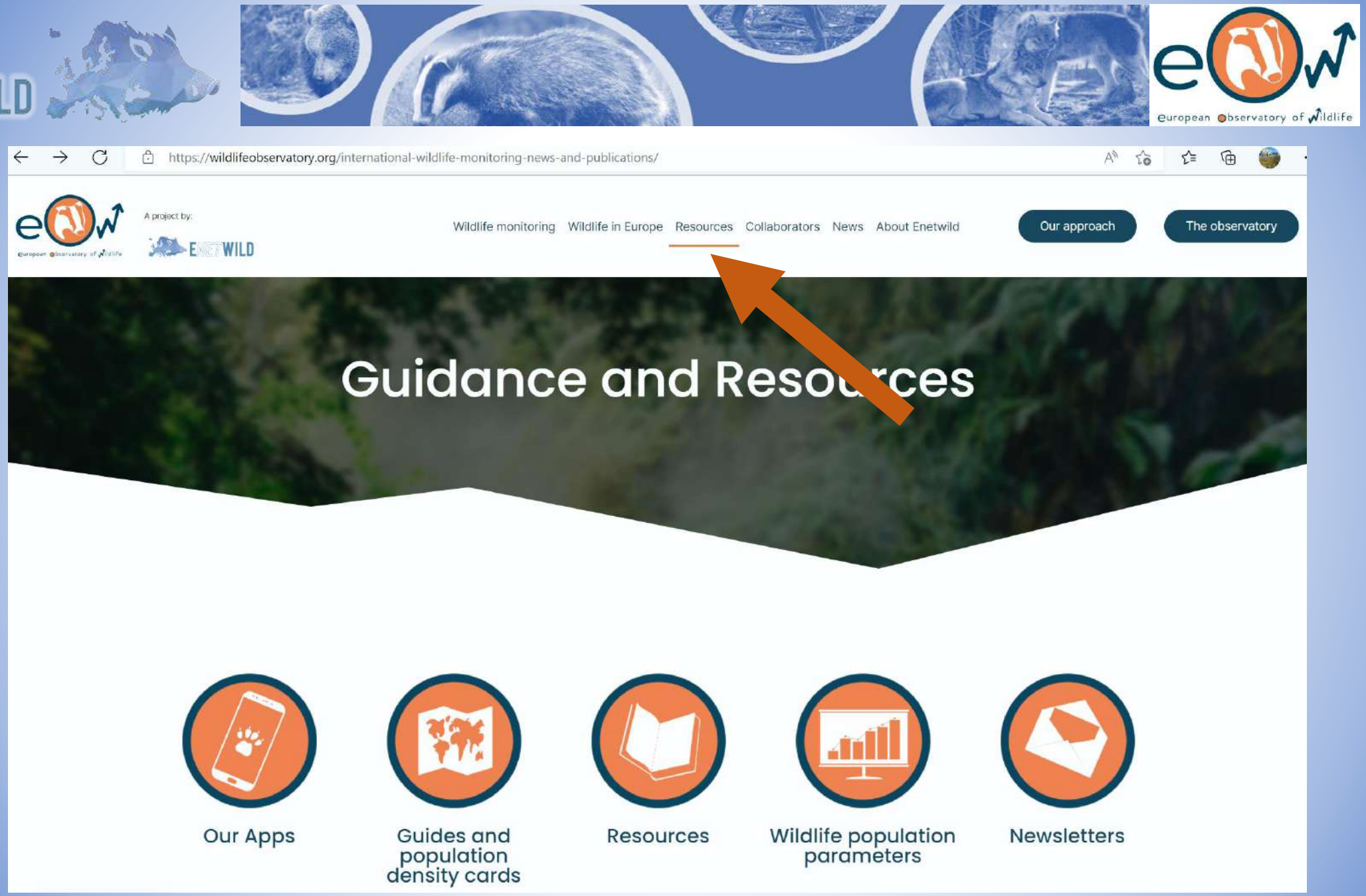
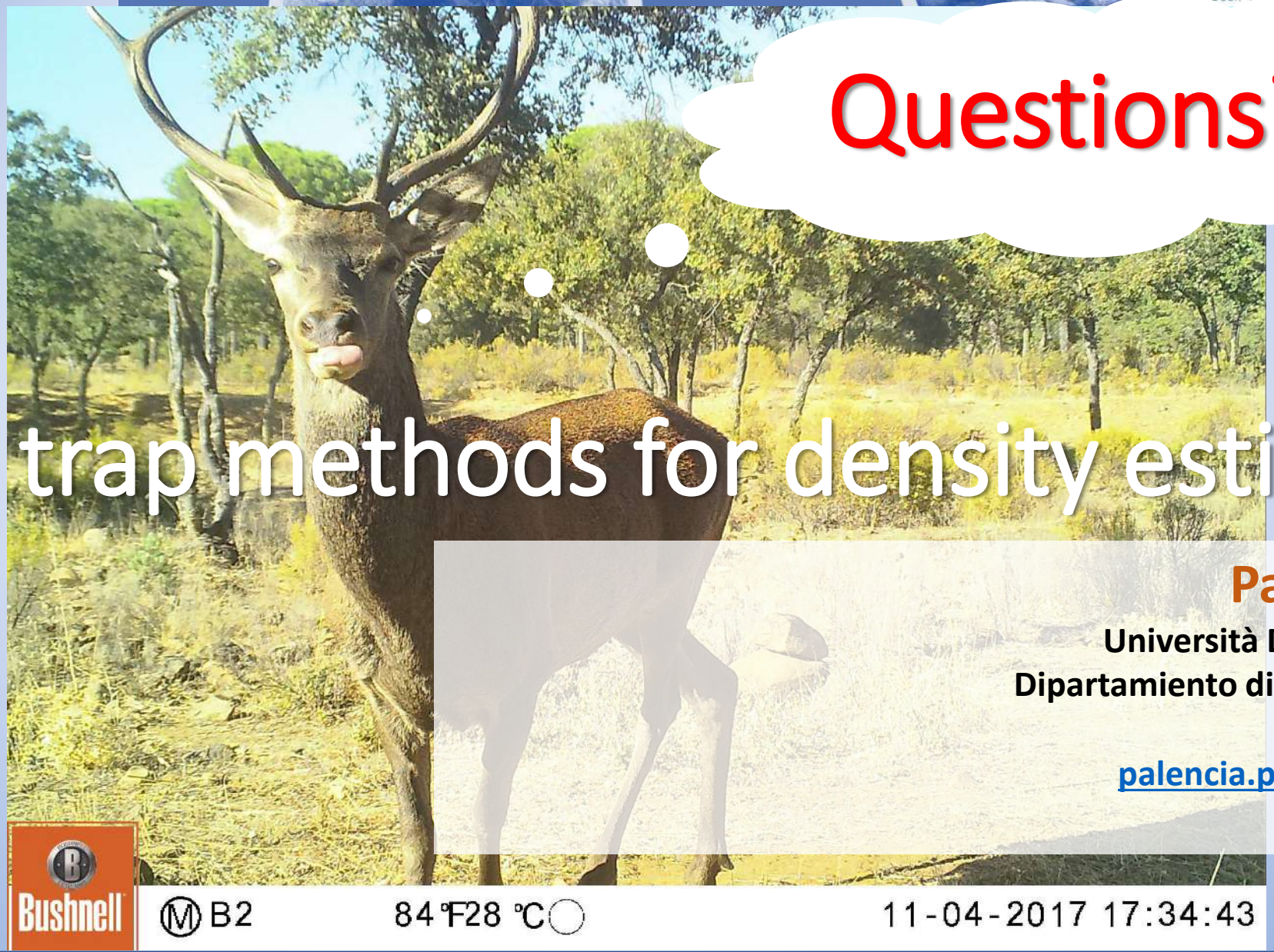
Rowcliffe et al. 2012– The Journal of Wildlife Management


https://wildlifeobservatory.org/international-wildlife-monitoring-news-and-publications/
A project by:
Wildlife monitoring
Wildlife in Europe
Resources
Collaborators
News
About Enetwild
Our approach
The observatory
Guidance and Resources
Our Apps
Guides and population density cards
Resources
Wildlife population parameters
Newsletters

Take home messages

1. **EOW** focused on **mammals' community** (**unmarked** methods preferred)
2. **Locate animals** in the field of view (needed for most of the methods)
3. **REM**, method to be applied



Questions??

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