

EUROPARC's Climate Change WEEK

What is the evidence for the effectiveness of corridors
for the conservation of terrestrial vertebrates
in Europe?

Hugo MELL, Joseph LANGRIDGE
UMS PatriNat (OFB-CNRS-MNHN)





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ADAPT

Context



Heller & Zavaleta, 2009

Review

Biodiversity management in the face of climate change: A review of 22 years of recommendations

Nicole E. Heller*, Erika S. Zavaleta

Environmental Studies Department, University of California, Santa Cruz, Santa Cruz, CA 95606, United States

Rank	Recommendation	No. articles	References
1	Increase connectivity (design corridors, remove barriers for dispersal, locate reserves close to each other, reforestation)	24	Beatley (1991), Chambers et al. (2005), Collingh Fonseca et al. (2005), de Dios et al. (2007), Dix (1999), Franklin et al. (1992), Guo (2000), Halpi Lovejoy (2005), Millar et al. (2007), Morecroft e

Prober et al., 2019

REVIEW

Ecological Monographs, 89(1), 2019, e01333

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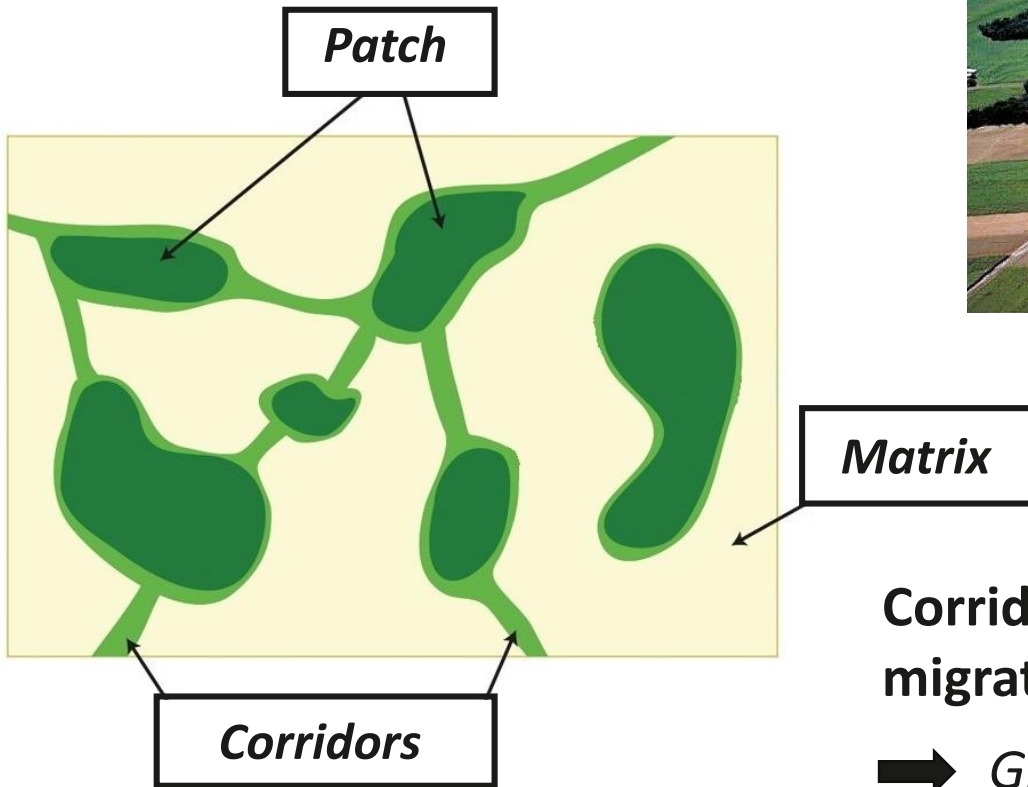
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Shifting the conservation paradigm: a synthesis of options for renovating nature under climate change

SUZANNE M. PROBER,^{1,5} VERONICA A. J. DOERR,² LINDA M. BROADHURST,³ KRISTEN J. WILLIAMS,² AND FIONA DICKSON⁴

“ [...] ensuring adequate connectivity was the most widely proposed action for helping biodiversity adapt to climate change “

Ecological networks



Corridors might support species migration in fragmented landscapes.

➡ *Green infrastructures*



Yet....

- Most recommendations seem to come from discussion/opinion and theoretical papers
- Lack of practical guidelines on when/how to build corridors effectively
 - ➔ Evidence synthesis to identify *empirical evidence* available for promotion of corridors.



Evidence synthesis



Aim of the synthesis

Gather *field studies*...

... measuring corridors' *effectiveness* ...

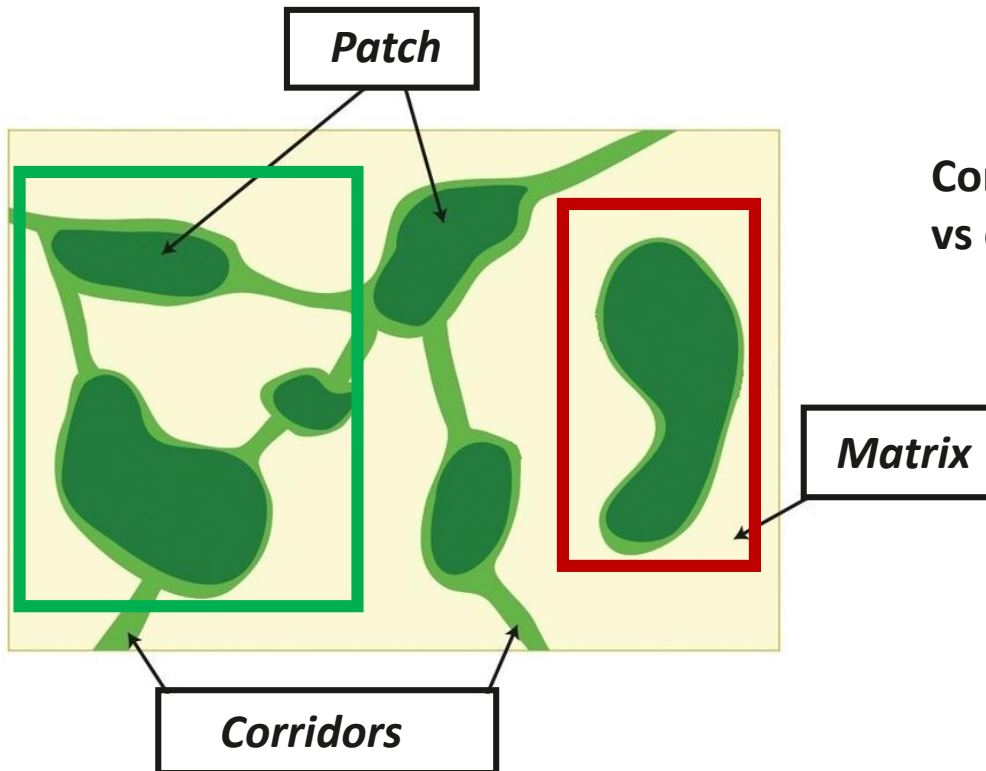
... for *terrestrial vertebrates* ...

... in **Europe**.



Corridors in field studies

- Isolated vs connected patches



Comparison of outcome in isolated vs connected patches

Corridors in field studies

- Gradient of linear features in landscape



Hedgerows, windbreaks, tree lines, riparian vegetations, ditches...

Association between quantity of linear features and *Abundance/Species richness*



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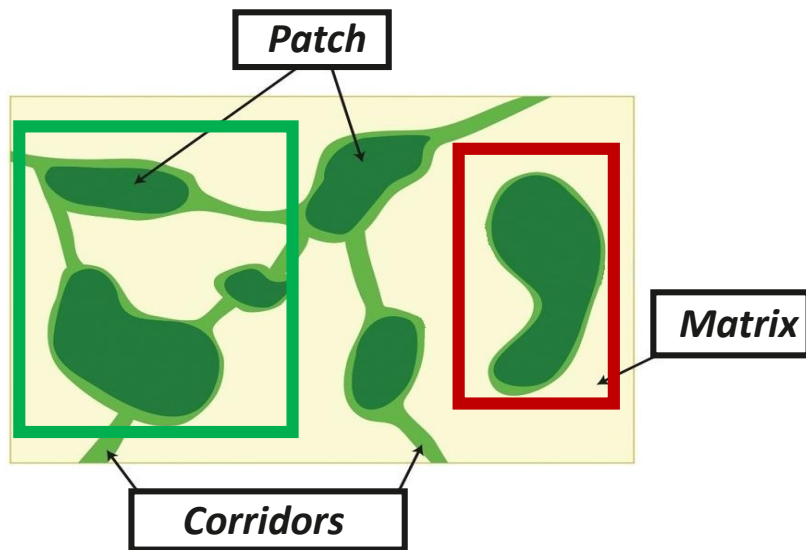
Main result

A lack of comparable studies for terrestrial vertebrates in Europe

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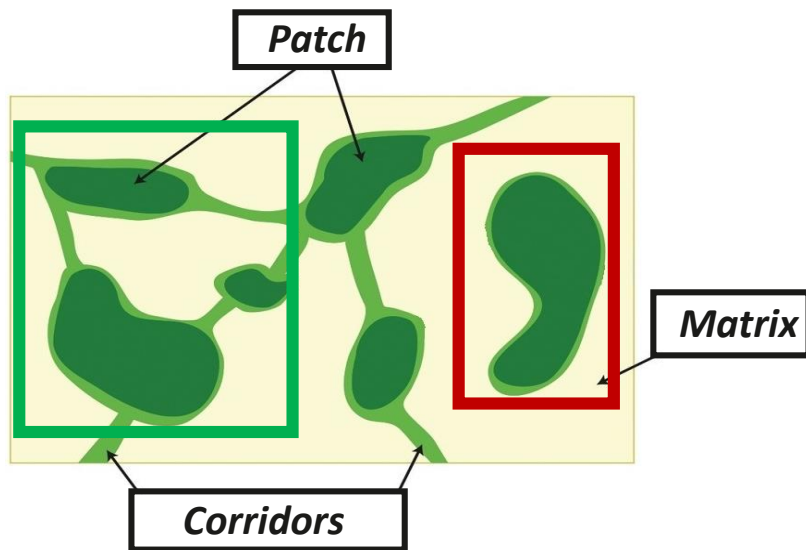
Isolated vs connected patches



Main result

A lack of comparable studies for terrestrial vertebrates in Europe

Isolated vs connected patches



No matching studies in our corpus.

4 studies from two previous reviews

[Gilbert-Norton et al., 2010](#)

[Resasco, 2019](#)

Main result

A lack of comparable studies for terrestrial vertebrates in Europe

Gradient of linear features



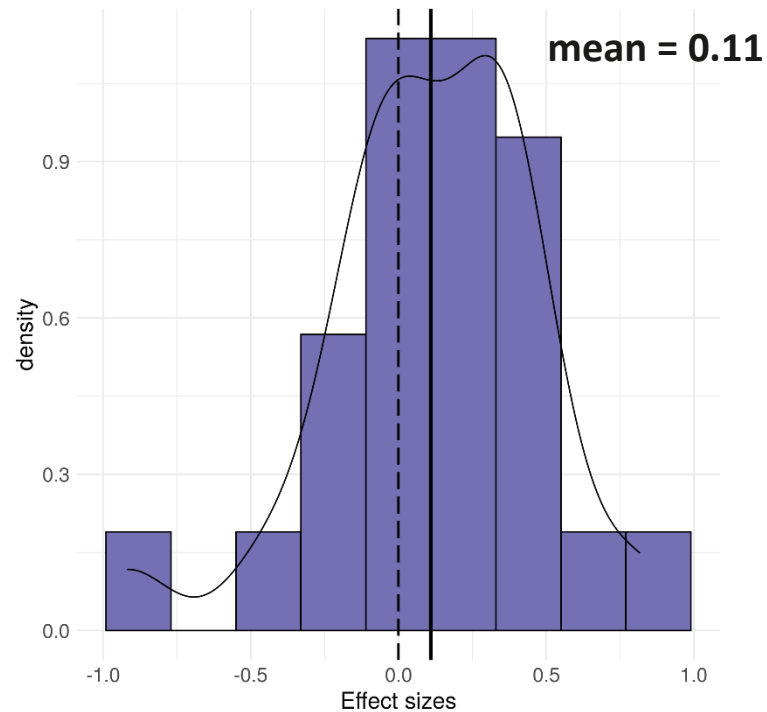
Main result

A lack of comparable studies for terrestrial vertebrates in Europe

Gradient of linear features



Distribution of effect sizes for *Species richness*



12 studies

24 effect sizes

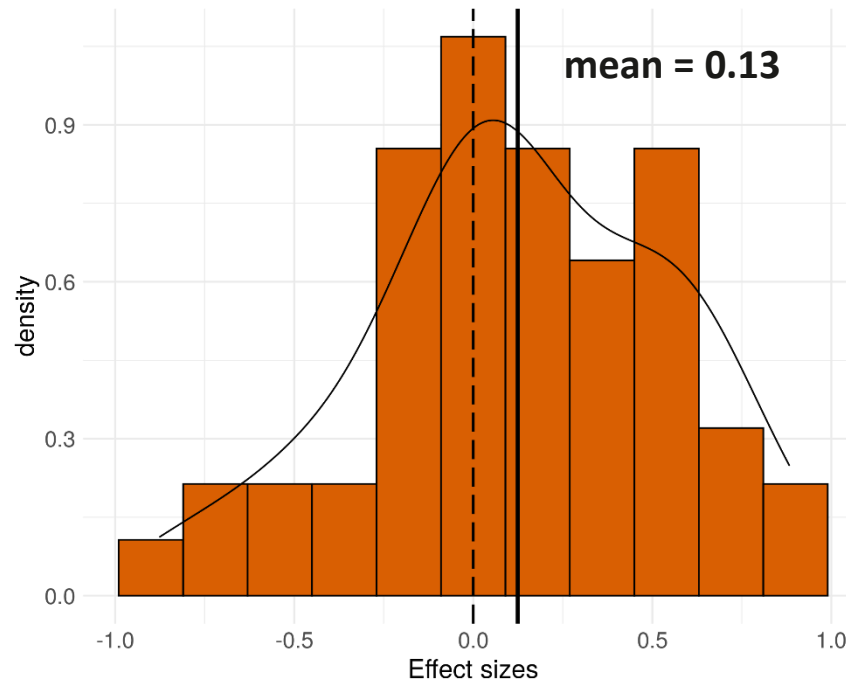
Main result

A lack of comparable studies for terrestrial vertebrates in Europe

Gradient of linear features



Distribution of effect sizes for *Abundance*



14 studies

52 effect sizes



Case studies



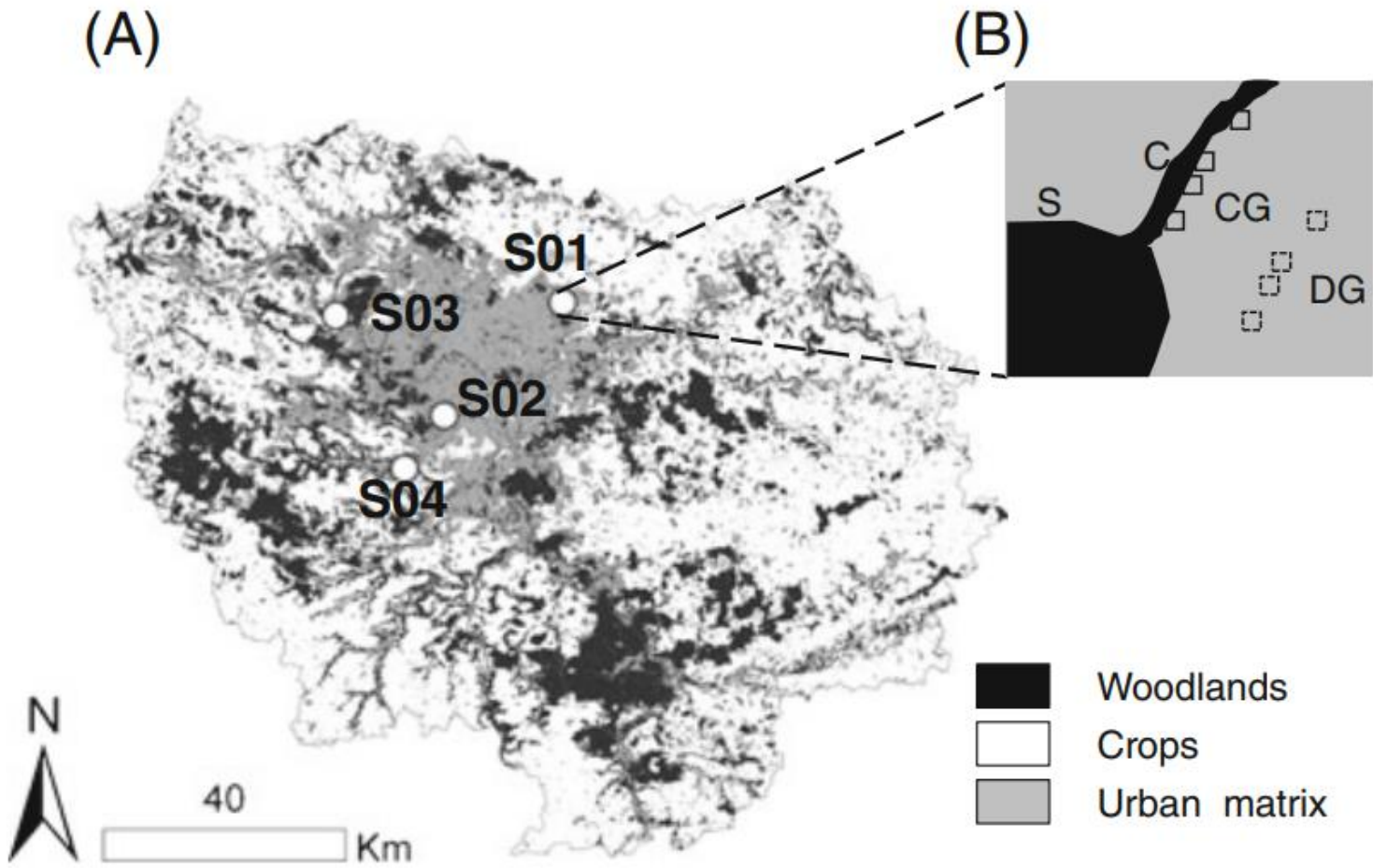
Ecological corridors also operate in an urban matrix: A test case with garden shrews

[Vergnes et al.,
2013](#)

Alan Vergnes • Christian Kerbiriou • Philippe Clergeau

- France
- Shrews (3 species)
- 16 domestic gardens connected or not to a woodlot via a woody corridor in 4 sites. 135 line traps distributed in woodlot, woody corridor and under hedgerows in gardens

Isolated vs connected patches



Ecological corridors also operate in an urban matrix: A test case with garden shrews

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- France
- Shrews (3 species)
- 16 domestic gardens connected or not to a woodlot via a woody corridor in 4 sites. 135 line traps distributed in woodlot, woody corridor and under hedgerows in gardens
- Results:

Isolated vs connected patches

Shrews occurred more often in connected gardens than isolated ones (with only one species found in isolated gardens).

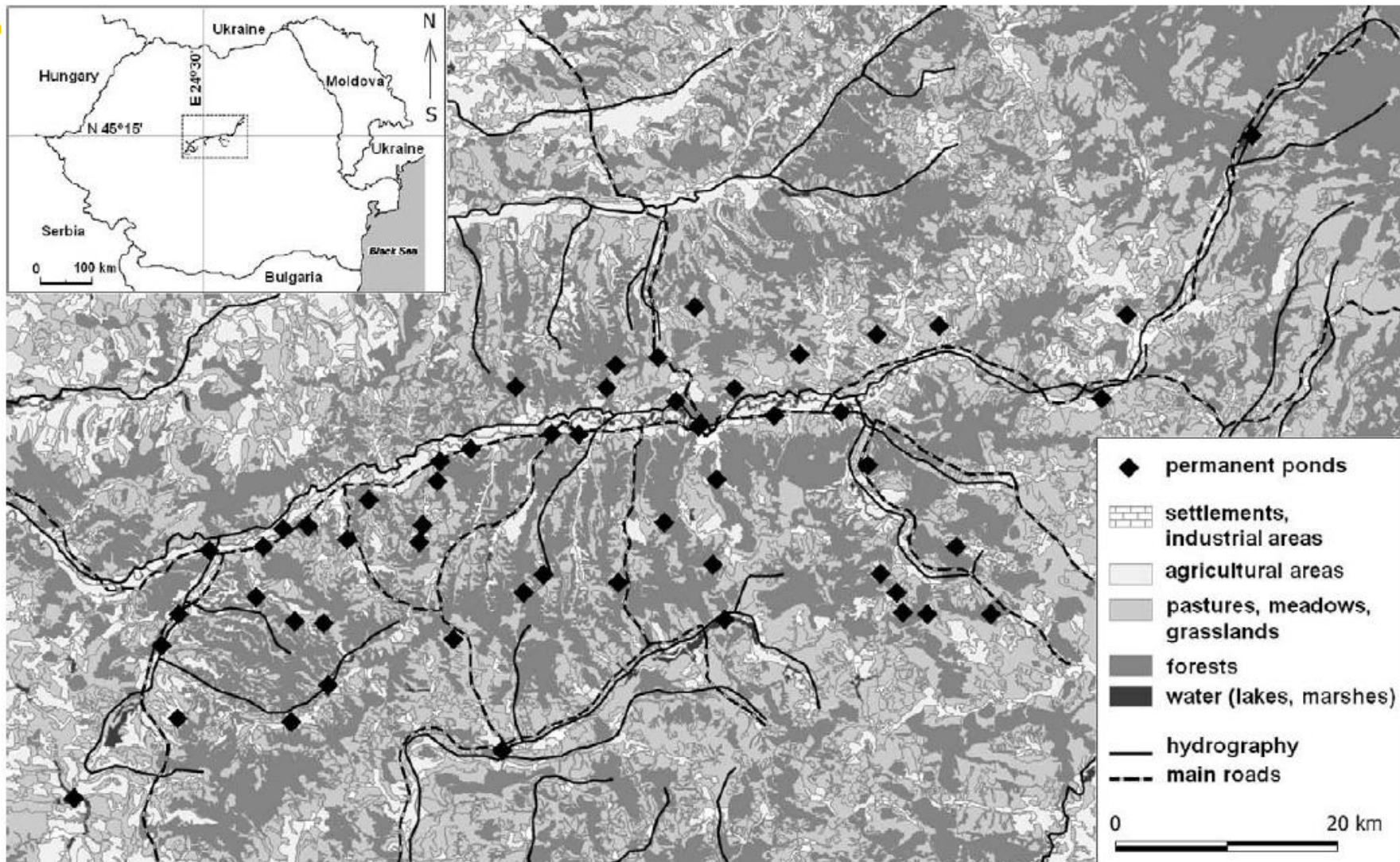


Hartel *et al.*, 2010

Amphibian distribution in a traditionally managed rural landscape of Eastern Europe: Probing the effect of landscape composition

Tibor Hartel ^{a,b,c,*}, Oliver Schweiger ^d, Kinga Öllerer ^e, Dan Cogălniceanu ^f, Jan W. Arntzen ^c

- **Romania**
- **Amphibians (10 species)**
- Permanent ponds in an agricultural system
- Pond surveys undertaken for 8 years and surveyed 3-4 times each season (February to August).





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- **Romania**
- **Amphibians (10 species)**
- Permanent ponds in an agricultural system
- Pond surveys undertaken for 8 years and surveyed 3-4 times each season (February to August).
- **Results:**

Ponds connected to a forest by a corridor had higher species richness



[Lewis-Phillips
et al., 2019](#)

Pond management enhances the local abundance and species richness of farmland bird communities



Jonathan Lewis-Phillips^{a,b,*}, Steve Brooks^{a,b}, Carl Derek Sayer^b, Rachel McCrea^c,
Gavin Siriwardena^d, Jan Christoph Axmacher^b

- UK
- Birds (> 10 species)
- 16 ponds in an agricultural matrix. Point count surveys conducted.

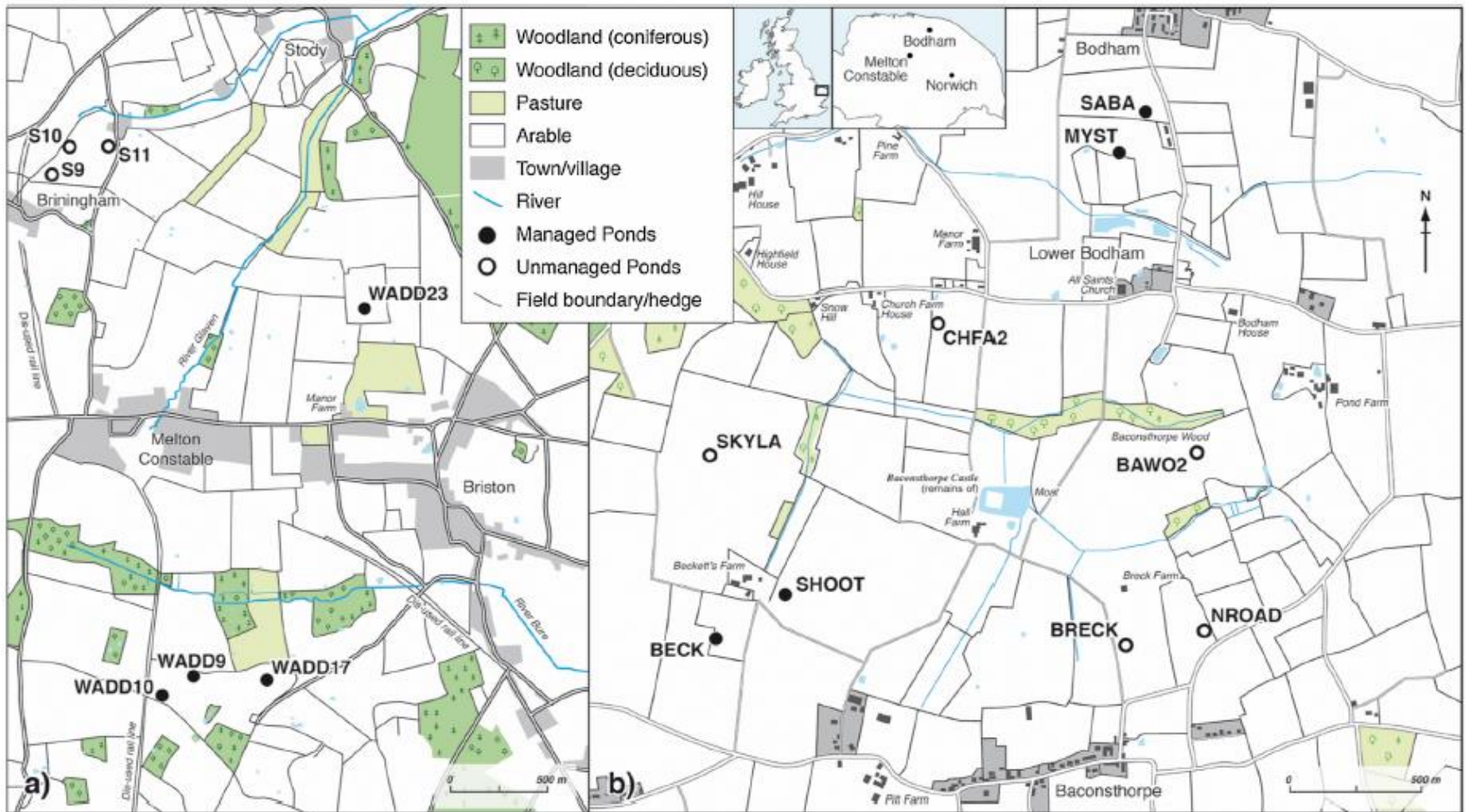


Fig. 1. The farmland study ponds and surrounding landscape near to Briston (a) and Bodham (b) in North Norfolk, eastern England.



Pond management enhances the local abundance and species richness of farmland bird communities



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Gavin Siriwardena^d, Jan Christoph Axmacher^b

Lewis-Phillips et al., 2019

- UK
- **Birds (> 10 species)**
- 16 ponds in an agricultural matrix. Point count surveys conducted.
- Results:
 - Positive effect of connectivity from ponds to hedgerows and woodland areas on abundance and species richness.
 - No effect of hedge length within 500m radius.



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Acta Oecologica

journal homepage: www.elsevier.com/locate/actoeec



Original article

The role of habitat patches on mammalian diversity in cork oak agroforestry systems

Luis M. Rosalino*, João do Rosário, Margarida Santos-Reis

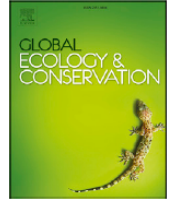
Universidade de Lisboa, Centro de Biologia Ambiental, Faculdade de Ciências de Lisboa, Ed. C2, Campo Grande, 1749-016 Lisboa, Portugal

- **Portugal**
- **Mammals**
- Oak woodland with or without riparian vegetation. Line transects (two sites - 5 trapping nights). Three orthogonal transects of 300m into the adjacent local landscape.
- **Results:**

Presence of riparian vegetation contributed positively to the total mammal species richness, increased the small mammals Shannon-Wiener Index and carnivore species richness.

[Carlier et al.,
2019](#)

- Ireland
- Bats (8 species)
- A rural Greenway corridor through arable land. 23-point count sites over the length of a Greenway route.



Original Research Article

Effects of greenway development on functional connectivity for bats



Julien Carlier ^{a,*}, James Moran ^{a,b}, Tina Aughney ^c, Niamh Roche ^c

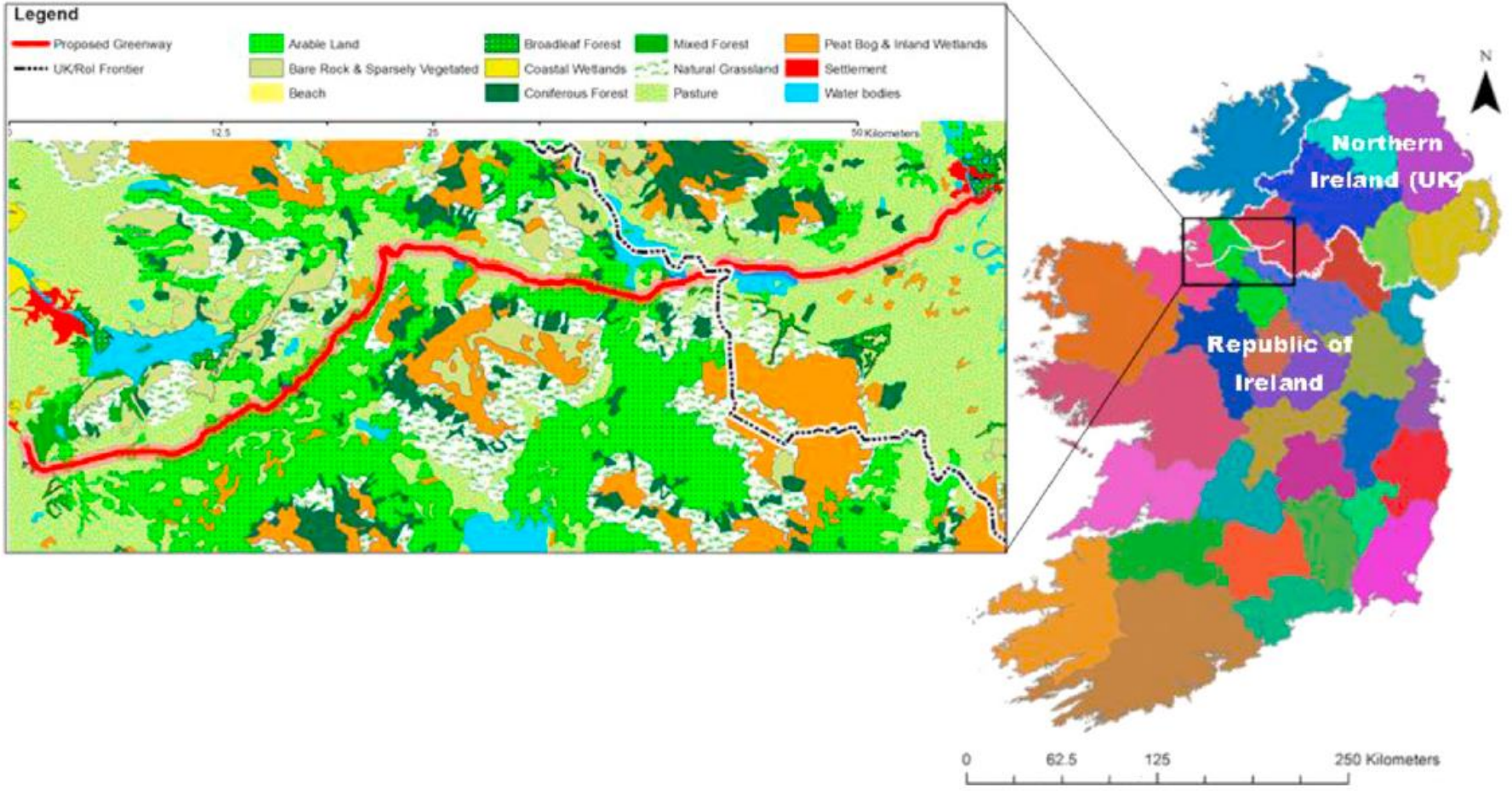


Fig. 2. Location of the Study Area and principal land uses within the four Counties in Ireland (left to right): Sligo, Leitrim, Cavan(Republic of Ireland) and Fermanagh (United Kingdom). Land use data adapted from Corine Land Cover 2012.



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Carlier et al., 2019

- Ireland
- Bats (8 species)
- A rural Greenway corridor through arable land. 23-point count sites over the length of a Greenway route.
- **Results:**
 - Bat diversity was positively associated with hedgerow gaps and negatively with hedge height
 - *Pipistrellus nathusii*, *M. daubentonii* and *M. mystacinus* were positively influenced by linear features (positively correlated with hedgerows)

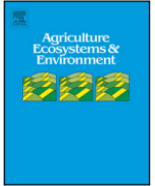


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Agriculture, Ecosystems and Environment

journal homepage: www.elsevier.com/locate/agee



[Dondina et al.,](#) [2016](#)

How to manage hedgerows as effective ecological corridors for mammals: A two-species approach

Olivia Dondina*, Leila Kataoka, Valerio Orioli, Luciano Bani

Department of Earth and Environmental Sciences, University of Milano-Bicocca, Piazza della Scienza 1, I-20126 Milano, Italy



- **Italia**
- **European badger and Hazel dormouse**
- 55 hedgerows sampled with varying structural properties.

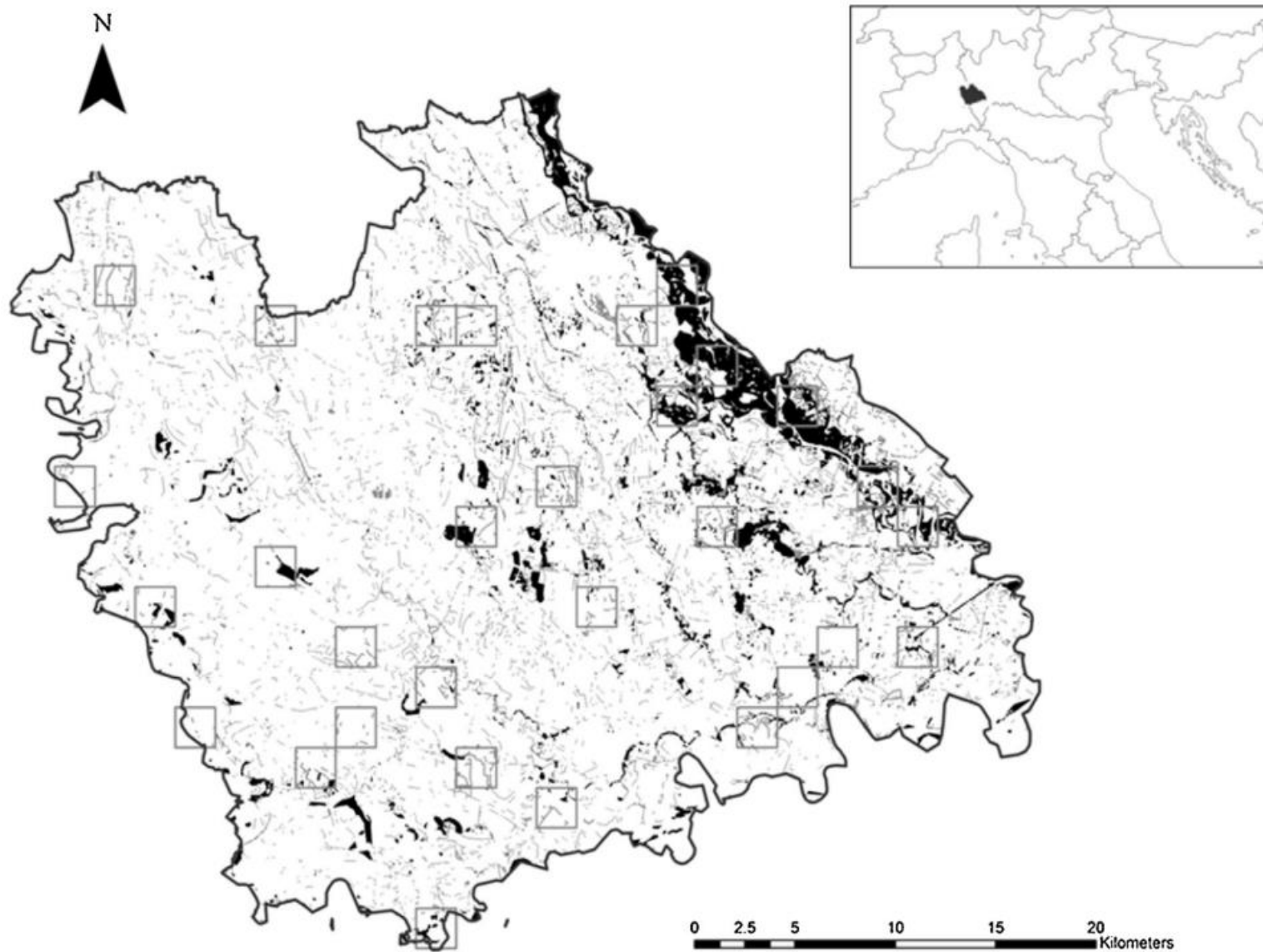


Fig. 1. Study area.

Study area in northern Italy ($45^{\circ} 21' N$ $8^{\circ} 80' E$). The gray color represents hedgerows, whereas the black color shows the original broadleaved forest remnants. The gray squares are the 2-km primary sampling units.

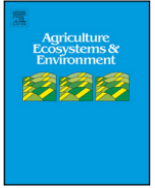


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- **Italia**
- **European badger and Hazel dormouse**
- 55 hedgerows sampled with varying structural properties.
- **Results:**
 - Presence of the European badger was more likely in larger hedgerows and hedgerows with less grass cover
 - Hazel dormouse were more likely to occur when continuous hedgerows were present in a 250m buffer and in hedgerows with more shrub cover (similar for abundance)

Batary et al.,
2012

**Contrasting effect of isolation of hedges from forests
on farmland vs. woodland birds**

P. Batáry^{1,2,6}, A. Kovács-Hostyánszki^{1,3}, C. Fischer^{1,4}, T. Tschamntke¹
and A. Holzschuh^{1,5}

- **Germany**
- **Birds (> 10 species)**
- Surveys of 200m long sections of six hedges connected to forest and six isolated hedges bordered by cropland.
- **Results:**
 - No difference in abundance or species richness between isolated vs connected hedges
 - Distinct bird communities however between two types of hedges
 - No effect of hedges' width and height



Conclusions

- Effectiveness of corridors has been studied but more rigorous and homogeneous studies are needed
- Some research on properties that increase quality of linear element as potential corridors exists but can mostly be used as case studies for now
- Theoretical justifications for green infrastructures still apply and results for other taxons and outside Europe can also be used (*Gilbert-Norton et al. 2010; Resasco 2019*)

Thank you!

Project coordination



Contact : naturadapt-rnf@espaces-naturels.fr / 03.80.48.91.00

Project partners



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