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Roadkill in a highly fragmented landscape: Insights from a Mediterranean Island

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Road Networks

- Commercially, financially and socially important for society
- Their effects well-studied the past decades through “Road Ecology”
- Direct effect on wildlife: **Roadkill**
- Indirect effects on biodiversity and ecosystems:
pollution, soil sealing, habitat fragmentation, and more.



(van der Ree et al. 2015; Grilo, et al., 2025).

Road Ecology in Island Ecosystems

Island Ecology: Study of traits that make islands differ from mainland areas

Effects of fragmentation intensifying due to limited resources, including space

Lack of research on road ecology matters in SMIs

Pressures often amplified by tourism = heightened traffic and denser infrastructure



(Veron, et al., 2019; Rendall, et al., 2021).

Roadkill Monitoring in Cyprus

Roadkill Monitoring in Cyprus is currently conducted by two groups:

The Department of Public Works (DoPW)

- Monitoring highways and main roads
- Data available from 2013
- Largely removal of dangerous carcasses
- Dogs, Cats and foxes in majority



ΤΜΗΜΑ
ΔΗΜΟΣΙΩΝ ΕΡΓΩΝ

The Cyprus Roadkill Observation System (CyROS)

- Data collected through CS since 2006
- CyROS platform launches in 2017
- More than 2000 observations / 33 species (Aug '25)
- A total of 236 registered users



Lack of Comparison of Data with Landscape Indices

(Zotos and Vogiatzakis, 2018; Vogiatzakis, et al., 2022)

Current Challenges

- A. Cyprus urbanscapes rapidly expanding, including plans for extensive new road networks.
- B. Few big wildlife species (mouflon, fox), resulting in little interest for road-related conservation efforts.
- C. Despite the dense road network, transport systems of Cyprus remain understudied, as in many islands compared to mainland areas.
- D. Lack of systematic work on road affects to wildlife, and how they interact with island landscape traits.



(Zomeni and Vogiatzakis, 2014)

Aim & Objectives

Aim

Analyzing 1.5 year of systematic roadkill reports to:

***Identify island landscape characteristics
that increase roadkill risk.***

Research Questions

- Which animals are the most affected by roadkill?
- What is the relationship of landscape context with roadkill hotspots?
- What is the relation between landscape fragmentation and roadkill risk?



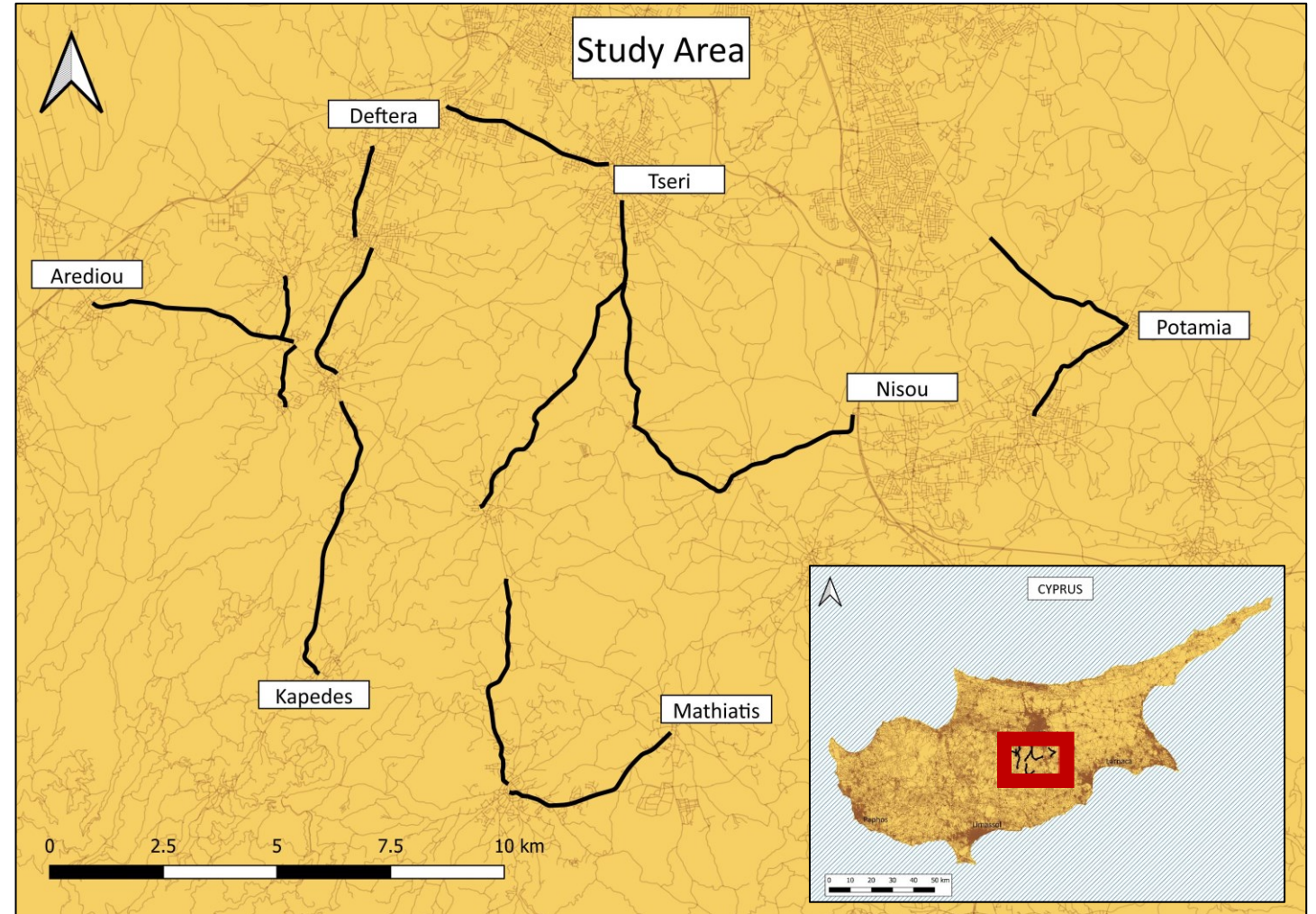
Data Collection

Systematic Data Collection
from 16 linear road segments
apr. 2-4km each, E&F categories

Monitored at 30km 4 times per month
from Jan 2024 to Jun 2025 (ongoing)

Each record includes:

- ID
- Species
- Geolocation
- Date
- Road ID
- CyROS ID
- Photo, if available
- Other comments



Methodology

Data collection

- Road monitoring Jan 2024 to Jun 2025, organised in database



Estimation of hotspots

- KDE+ 3.3 Toolbox in ArcMap 10.7



Creation of hotspot buffer based on road effect zone

- 1km diameter buffer around each hotspot with QGIS 3.40.10



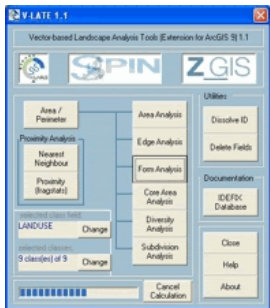
Landscape metrics per buffer calculated

- V-LATE 2.0 software in ArcMap 10.7



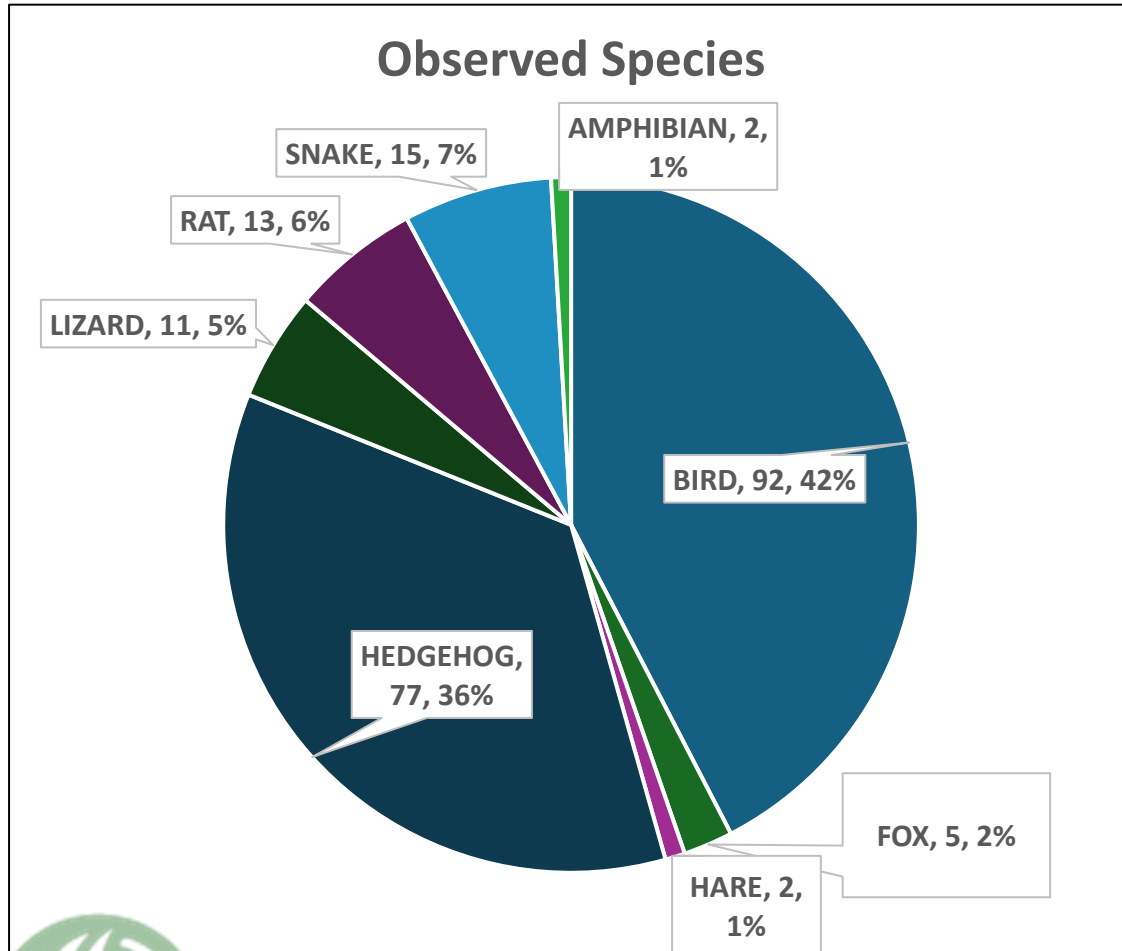
Statistical analysis – GLMM modelling

- Rstudio, packages “stats” and “glmer”



Data Collected

Observed Species



327

- Total Observations

-110

- Observations excluding domestic and unrecognisable animals
- Insects (n=9) also excluded

-46

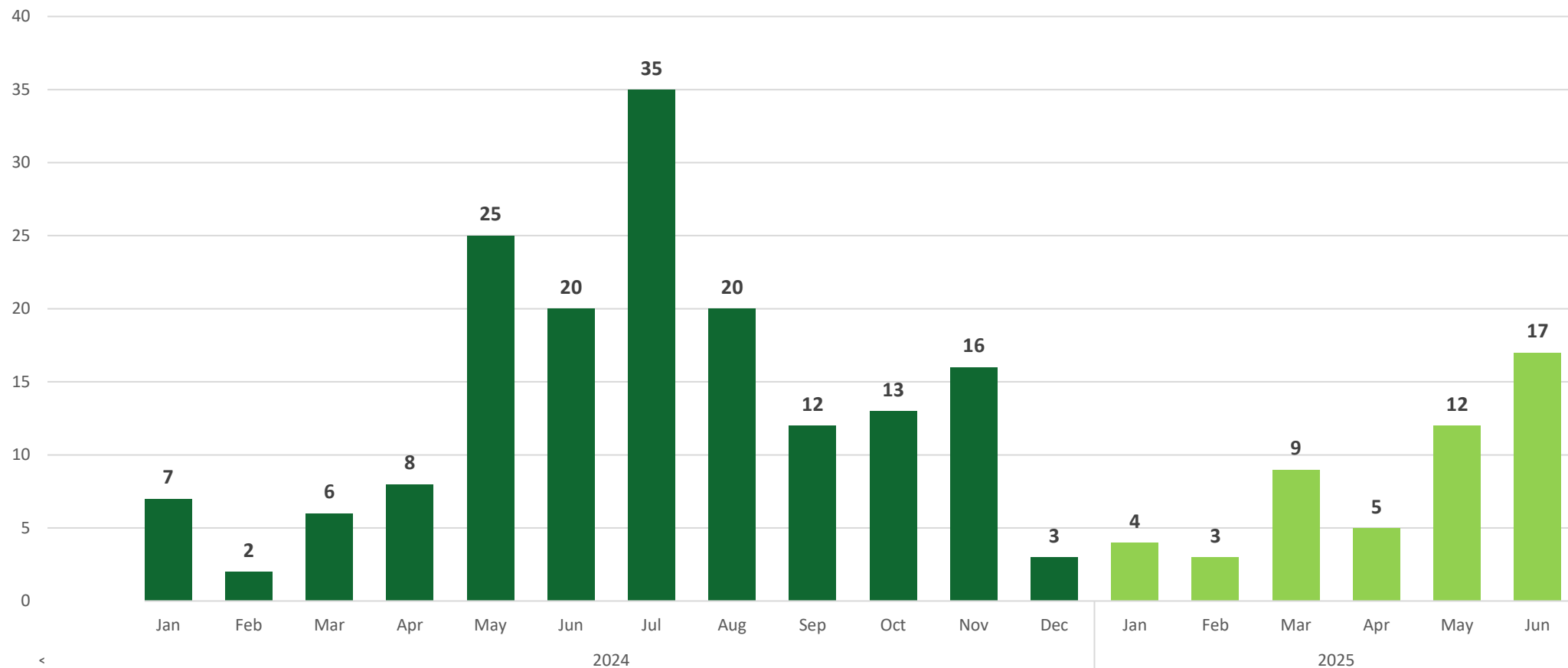
- Observations excluding chance encounters at roads connecting study area

217

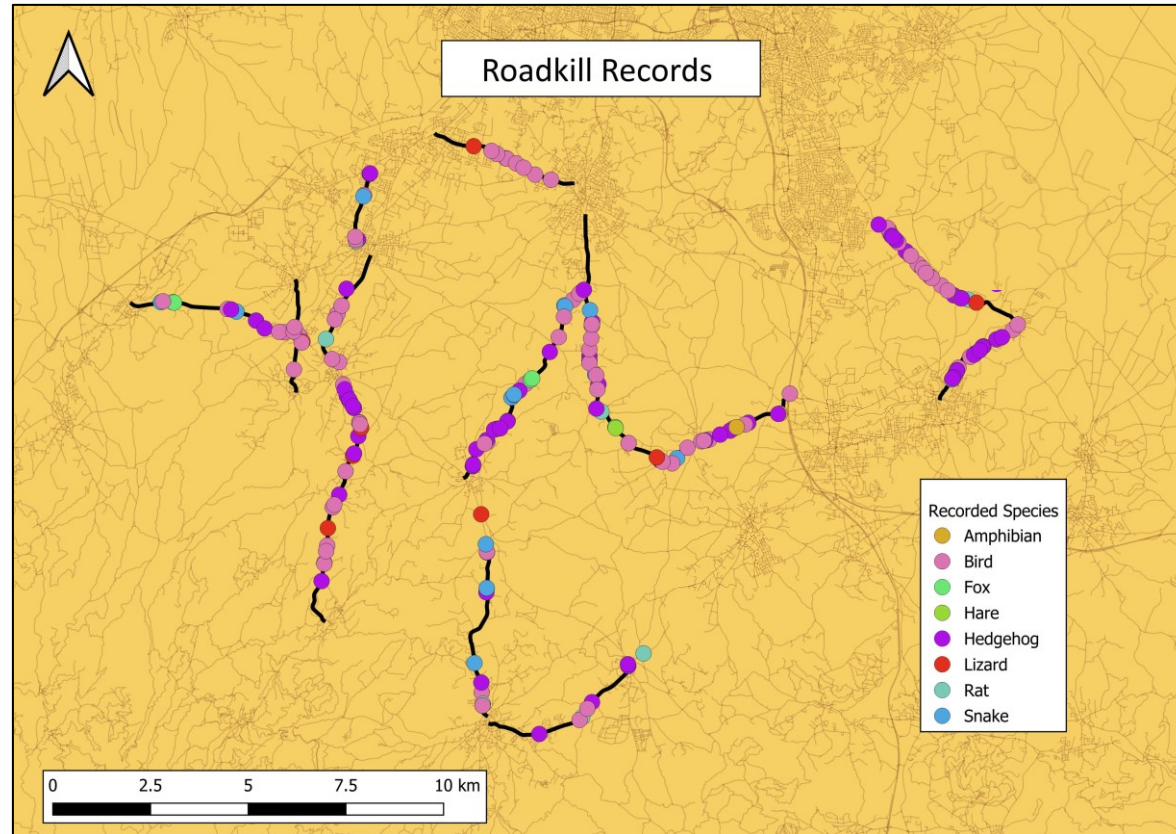
- Observations for further analysis

Seasonal Data

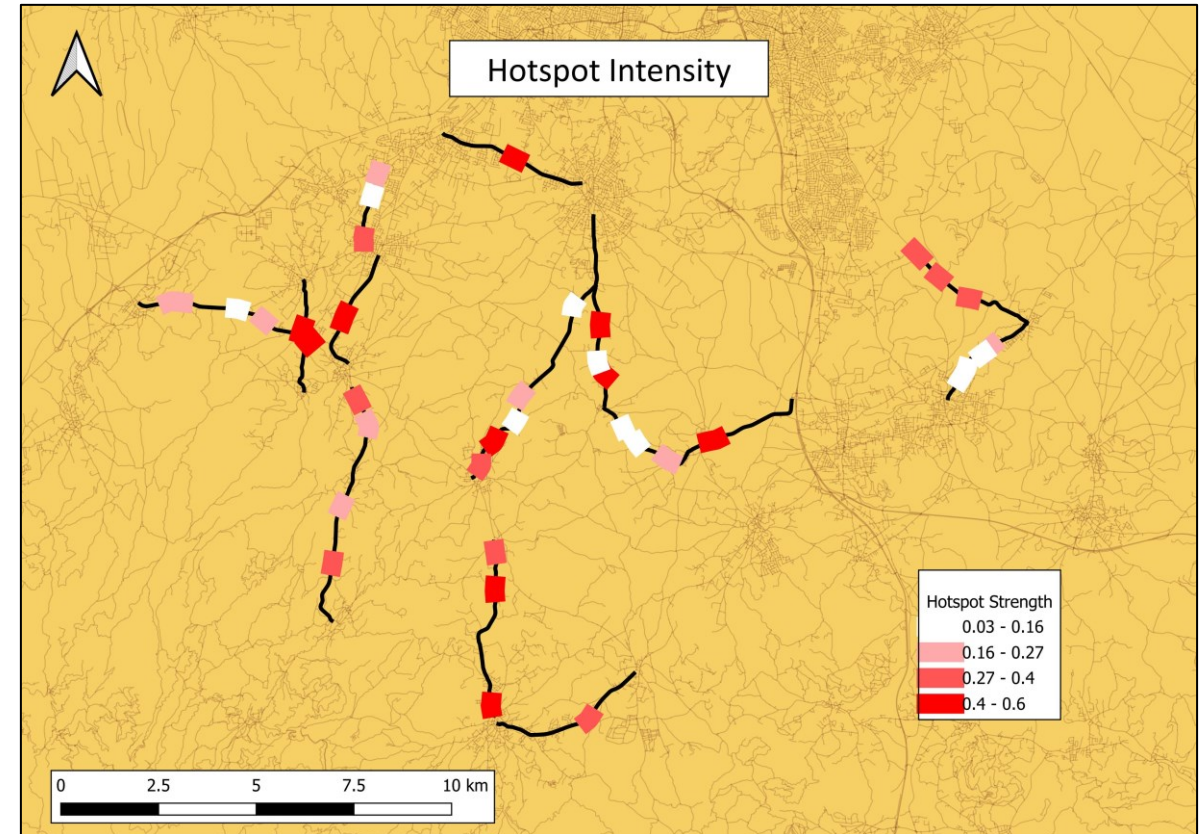
Observations per Collection Month



Hotspots

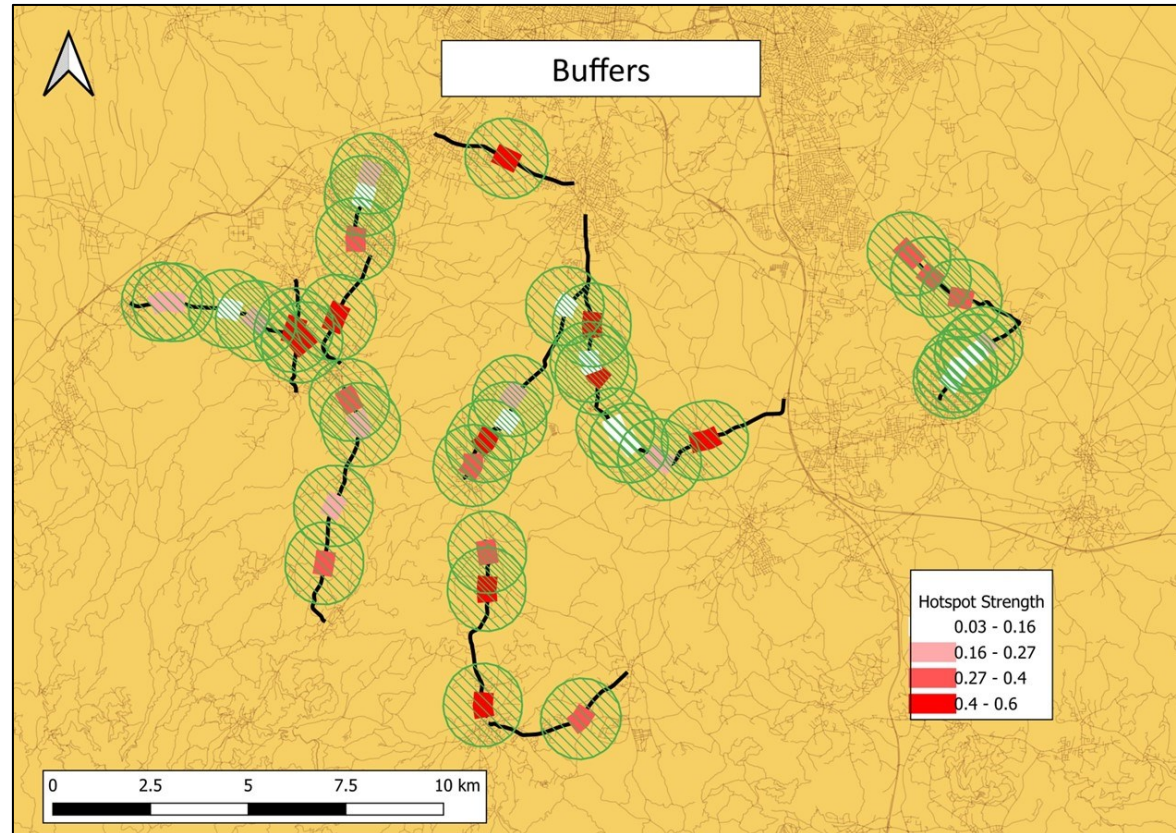


Final 217 observations used



Hotspots (n=38) calculated by KDE+

Results



Factors calculated per buffer:

- Hotspot Strength
- Points Density



Dependent Variables

- Hotspot Length
- Cluster Points
- No. of Patches
- Total Road Length
- **Road Density**
- **No of CLC classes**
- Landscape Division Index
- Splitting Index
- **Effective Mesh Size**



**Check with Pearson
Correlation >80%**

- **Road Category**
- Sampling Road



Categorical

GLMM results

Hotspot_Strength			
Predictors	Estimates	CI	p
(Intercept)	-0.25	-0.56 – 0.07	0.120
Effective Mesh Size	0.00	0.00 – 0.00	0.044
Road Density	33.37	1.90 – 64.85	0.038
Category [2]	0.07	-0.09 – 0.23	0.396
CLC Classes No	0.04	0.00 – 0.08	0.049
Random Effects			
σ^2	0.01		
τ_{00} Road_Name	0.02		
ICC	0.60		
N _{Road_Name}	15		
Observations	38		
Marginal R ² / Conditional R ²	0.181 / 0.669		

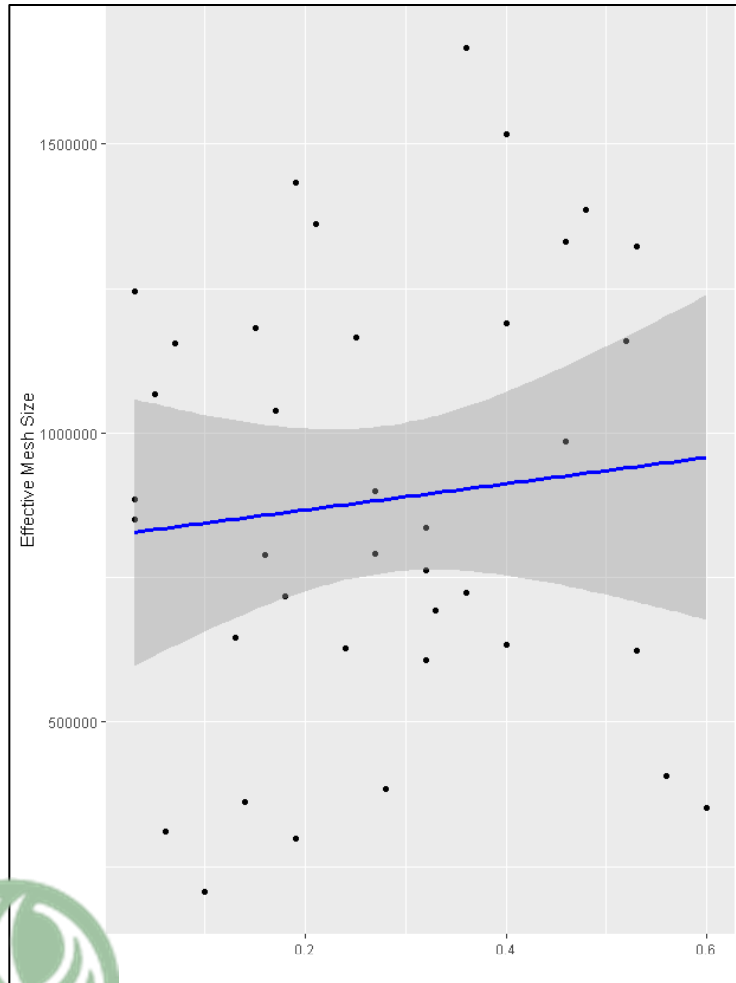
Significant
p-values

Points_Density			
Predictors	Estimates	CI	p
(Intercept)	4.76	2.08 – 7.44	0.001
Effective Mesh Size	-0.00	-0.00 – 0.00	0.591
Road Density	-64.15	-313.73 – 185.42	0.604
Category [2]	0.08	-0.89 – 1.05	0.868
CLC Classes No	-0.32	-0.65 – 0.02	0.067
Random Effects			
σ^2	1.01		
τ_{00} Road_Name	0.35		
ICC	0.26		
N _{Road_Name}	15		
Observations	38		
Marginal R ² / Conditional R ²	0.108 / 0.340		

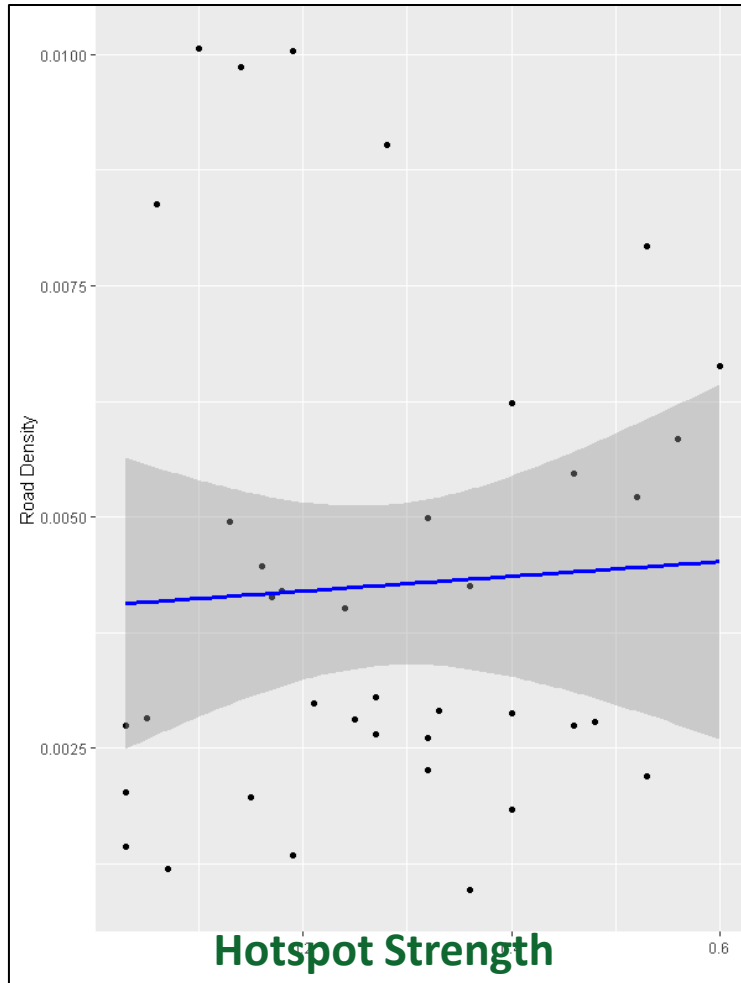
No significant
p-values

Correlation of Hotspot Strength with:

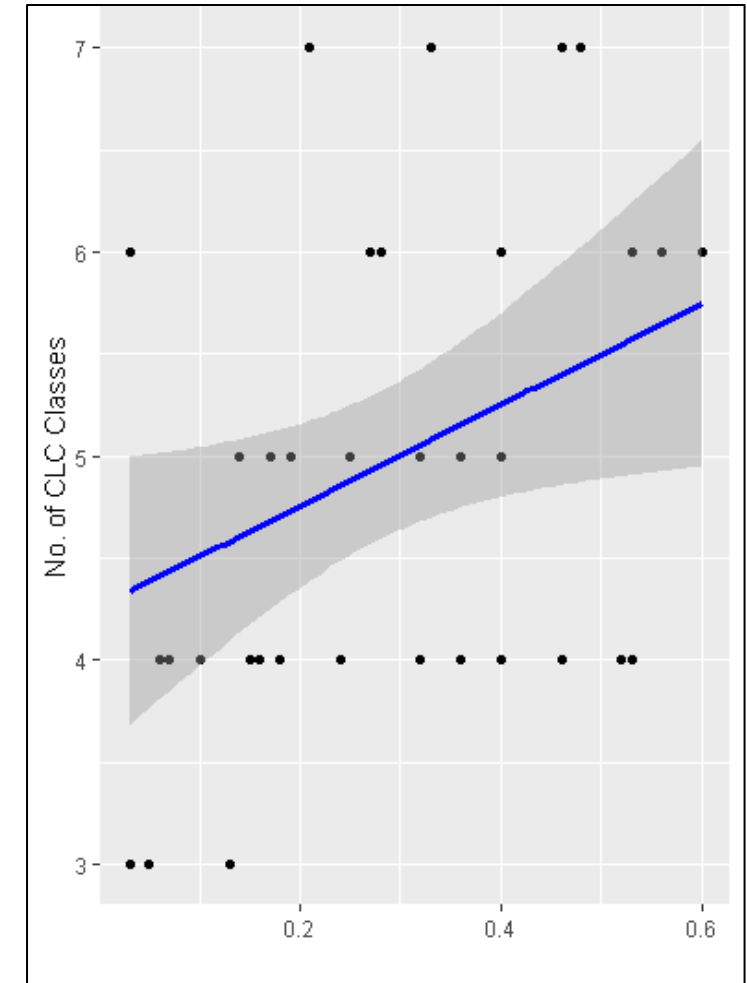
Effective Mesh Size



Road Density



No. of CLC Classes



Data Implications

- No significant correlation between Points Density and landscape features.
- **Possible influence of point density by other factors, like species behaviour**
- Significant correlation between Hotspot Strength with Effective Mesh Size, Road Density, and Number of CLC Classes.
- **Higher Effective Mesh Size = Less Fragmentation**
- Subject for additional investigation**
- More intense positive correlation of Hotspot Strength with Number of Corine Land Cover Classes.
- **Higher possibility for barriers between land covers**



Take Home Message

Established that landscape context interacts with road characteristics and influences roadkill risk.

- We expect this interaction to be more intense in island ecosystems
→ relevant research still in initial stages
- Higher Effective Mesh Size, Road Density and number of Land Cover Classes promote roadkill risk.
- Land Cover Classes the most influential for roadkill risk.
- Pont density seemingly unrelated to landscape characteristics.



Current and Upcoming Actions

- Collection of systematic data for two years (2024 - 2025).
- Research on relationship of roadkill with other landscape traits.
- Expansion of data to strengthen results.
- Collaboration with Department of Public works for measures.
- Automation of roadkill detection through image recognition.

**Further research needed,
especially for Mediterranean island ecosystems!!!**





Thank you!
Any questions?

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