Assessing the impacts of major roads on Barn Owls in Ireland to identify requirements for mitigation

John Lusby
BirdWatch Ireland

Where there are Barn Owls & major roads…..there are Barn Owl road mortalities!

Current knowledge

Extent of Barn Owl road mortalities

- Mortality rate increasing (Newton et al. 1997)
- Most common raptor recorded as road casualty e.g. France & UK (Baudvin 1997, Massesmin & Zorn 1998, Shawyer & Dixon 1998)
- Most common bird species recorded as road casualty in Idaho, US (Boves & Belthoff 2012)
- Scale of casualty rate per 100km of motorway per year varies significantly

- 7 casualties/100km/year in Switzerland (Bourquin 1993)
- 25 casualties/100km/year in France (Baudvin 1997)
- 49 casualties/100/yr. in Portugal (Gomes et al. 2009)
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Impacts on Barn Owl populations

- Major roads contribute to 10 – 15% of adult Barn Owl deaths in Germany resulting in significant impact (Ilner 1992)
- Population declines in parts of Netherlands linked to increases in major road networks (De Bruin 1994)
- Major roads have caused loss of Barn Owl sites over 40% of rural England (Ramsden 2003)
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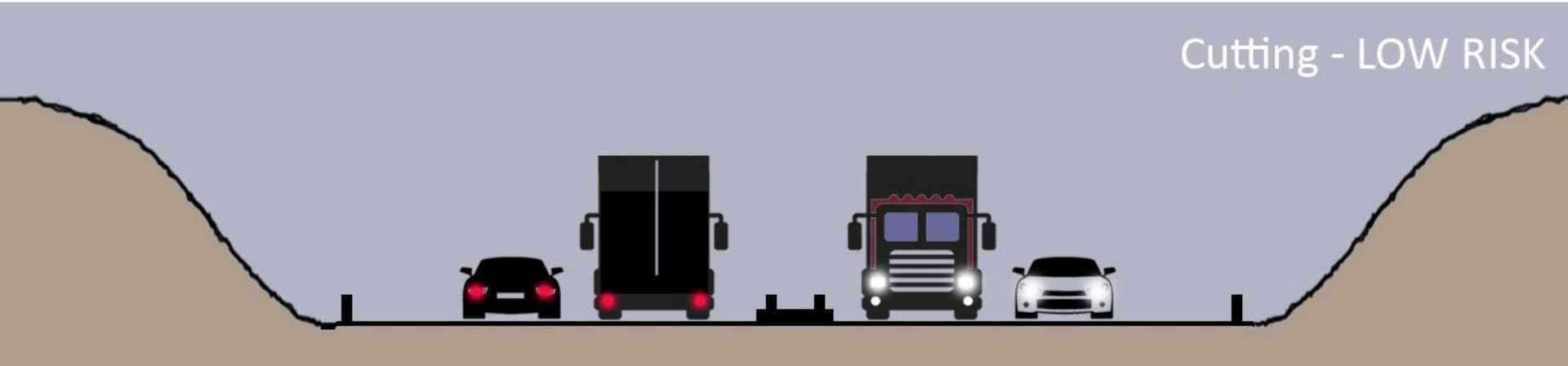
Current knowledge

Factors which may influence collision risk



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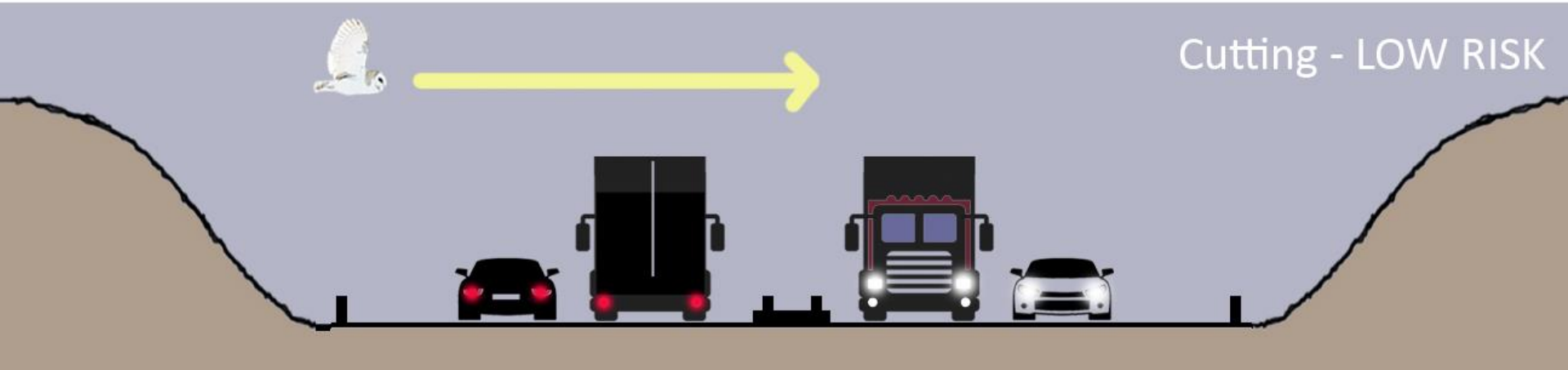

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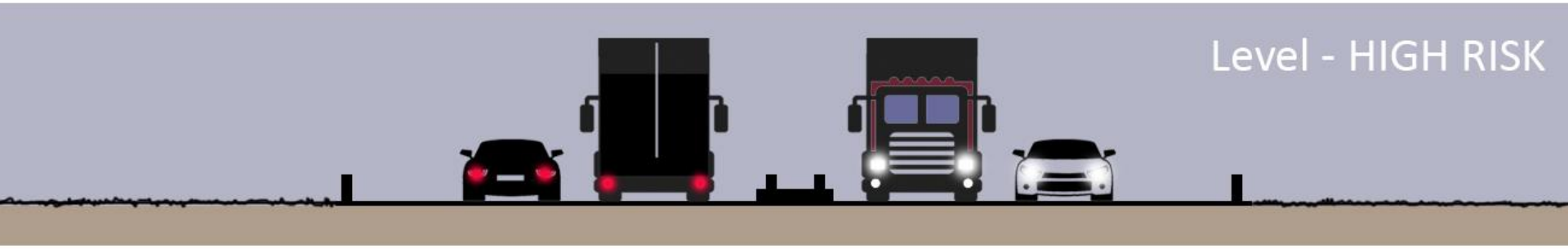

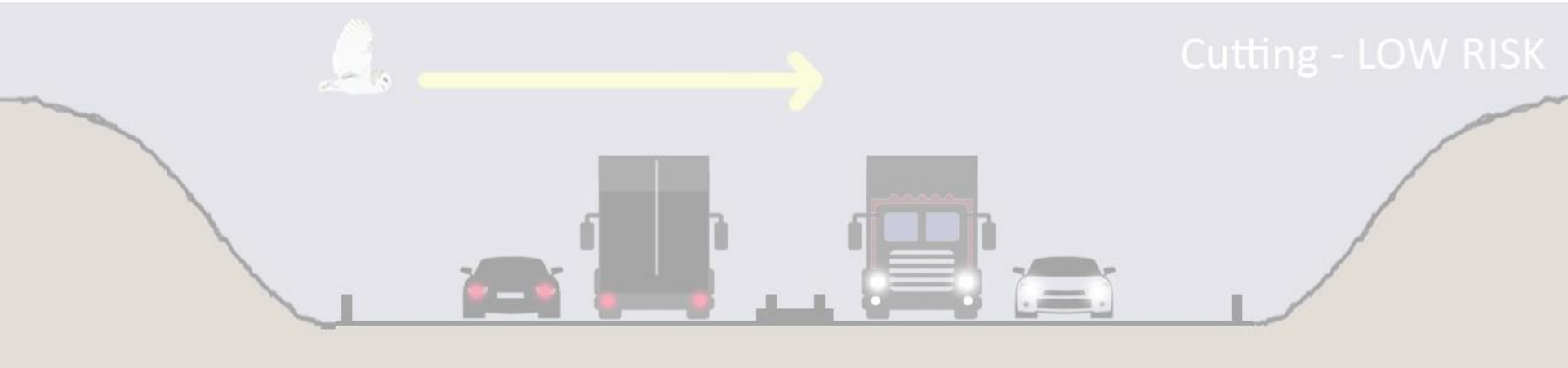

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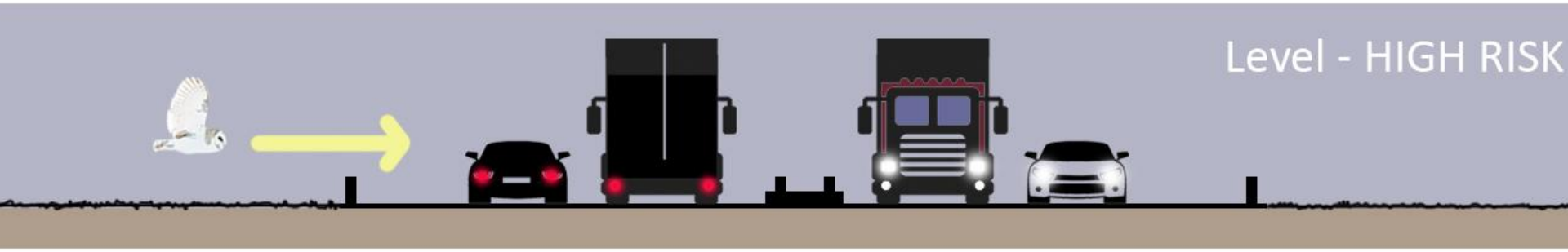

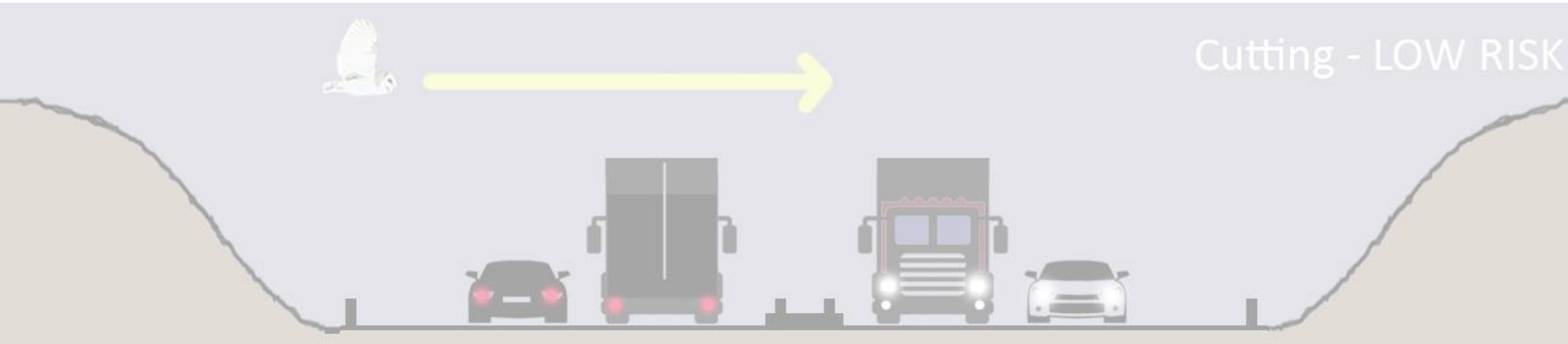

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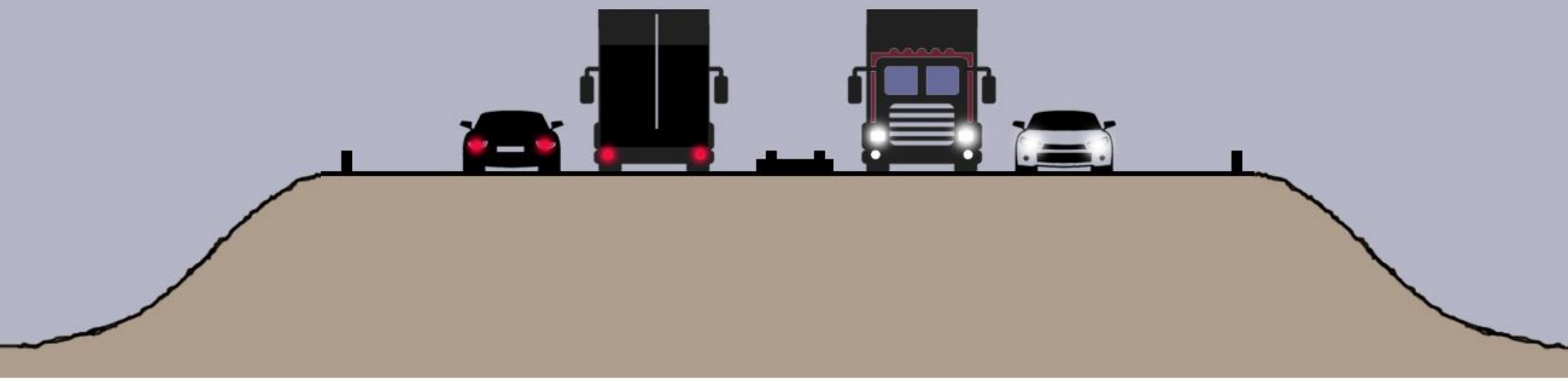

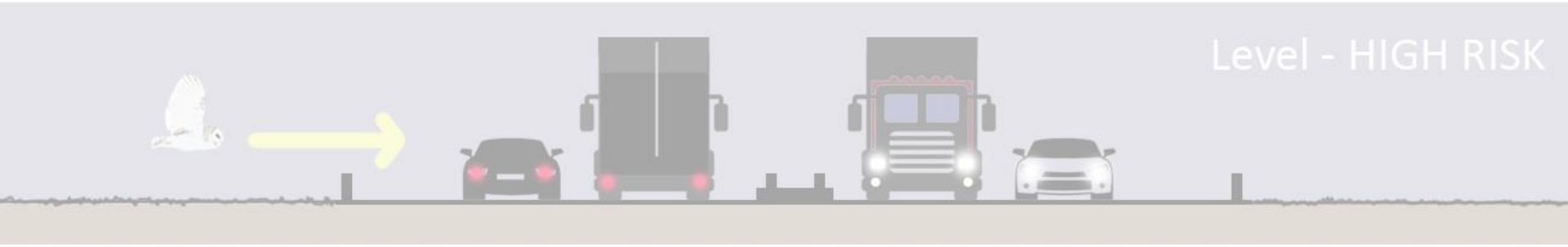

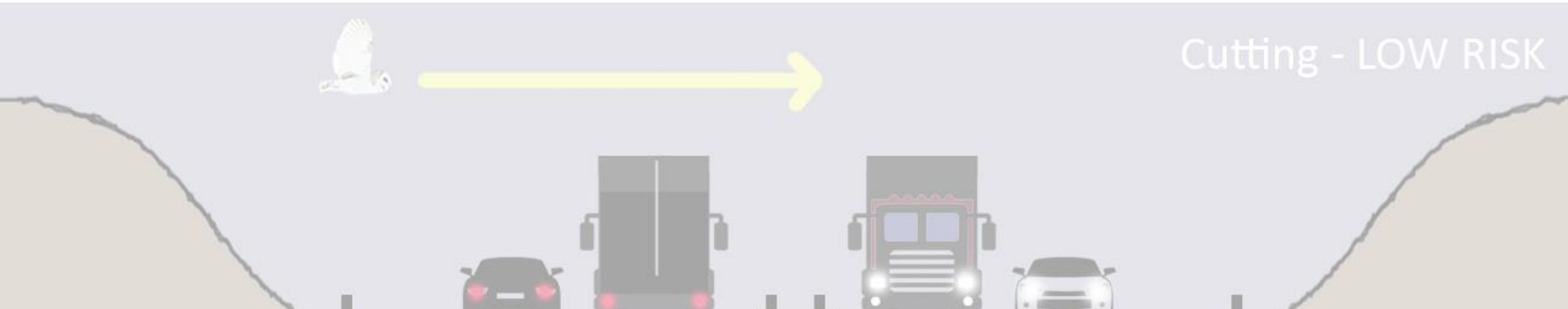

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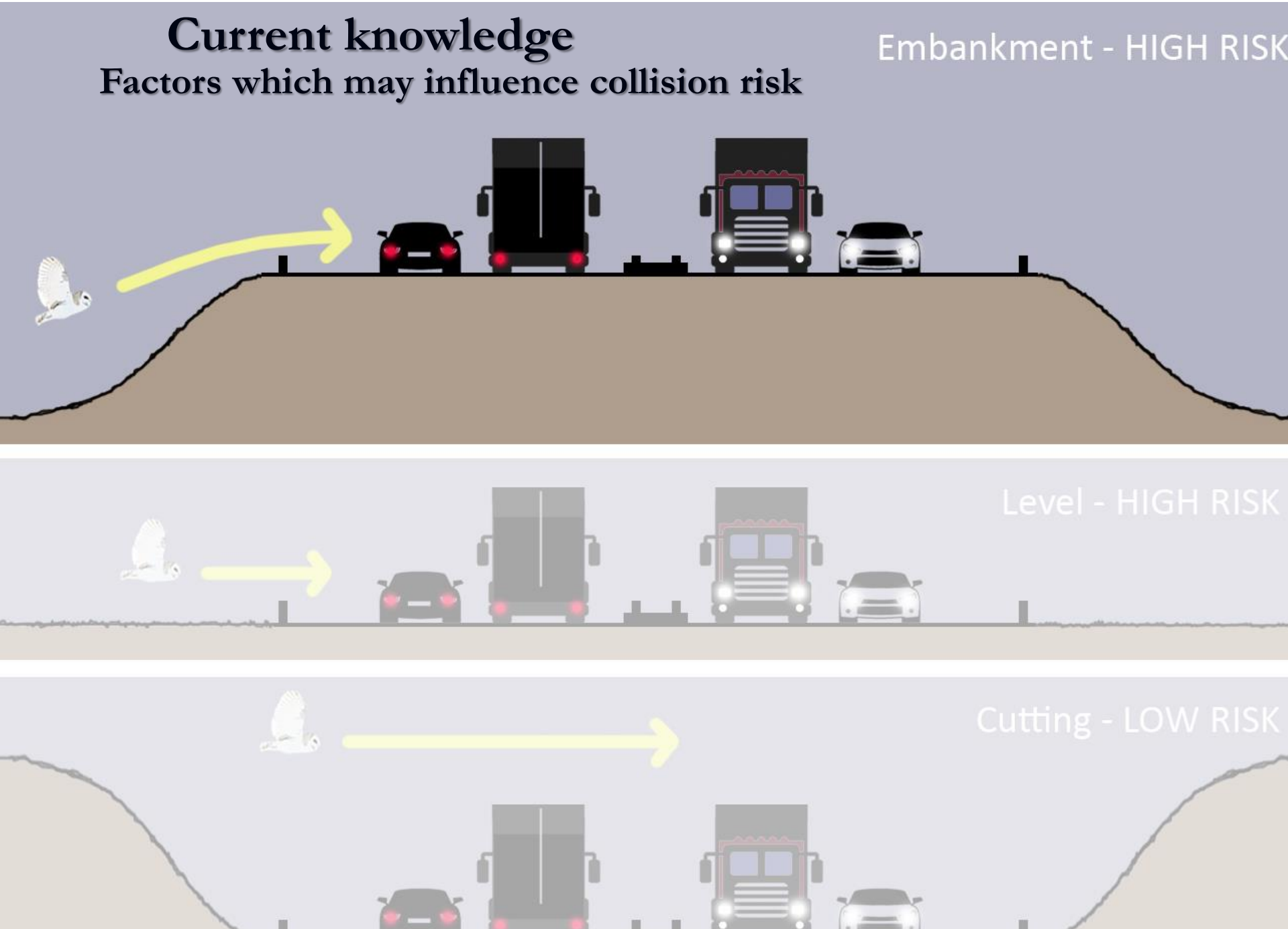

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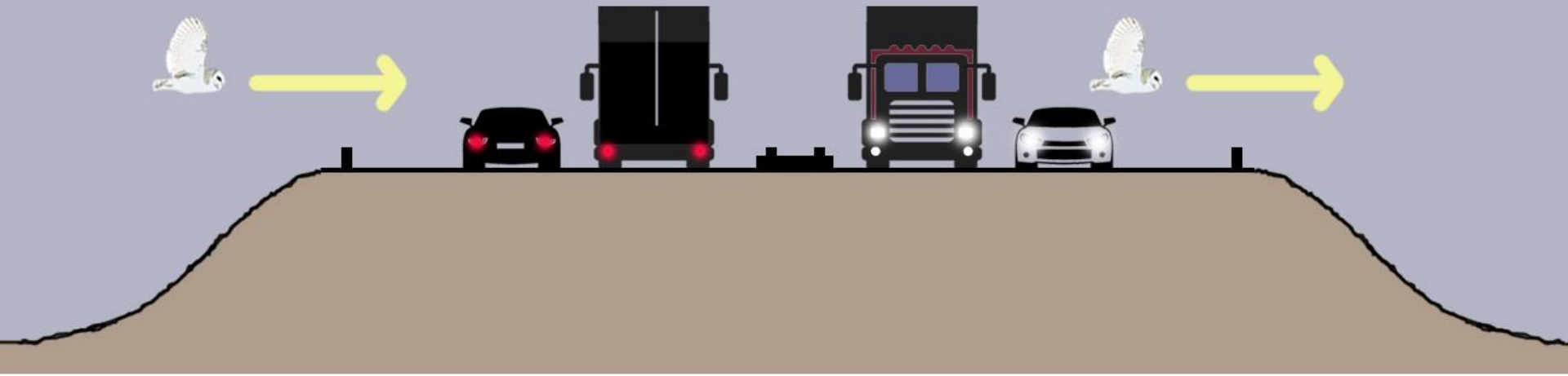
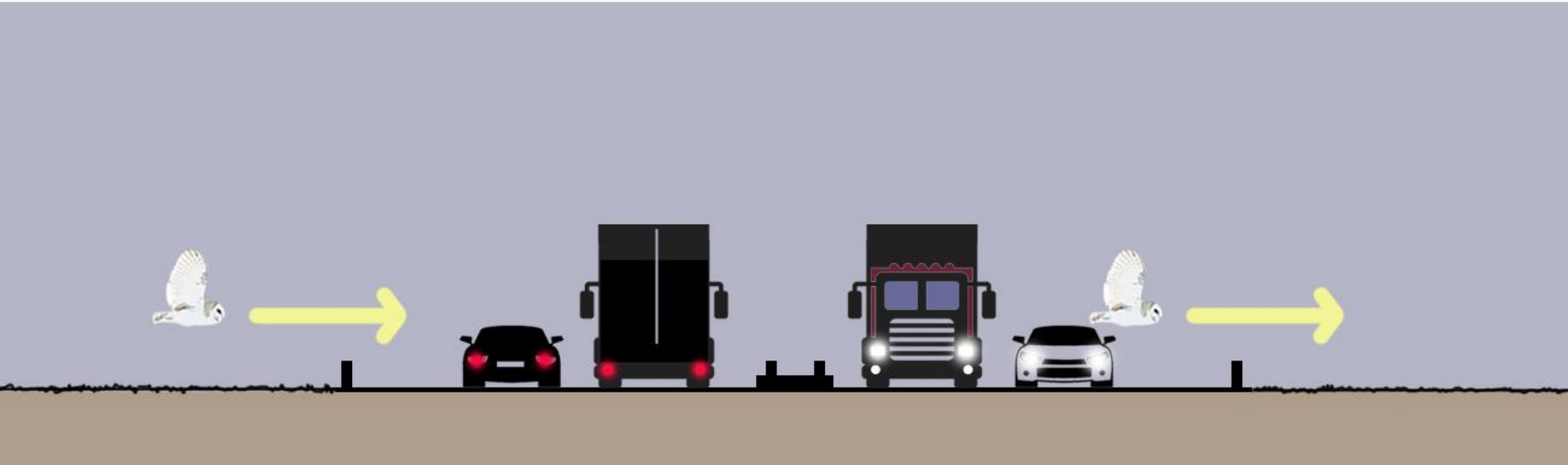
Current knowledge

Proposed mitigation





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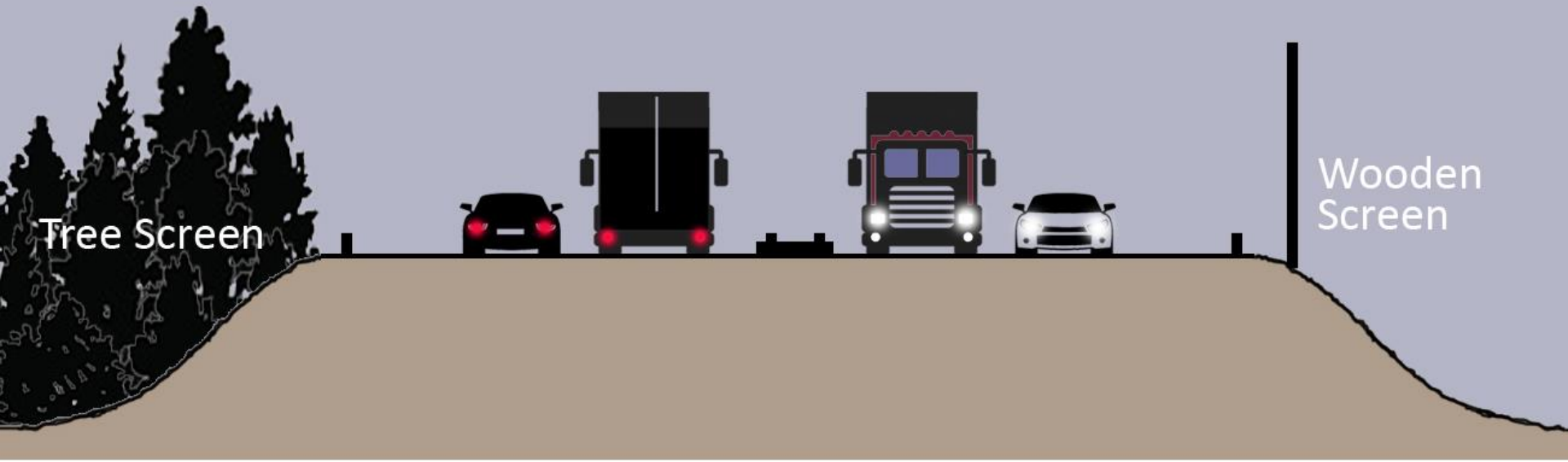

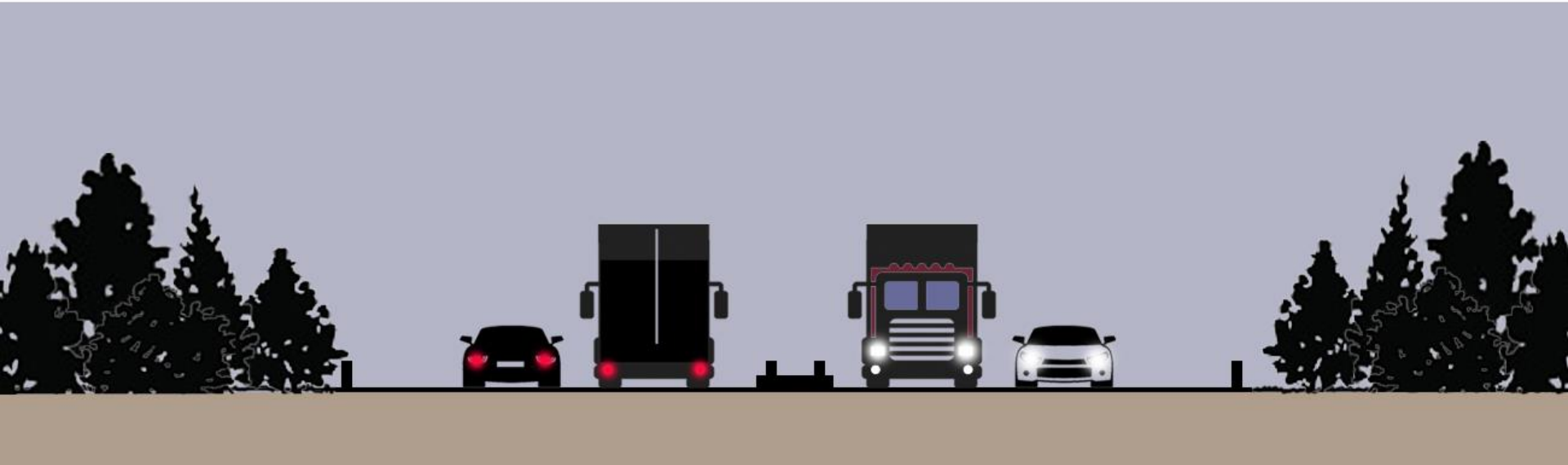

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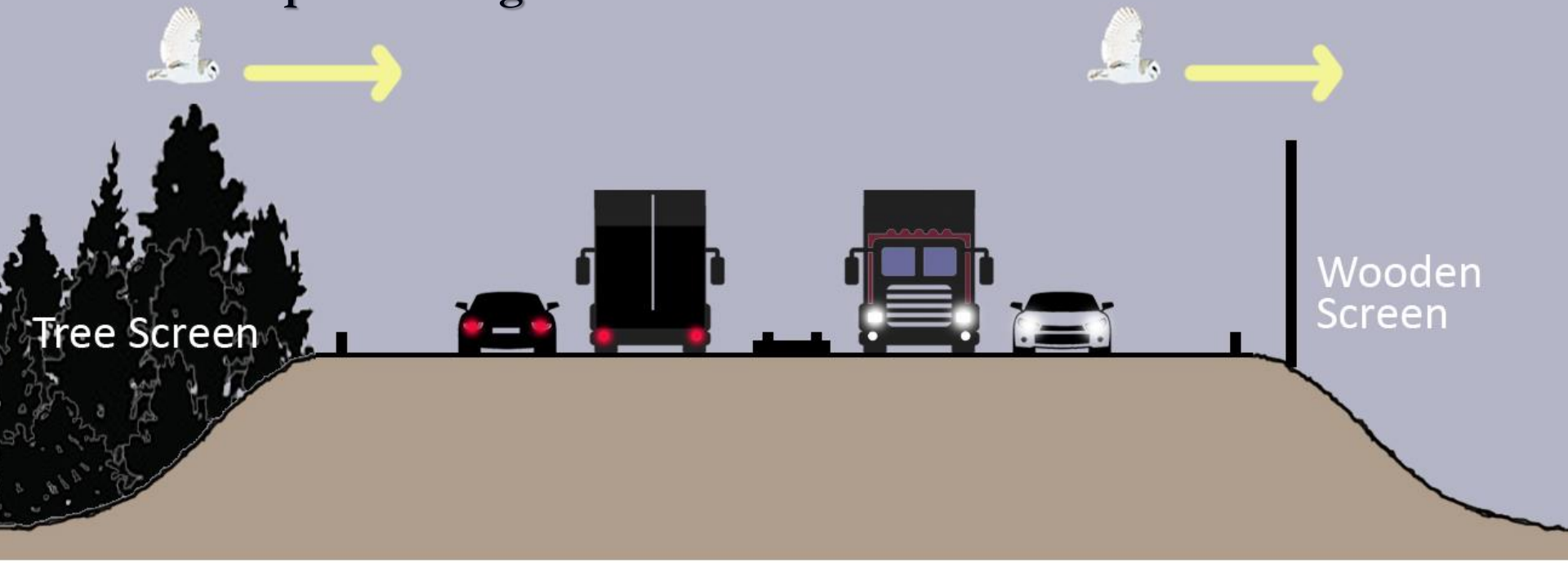

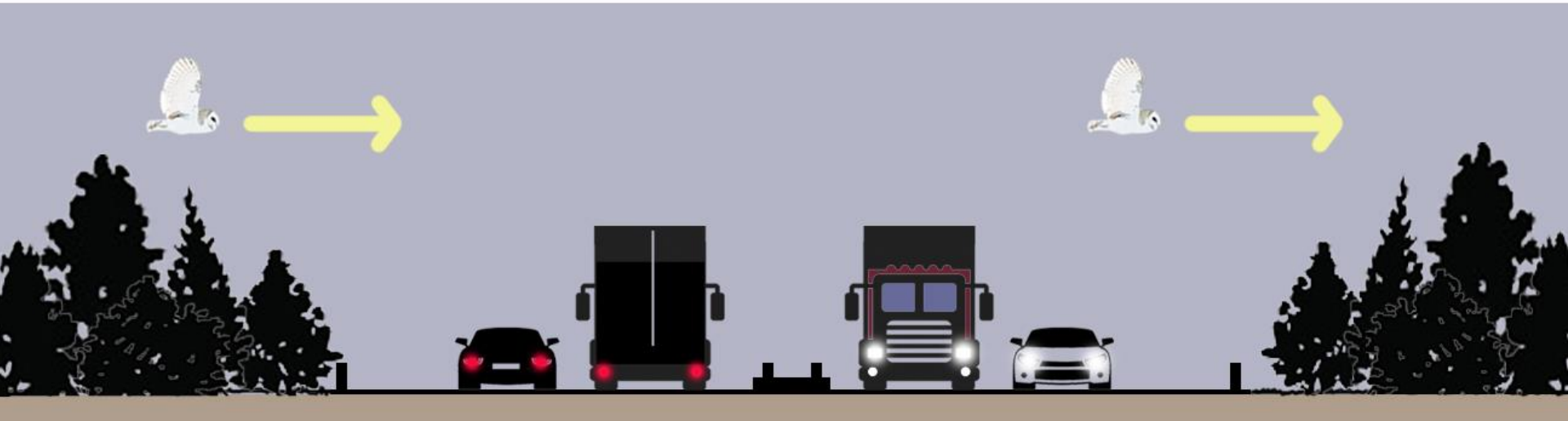

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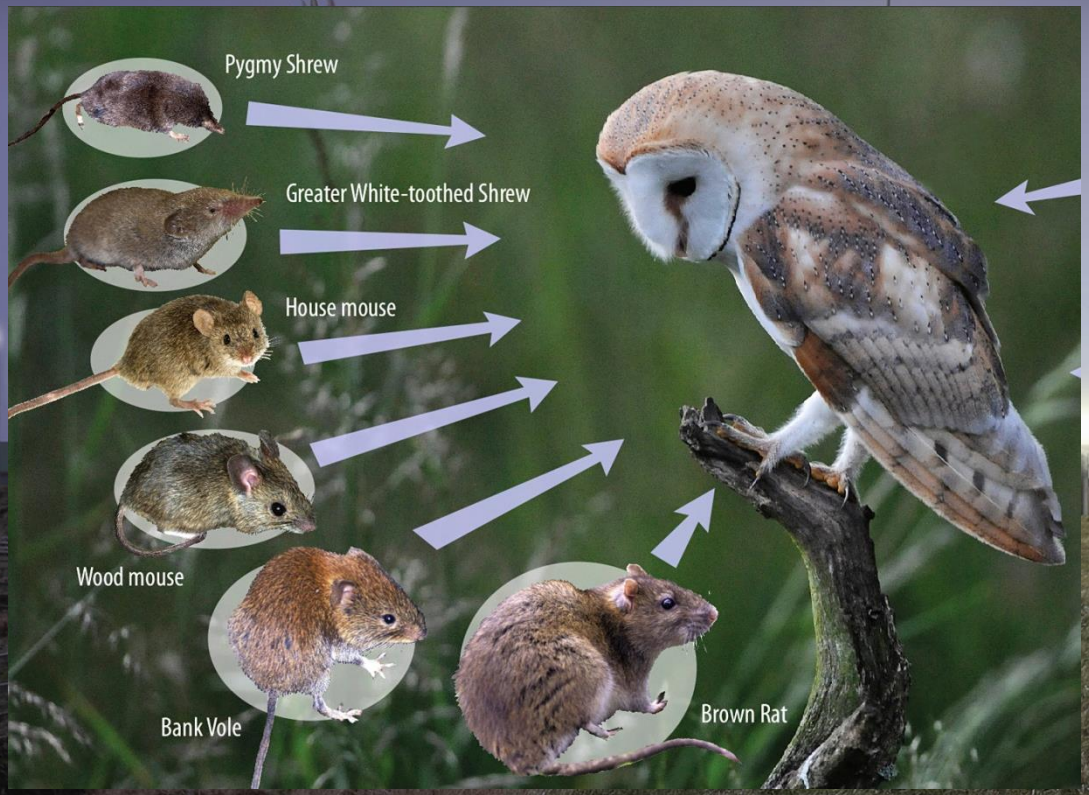
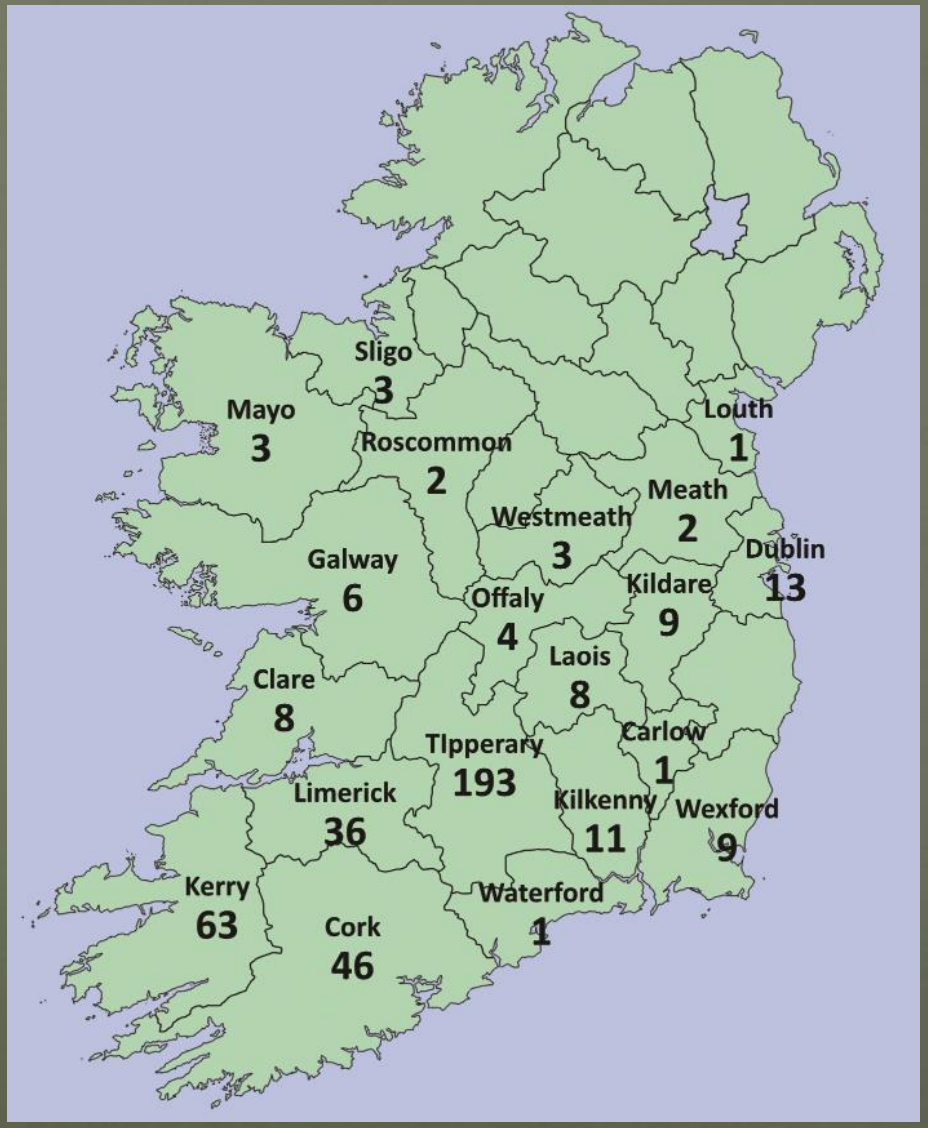
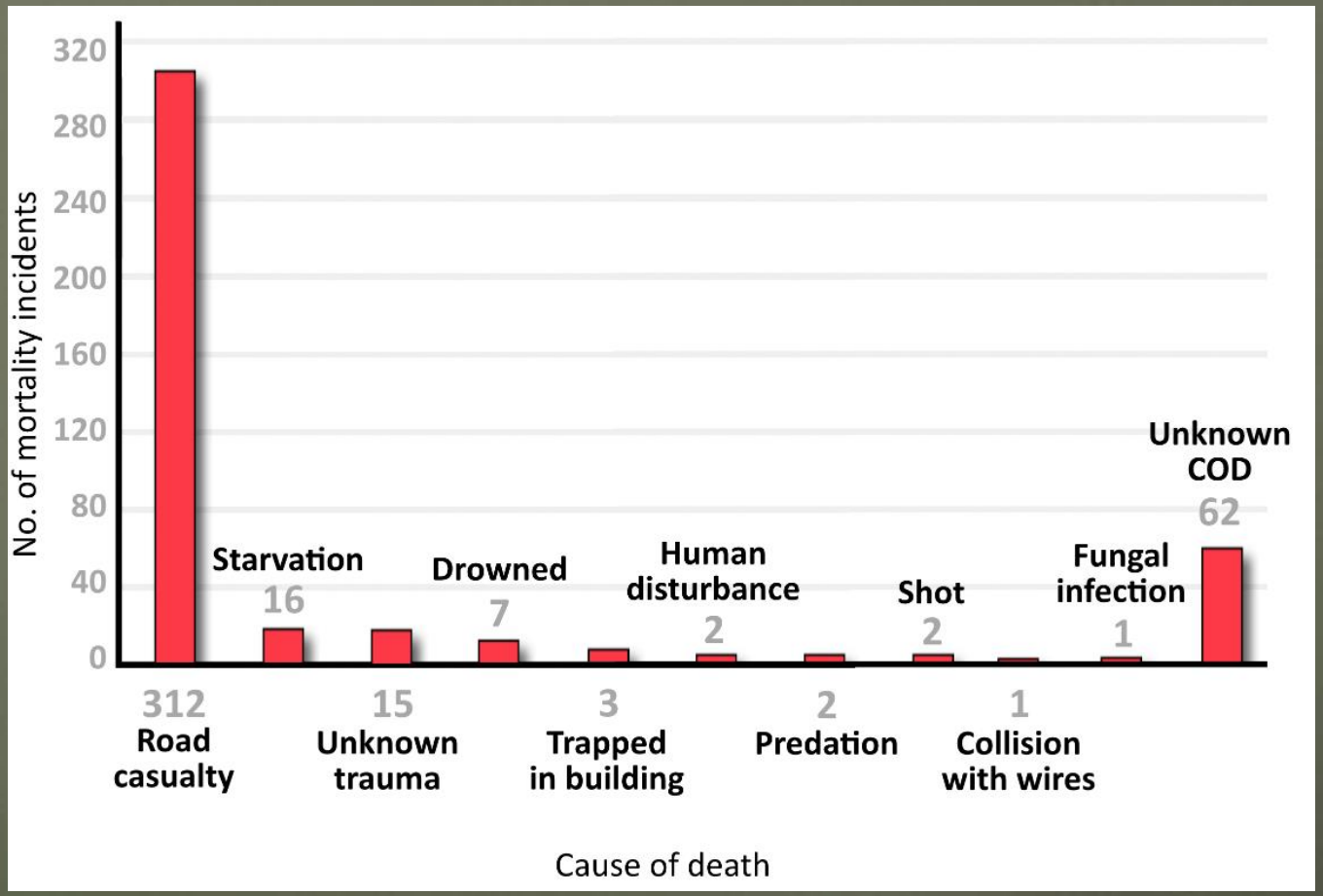


Road mortality as a cause of death



The distribution of recorded Barn Owl mortality incidents (n = 423) in the Republic of Ireland (2008 - 2017).

Road mortality as a cause of death



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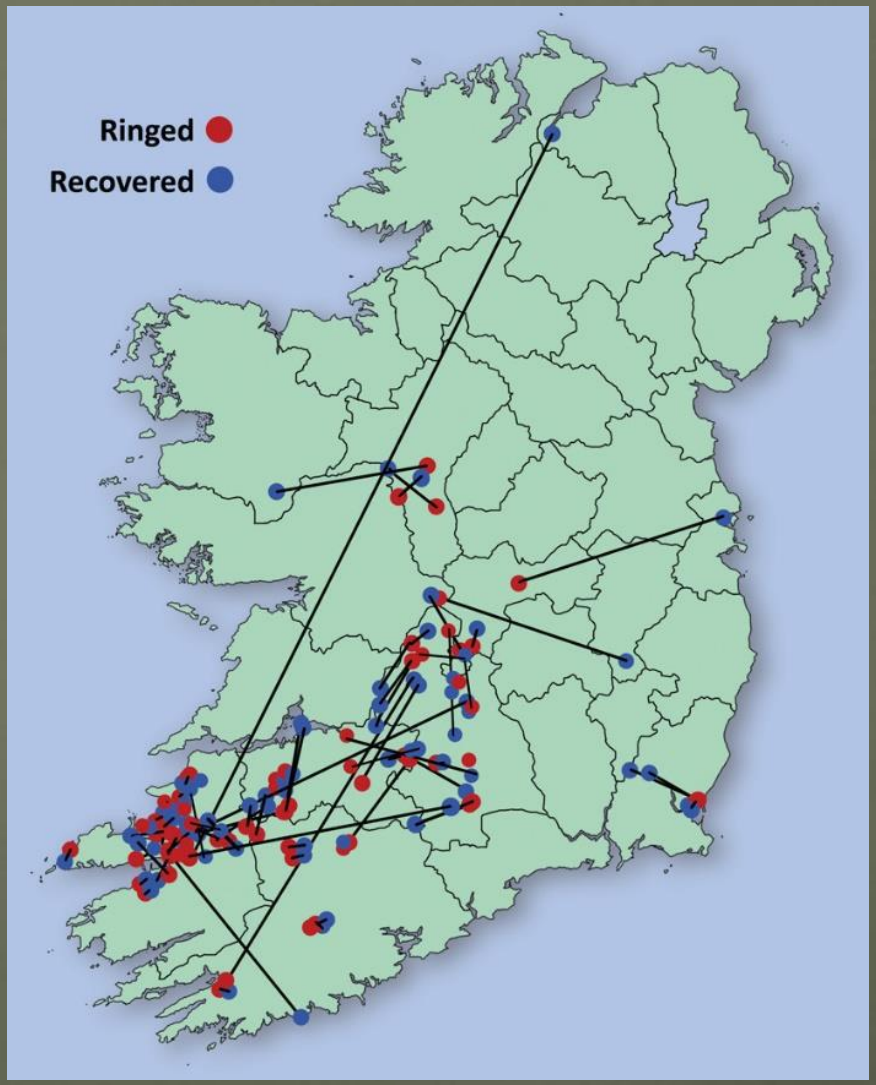
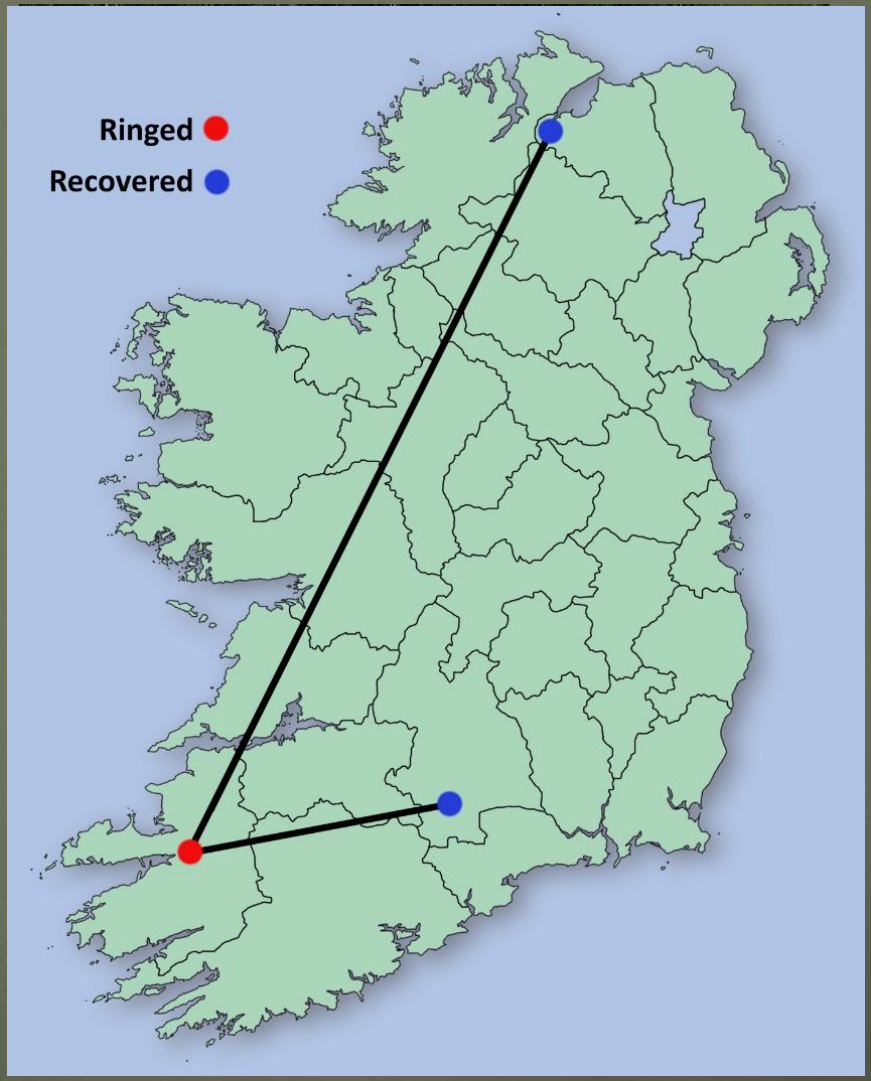


The movement of 73 Barn Owls ringed which were recovered (64) or controlled (9) between 2008 – 2017.

A total of 979 Barn Owls ringed (2008 – 2017), of which 84 (8.5%) individuals recovered (64), controlled (9) & re-trapped (6).

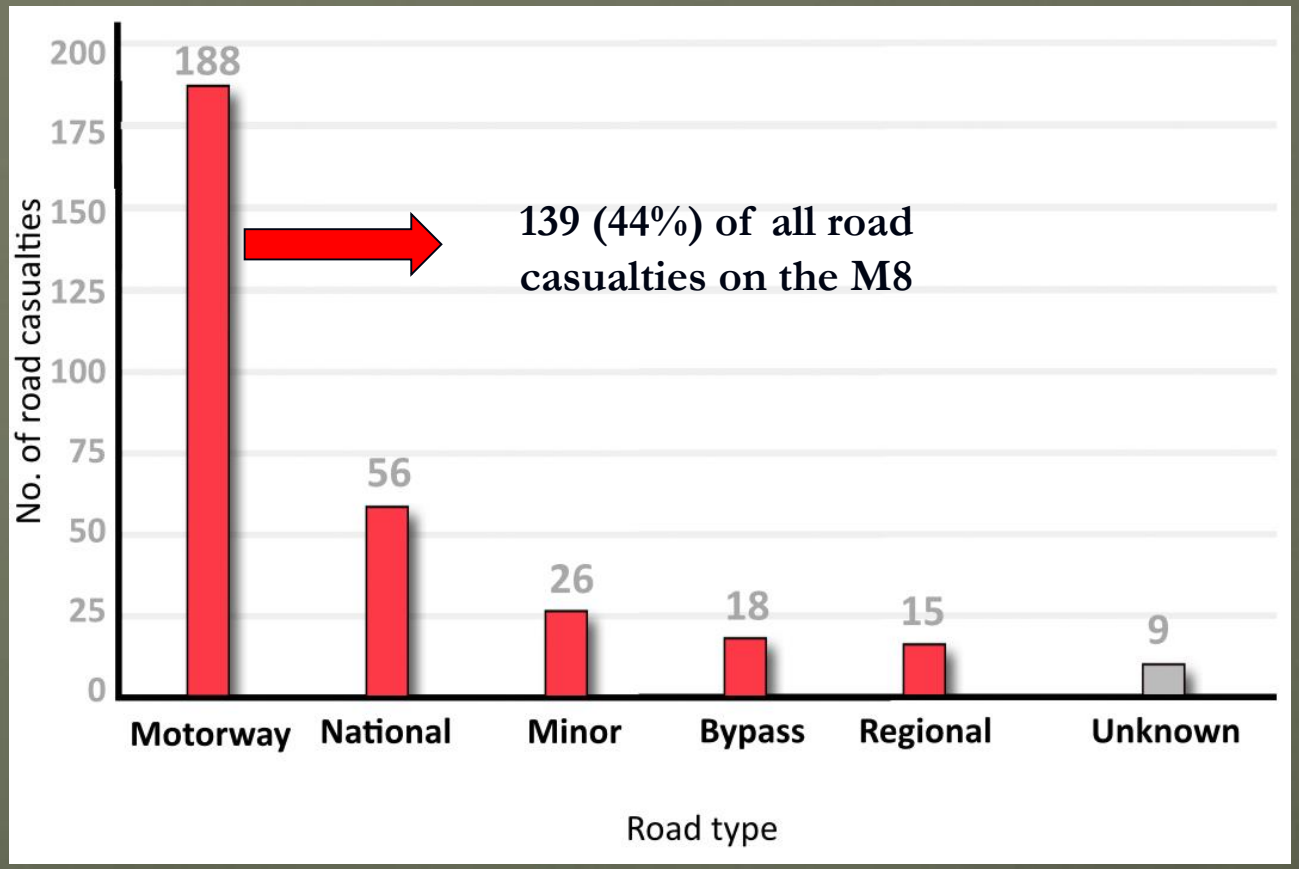
Average dispersal distance = 37km (n = 73)

Barn Owls & major roads



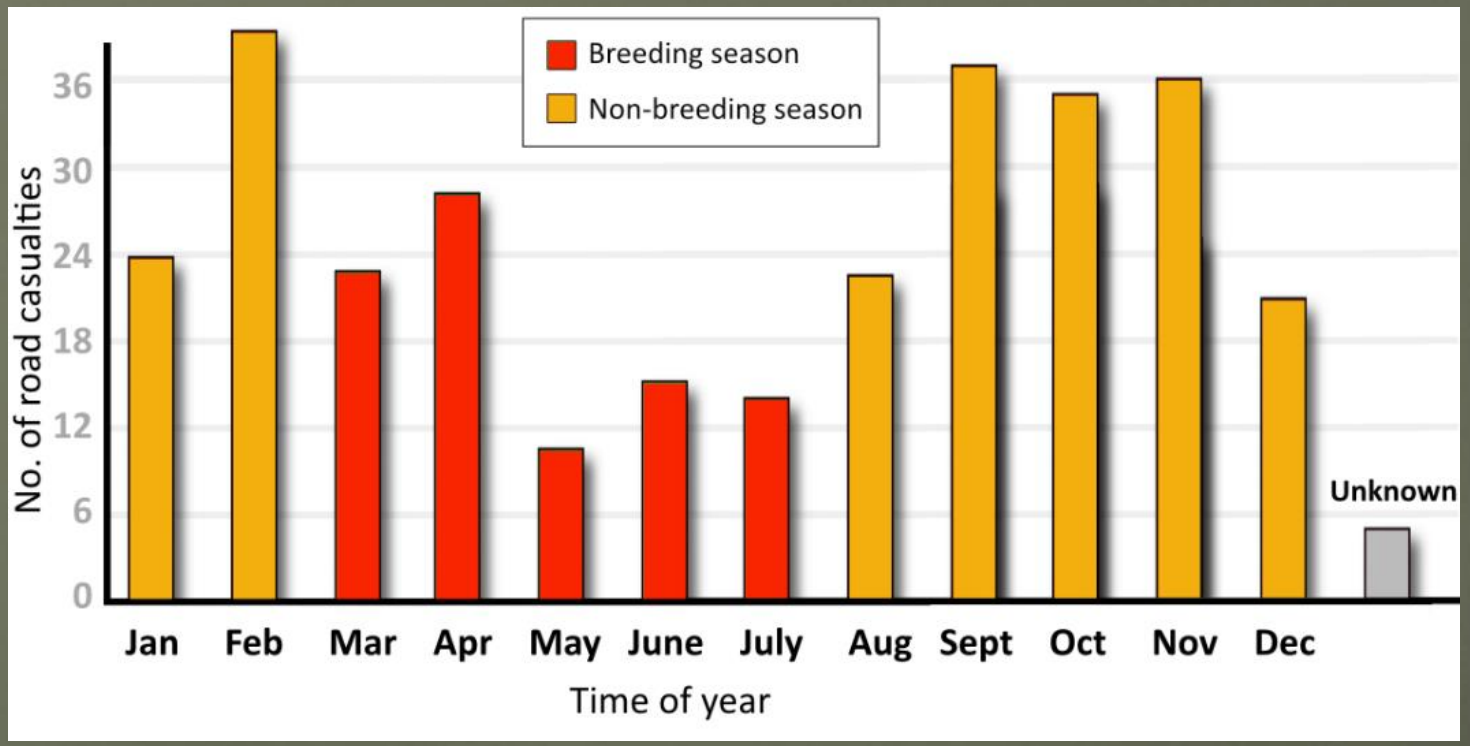
Two young from a brood of three killed on major roads in 2015 during dispersal

Road mortality as a cause of death



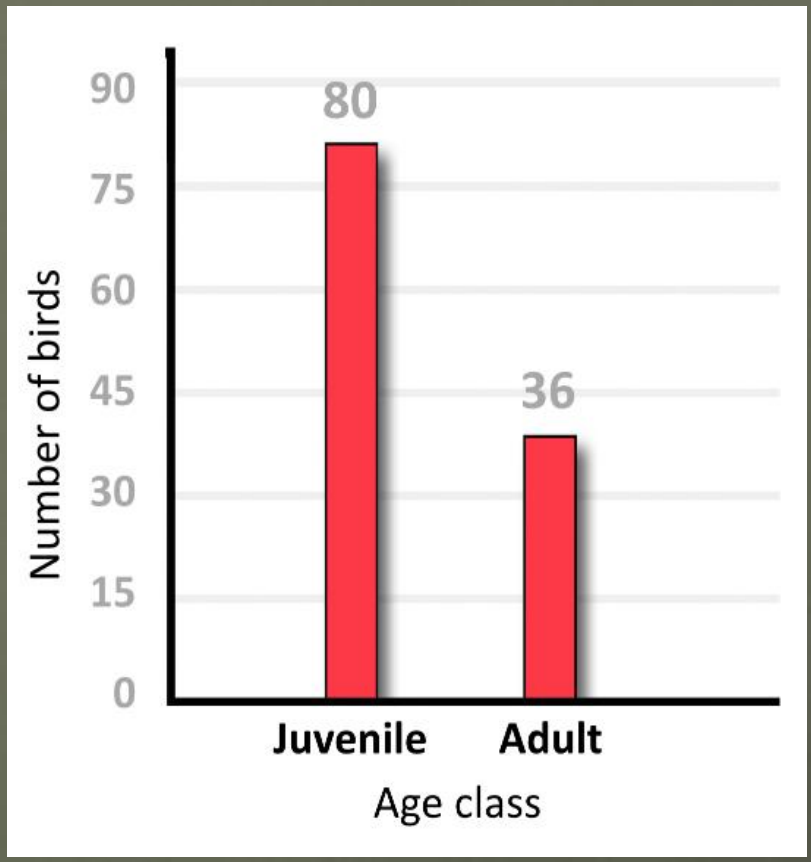
The road type on which all Barn Owl road mortalities were recovered (n = 312) in the Republic of Ireland (2008 - 2017).

Road mortality as a cause of death



The month in which Barn Owl road mortalities were recorded (n = 312) in the Republic of Ireland (2008 - 2017).

Road mortality as a cause of death



The age profile of Barn Owl road casualties (n = 116) in the Republic of Ireland (2008 - 2017).

Knowledge gaps

The extent of Barn Owl road mortalities on a local and national scale in Ireland?

- The factors which influence risk of collision?

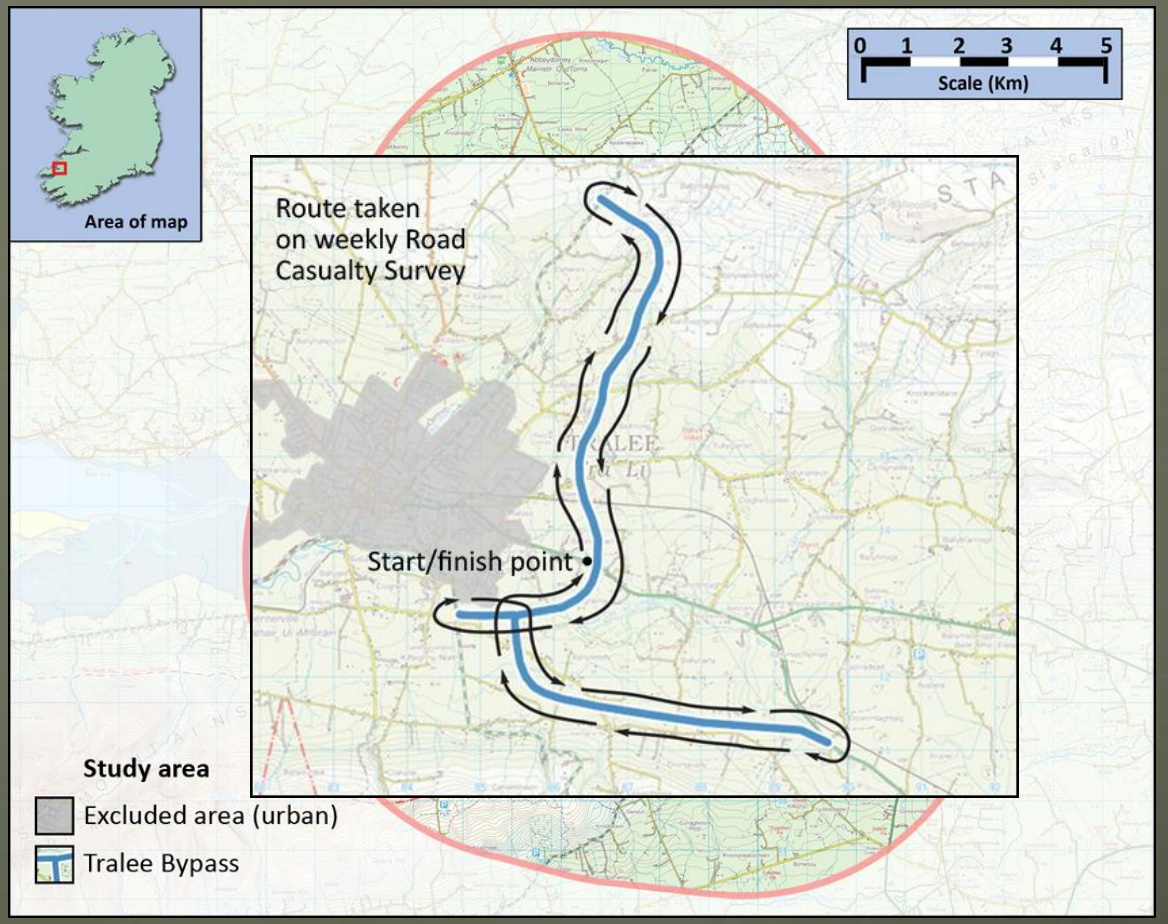
- The population level impact of road mortalities on Barn Owl populations in Ireland?

- Whether it is possible to mitigate risk of collision?

- Identification of mitigation which is practical and effective?

The Tralee Bypass and M8 motorway - the main study sites for the Barn Owl road casualty survey.

Extent of road casualties – Tralee Bypass

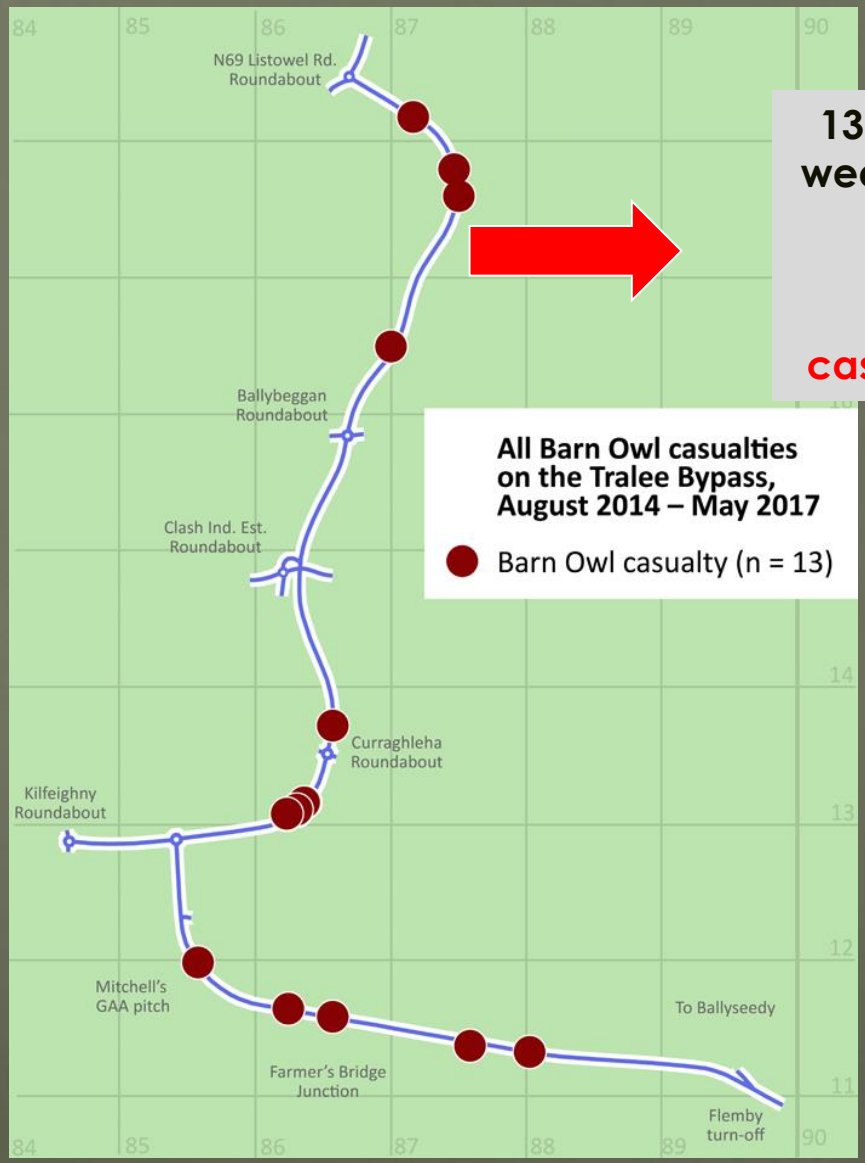


The Tralee Bypass (13.5km) study site for the strategic Barn Owl survey.

METHODS:

- **One survey / week for 144 weeks (Aug 2014 – May 2017)**
- **All avian & mammalian road mortalities recorded**

Extent of road casualties – Tralee Bypass



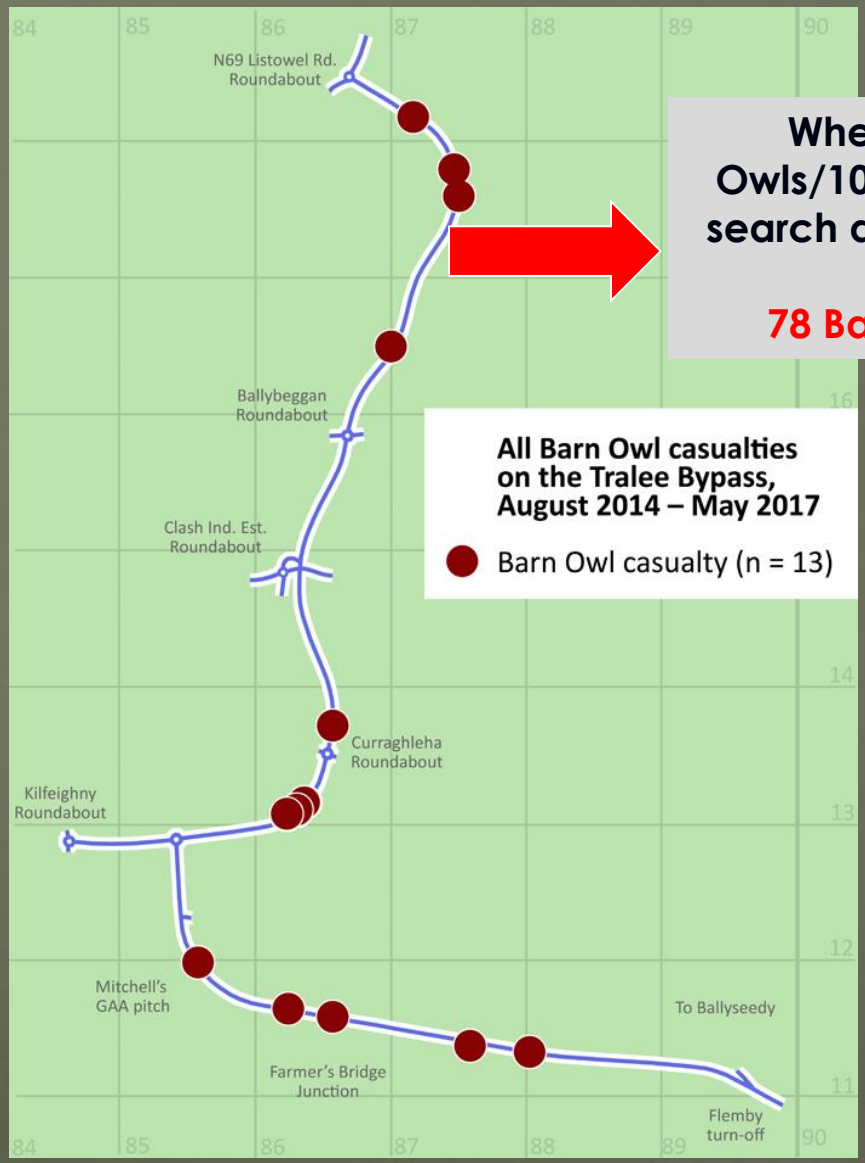
13 Barn Owls over 144 weeks on Tralee Bypass (13.5km)
=
35 Barn Owl casualties/100km/year

Distribution of Barn Owl road casualties on the Tralee Bypass Aug 2014 – May 2016 (n = 11)

Extent of road casualties – Tralee Bypass

Effect of search & removal bias

Extent of road casualties – Tralee Bypass

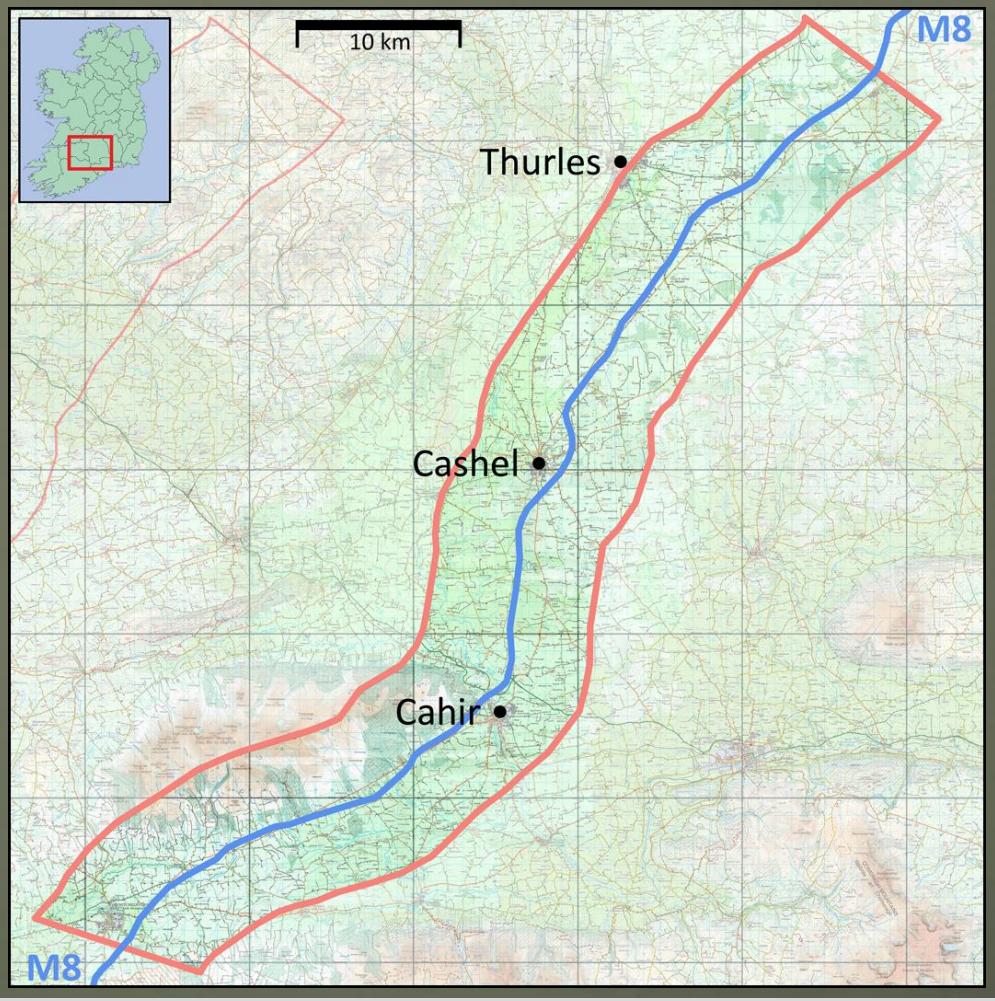


When figures (35 Barn Owls/100km/yr.) adjusted for search and removal, estimate =

78 Barn Owls/100km/yr.

Distribution of Barn Owl road casualties on the Tralee Bypass Aug 2014 – May 2016 (n = 11)

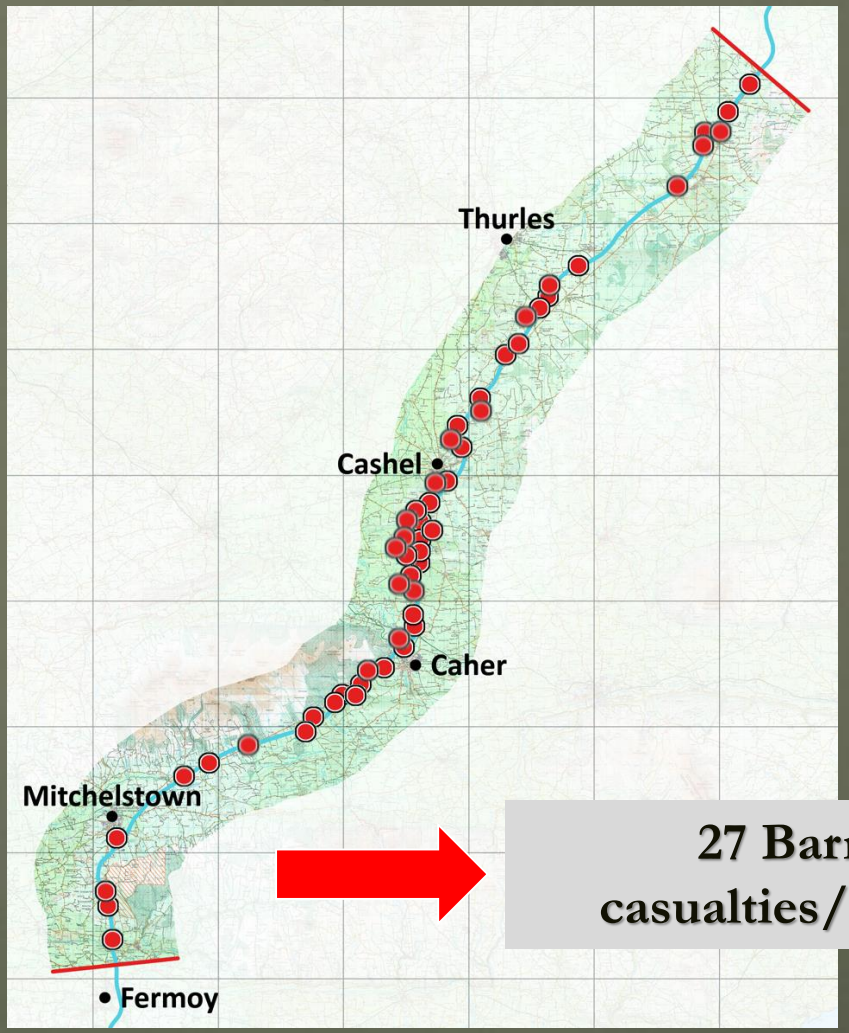
Extent of road casualties – M8



METHODS:

- **Daily survey (96km) for 81 weeks (Nov 2015 – May 2017)**
- **All Barn Owl road mortalities recorded and collected**

Road Casualty Survey – M8

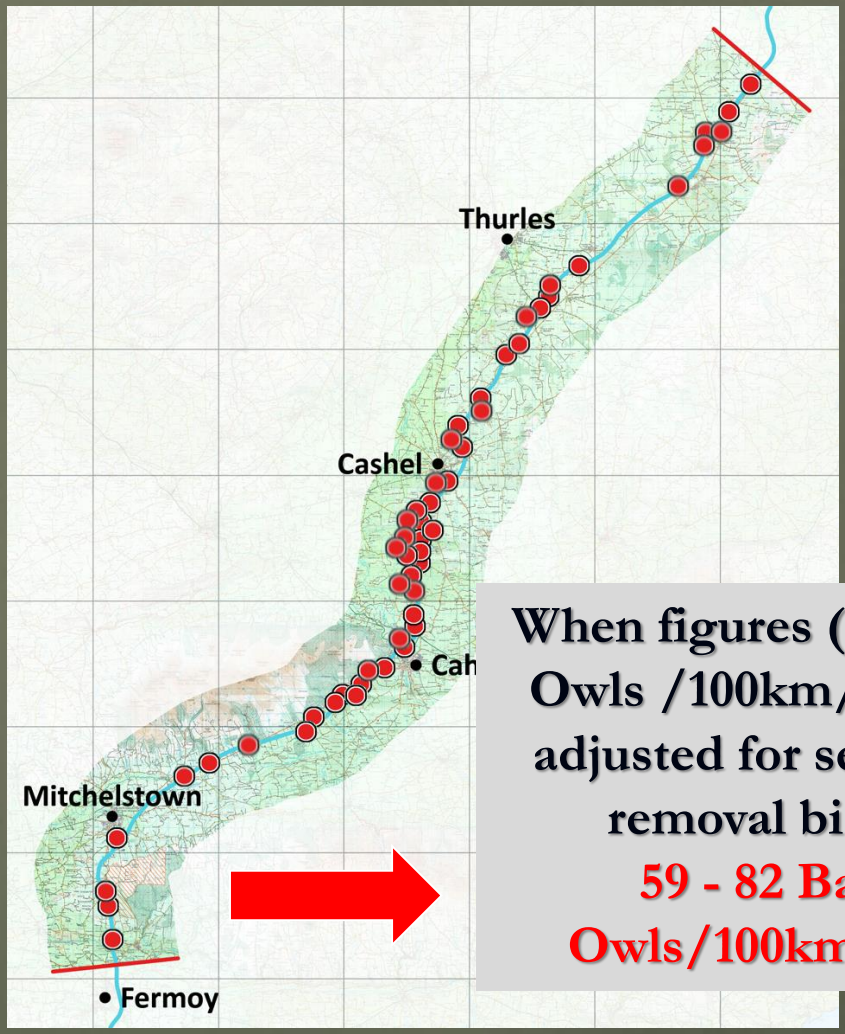


27 Barn Owl casualties/100km/yr.

The location of Barn Owl road mortalities on the M8 (n = 54) recorded by EgisLagan survey (Nov 2015 – Nov 2017).

Search & removal bias – M8

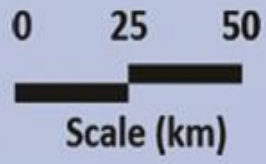
Trials to determine efficiency of survey/detection rates



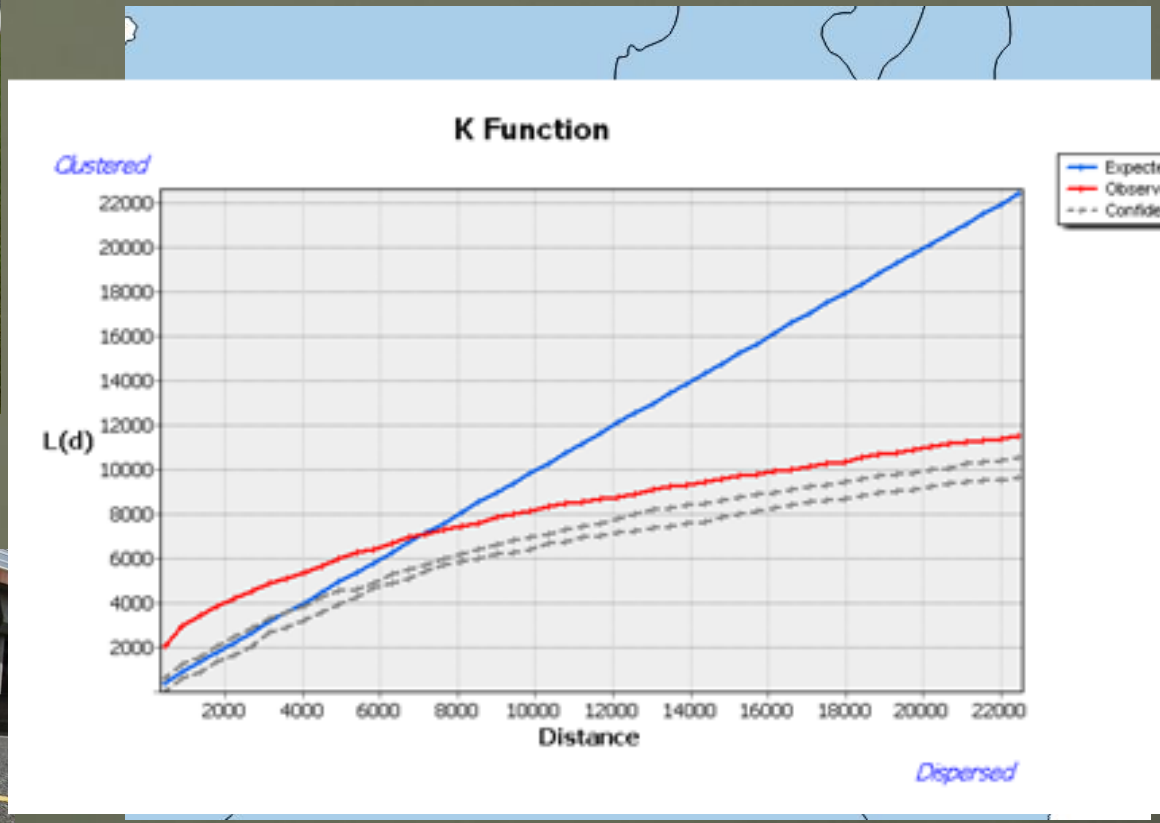
The location of Barn Owl road mortalities (n = 54) on the M8 (Nov 2015 – Nov 2017).

When figures (27/Barn Owls /100km/yr.) are adjusted for search & removal bias = 59 - 82 Barn Owls/100km/year

Rd casualty rate	Region	Study
7 casualties/100km/yr.	Switzerland	Bourquin 1993
25 casualties/100km/yr.	France	Baudvin 1997
65 casualties/100km/yr	France	Massesmin & Zorn 1998
68 casualties/100km/yr.	UK	Shawyer & Dixon 1998
59 – 82 casualties/100km/yr.	Ireland	This study
599 casualties/100km/yr.	Idaho, US	Boves & Belthoff 2012



Factors which influence risk of collision – M8

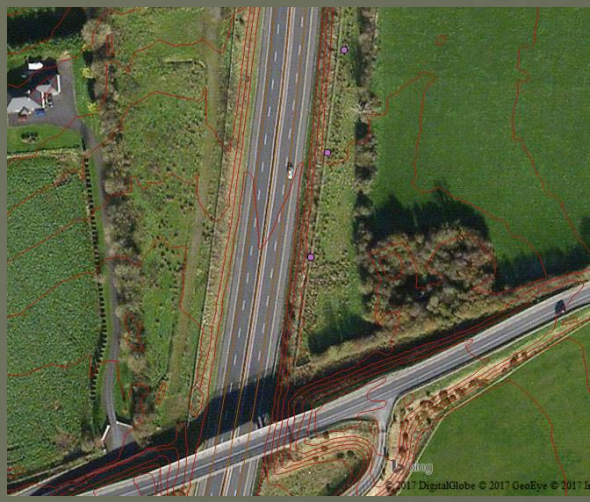


Barn Owl collision points on the M8 (n = 50; 2009 – 2017)

Factors which influence risk of collision – M8

Data attributed to each collision point (n = 50) & random point (n = 50)

- Adjacent habitat type
- Verge width
- Distance to junction
- Distance to flyover
- Distance to linear feature
- Verge habitat
- Embankment / verge height



Sources: 1m contour maps, CORRINE Land Cover, Satellite – Bing Maps & Google Streetview

Factors which influence risk of collision – M8

Factors which significantly influenced collision

- Width of verge (p= 0.035)
- Proportion of grassland in roadside verges (p=0.006)
- Distance to rivers (p=0.024)

Factors which influence risk of collision – M8

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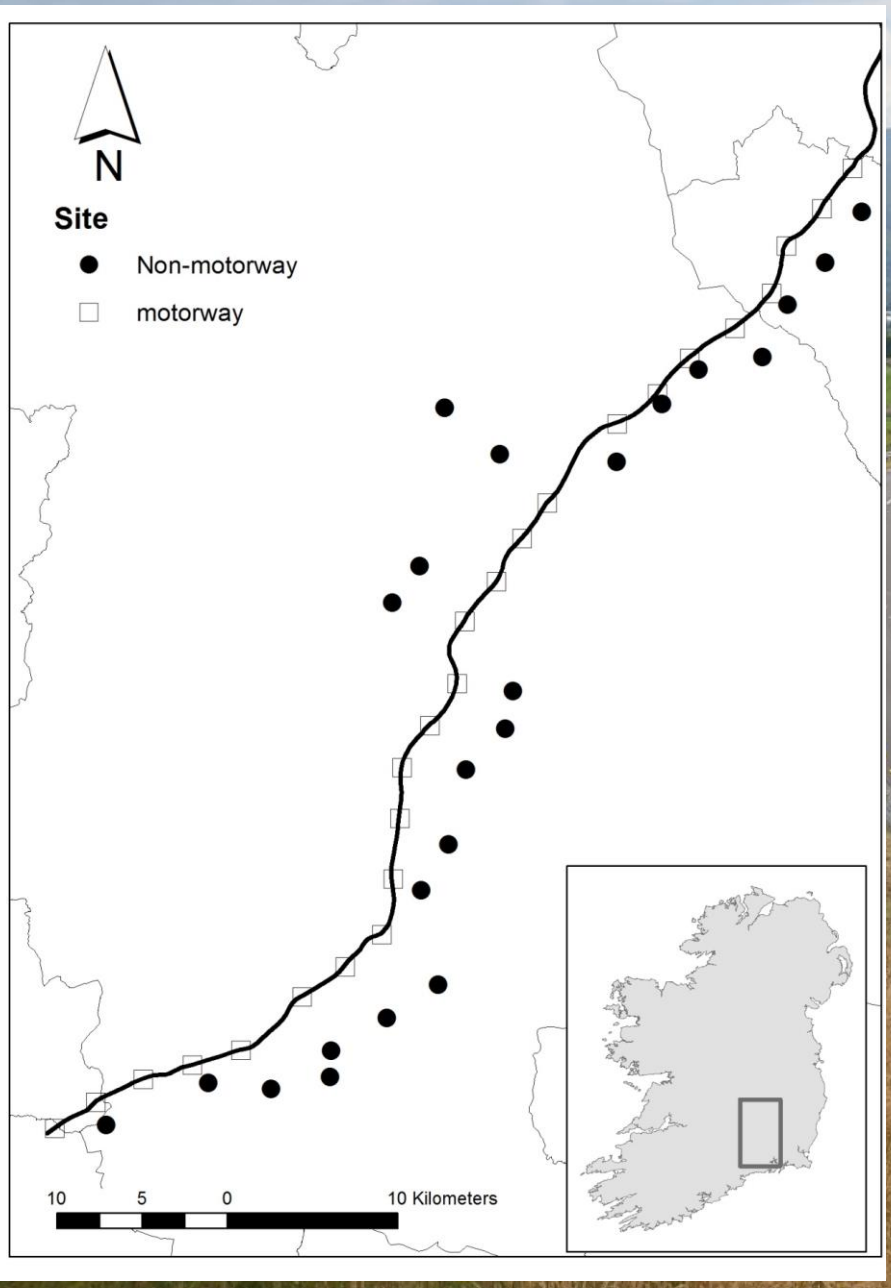

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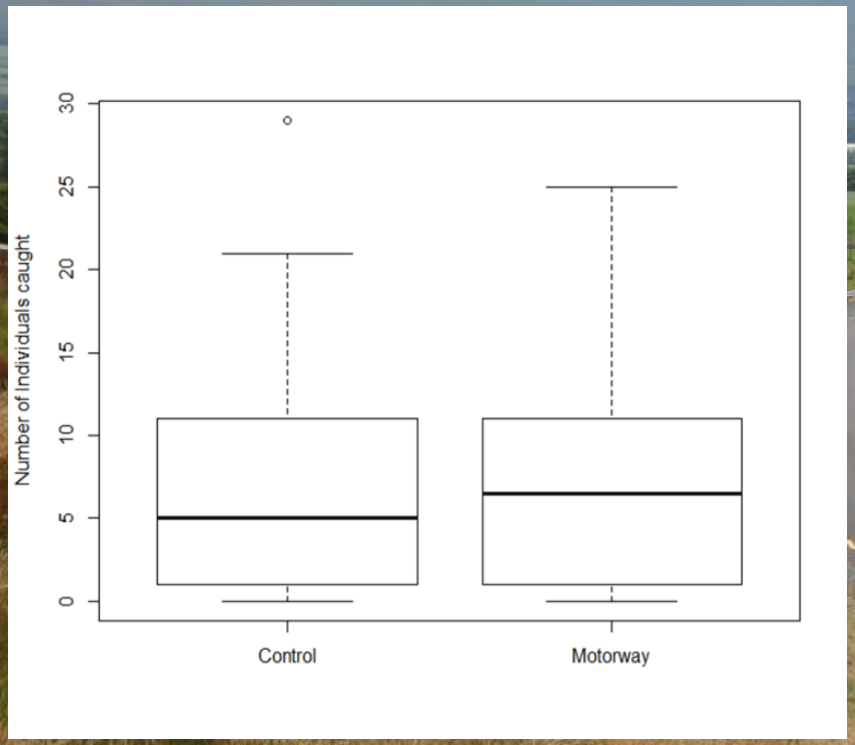


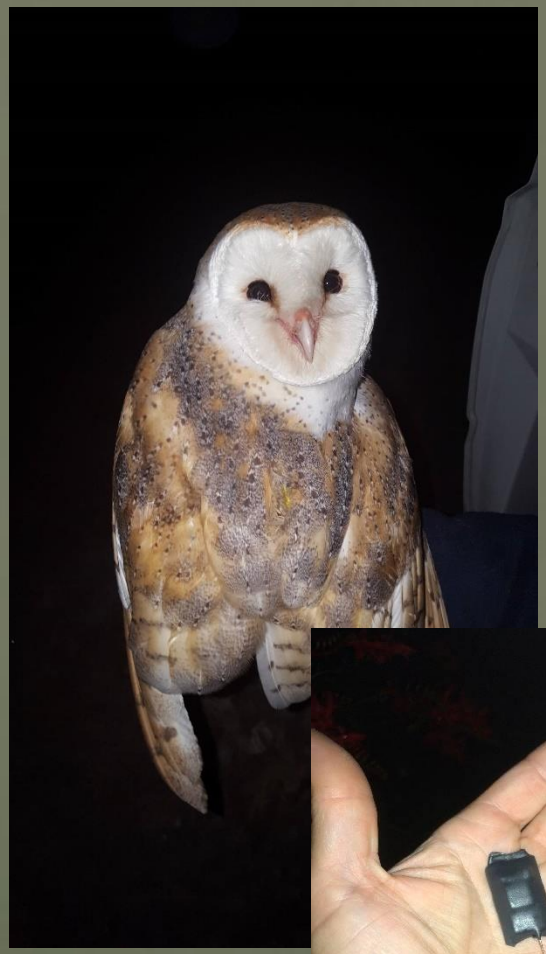
Comparison of small mammal abundance in motorway verges and hedgerows

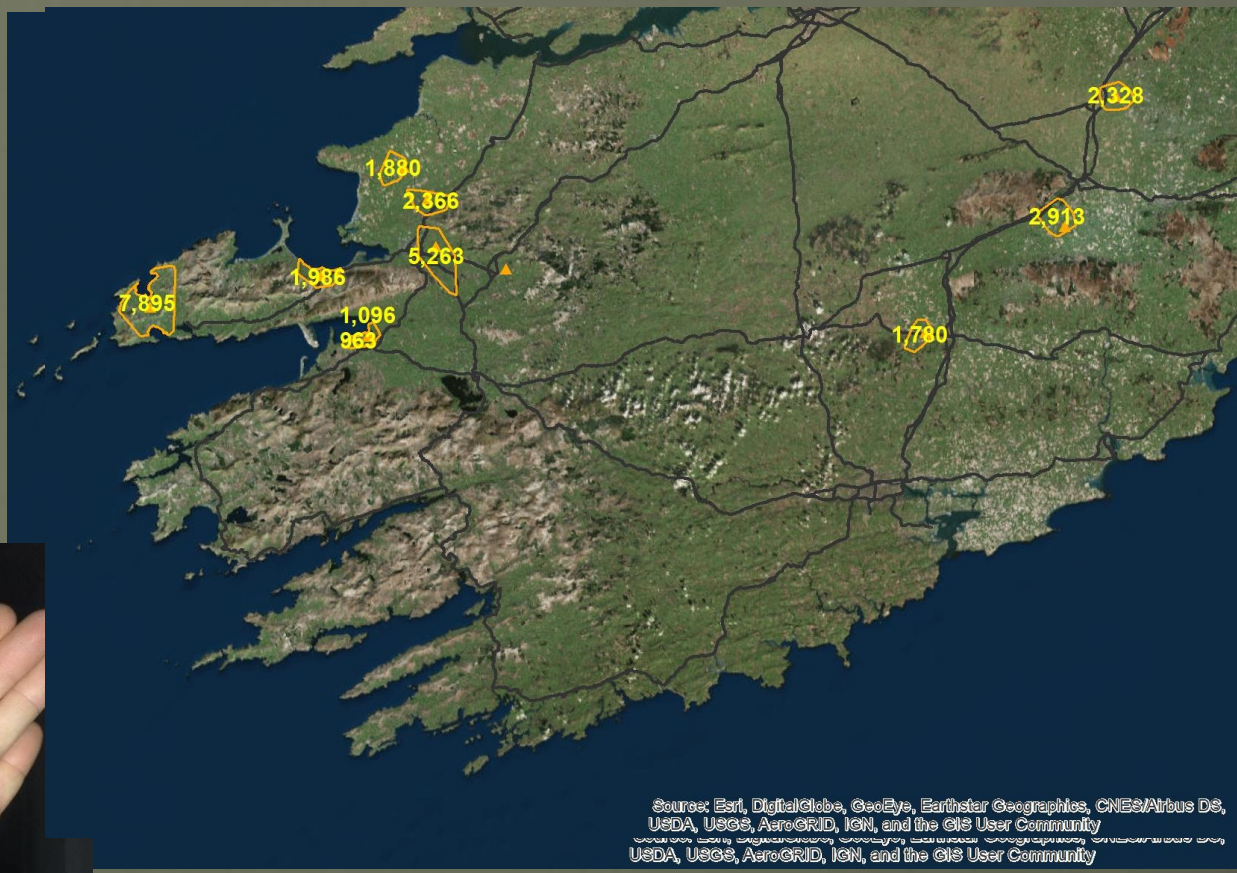
Factors which influence risk of collision – M8

	Motorway	Hedgerow	Significance
Small mammal species (individual)			
Wood mouse	163	86	t-2.787, p=0.005
House mouse	25	26	-
Bank vole	284	326	-
Greater white-toothed shrew	270	226	-
Total Individuals caught	727	663	-
Small mammal captures/trap night	0.488	0.438	F=0.021, p=0.884
Small mammal biomass (g)	6.20	6.1	-
Mean trap line biomass (g)	399.57	380.81	F=0.318, p=0.575
Species richness (mean) (S)	3.44	3.0	W=432, p<0.001
Species Diversity (mean) -Shannon Weaver (H)	1.00	0.92	W=406.5, p = 0.033
Equitability - evenness (mean) (E_H)	0.82	0.84	W=267, p=0.510

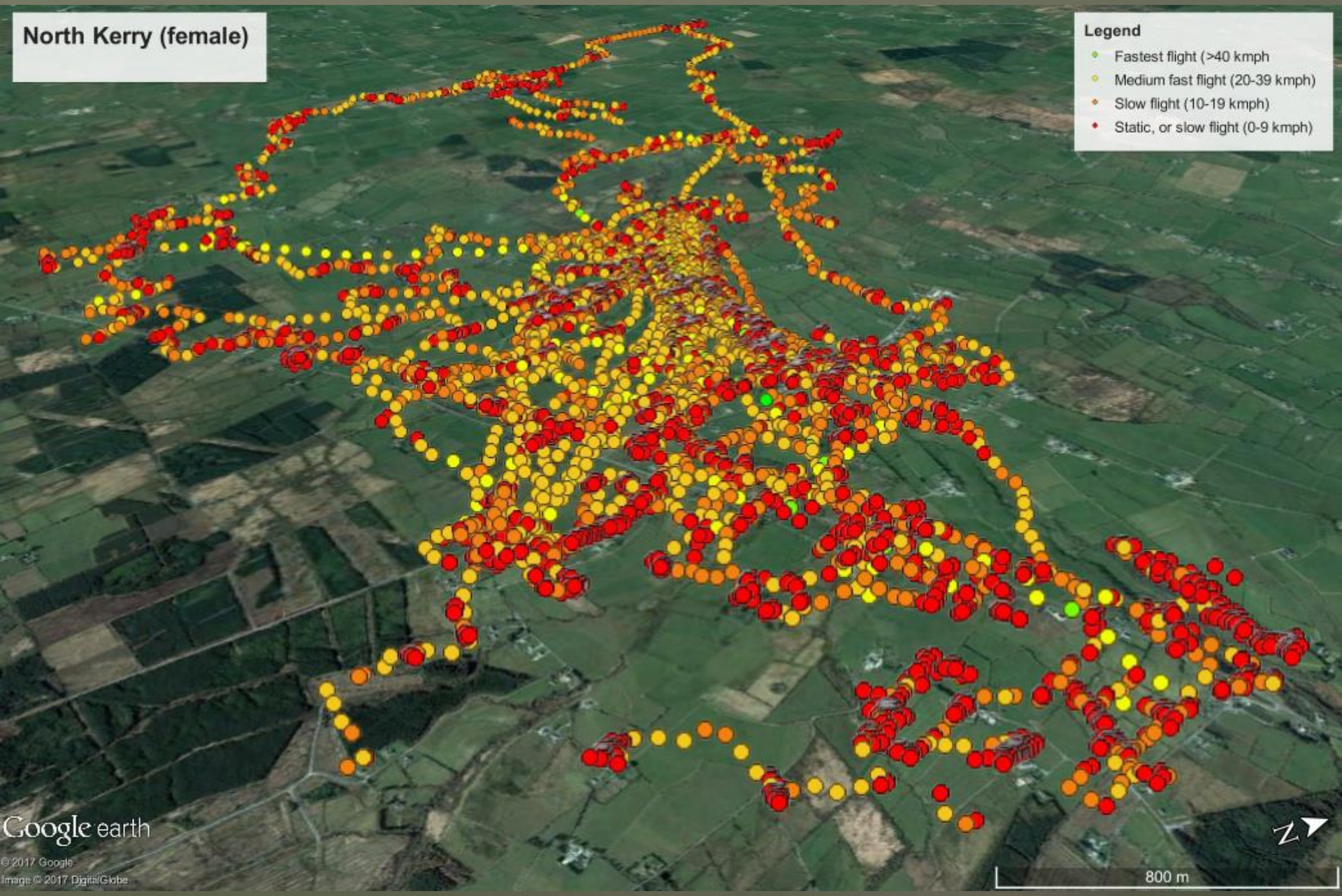
Comparison of small mammal communities in motorway verges and hedgerows

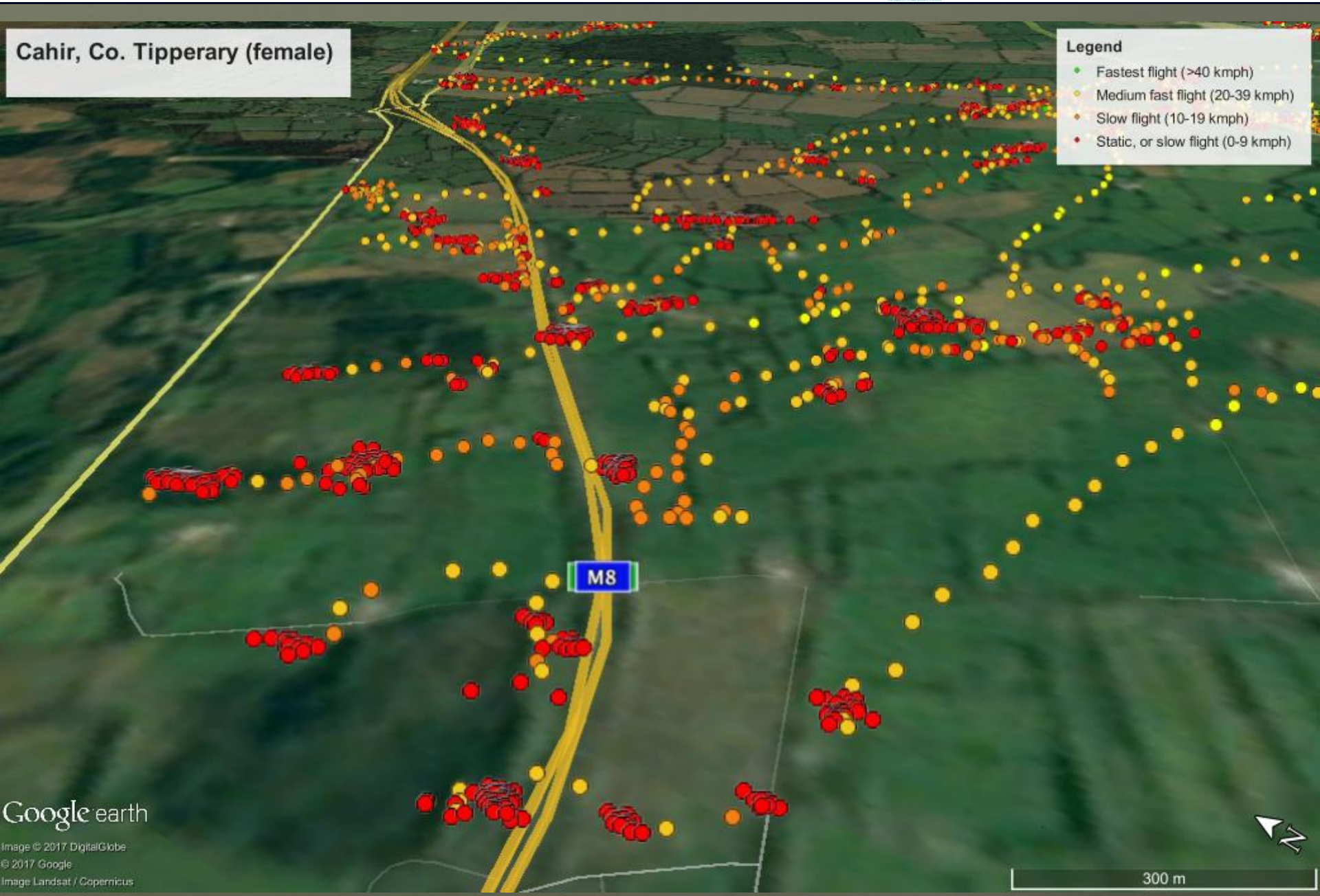
Individual responses – M8 & Tralee Bypass

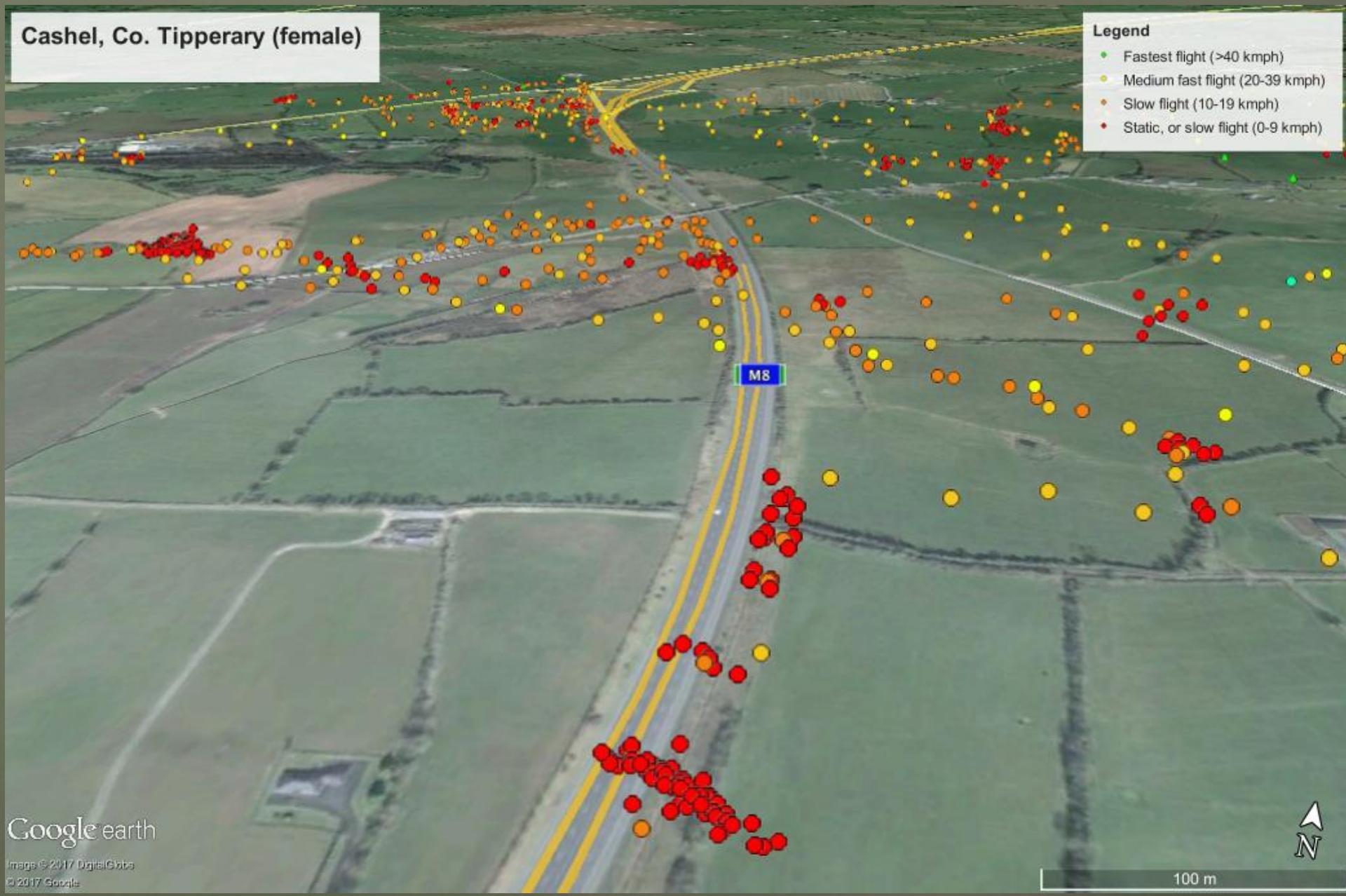




The location of Barn Owl breeding sites (n = 10) where adult breeding birds (n = 13) were fitted with GPS tags (2016 – 2017)


North Kerry (female)
Legend
Fastest flight (>40 kmph
Medium fast flight (20-39 kmph)
Slow flight (10-19 kmph)
Static, or slow flight (0-9 kmph)
Google earth
© 2017 Google
Image © 2017 DigitalGlobe
800 m


Cahir, Co. Tipperary (female)
Legend
Fastest flight (>40 kmph)
Medium fast flight (20-39 kmph)
Slow flight (10-19 kmph)
Static, or slow flight (0-9 kmph)
M8
Google earth
Image © 2017 DigitalGlobe
© 2017 Google
Image Landsat / Copernicus
300 m


Cashel, Co. Tipperary (female)
Legend
Fastest flight (>40 kmph)
Medium fast flight (20-39 kmph)
Slow flight (10-19 kmph)
Static, or slow flight (0-9 kmph)
M8
Google earth
Image © 2017 DigitalGlobe
© 2017 Google
N
100 m

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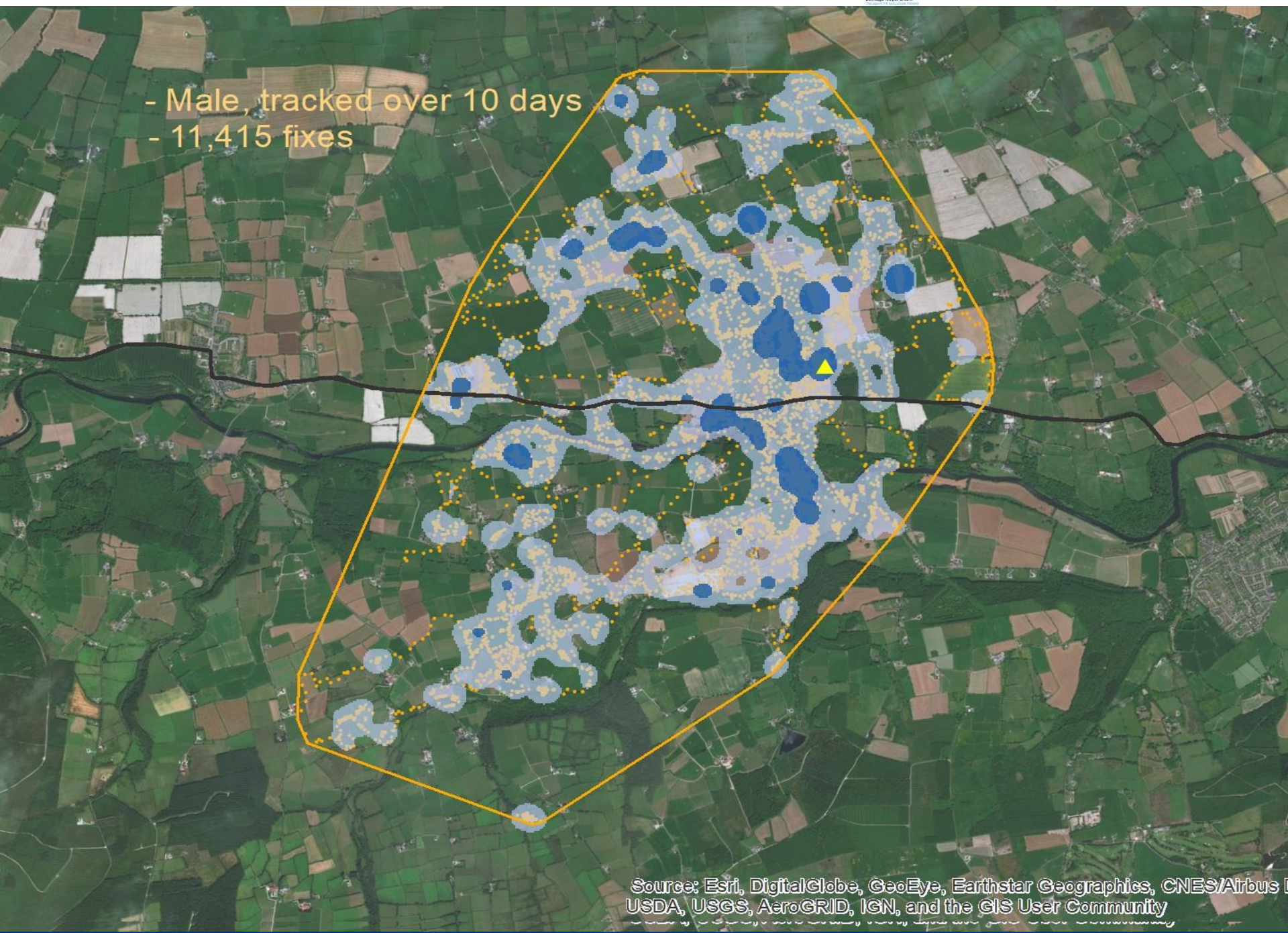
protecting birds and biodiversity


- Male, tracked over 10 days
- 11,415 fixes
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus
USDA, USGS, AeroGRID, IGN, and the GIS User Community

Barn Owls & major roads

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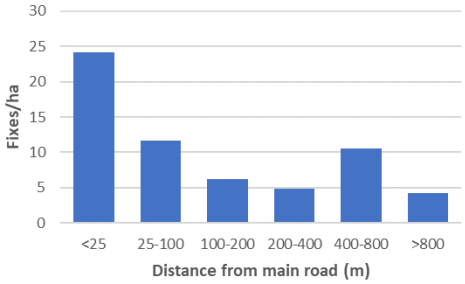
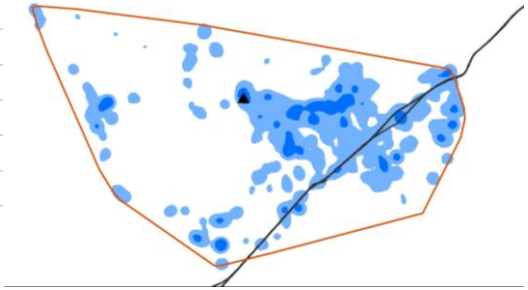
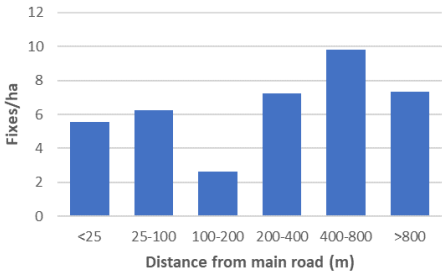
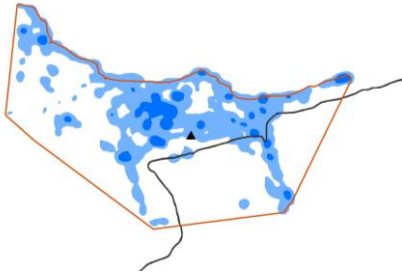
Ballyconnell Female



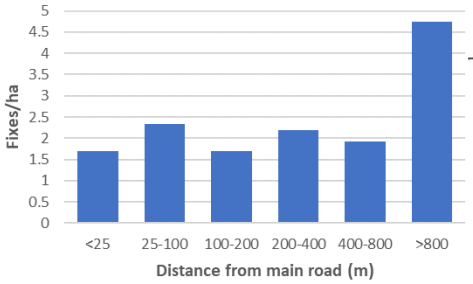


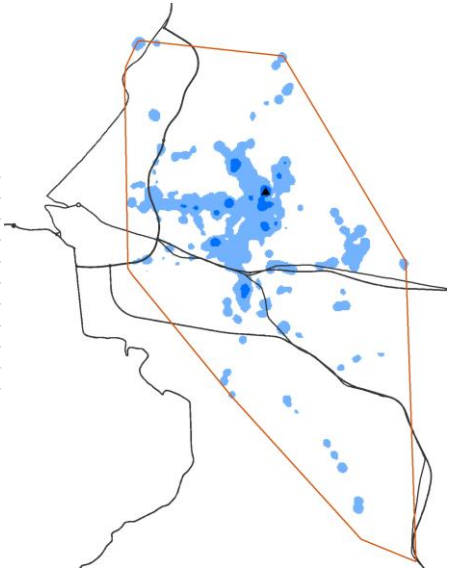
Camp Male



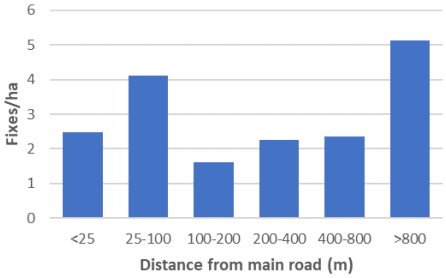


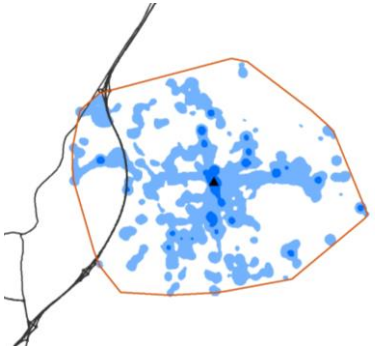
Ballynahinch Female

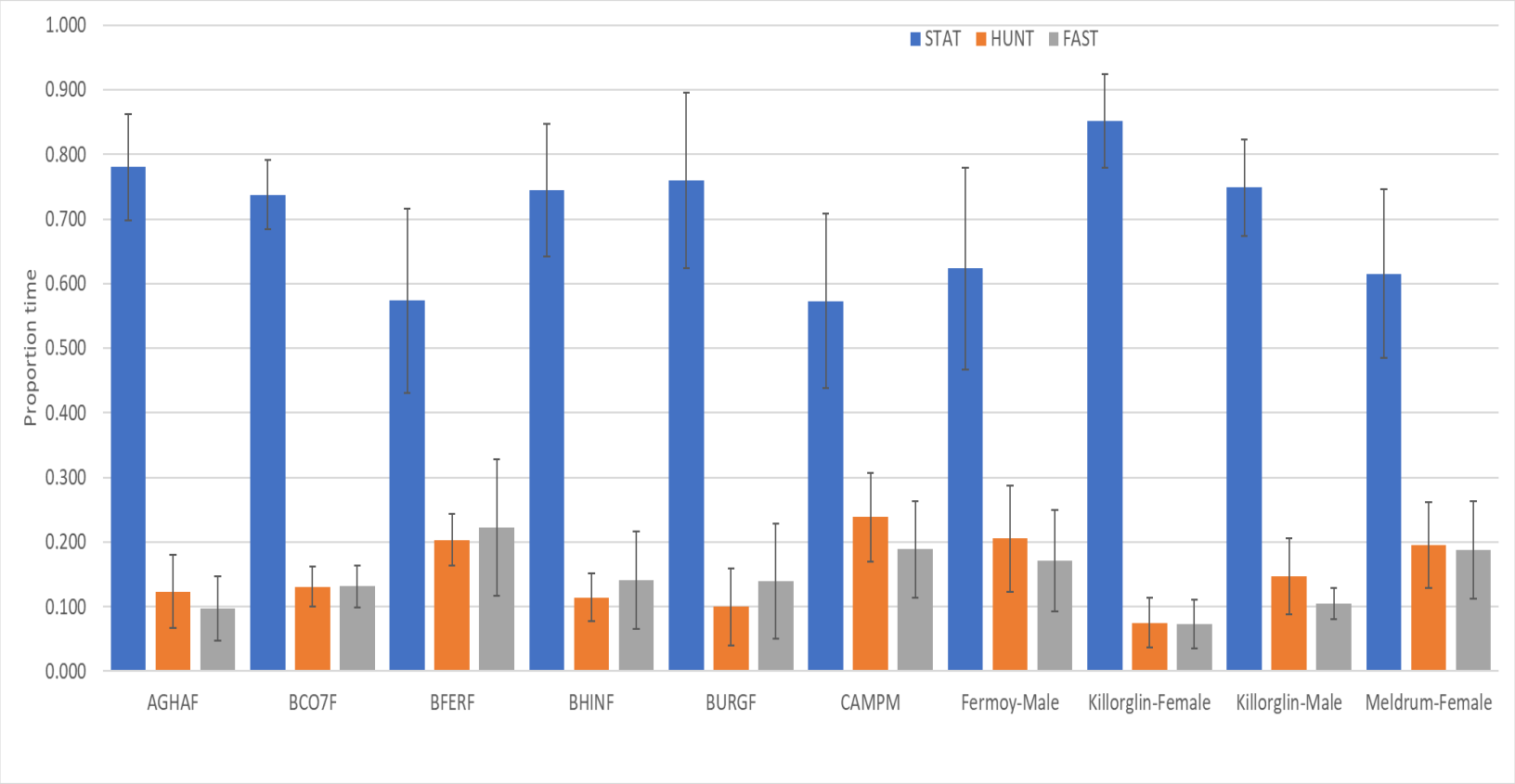




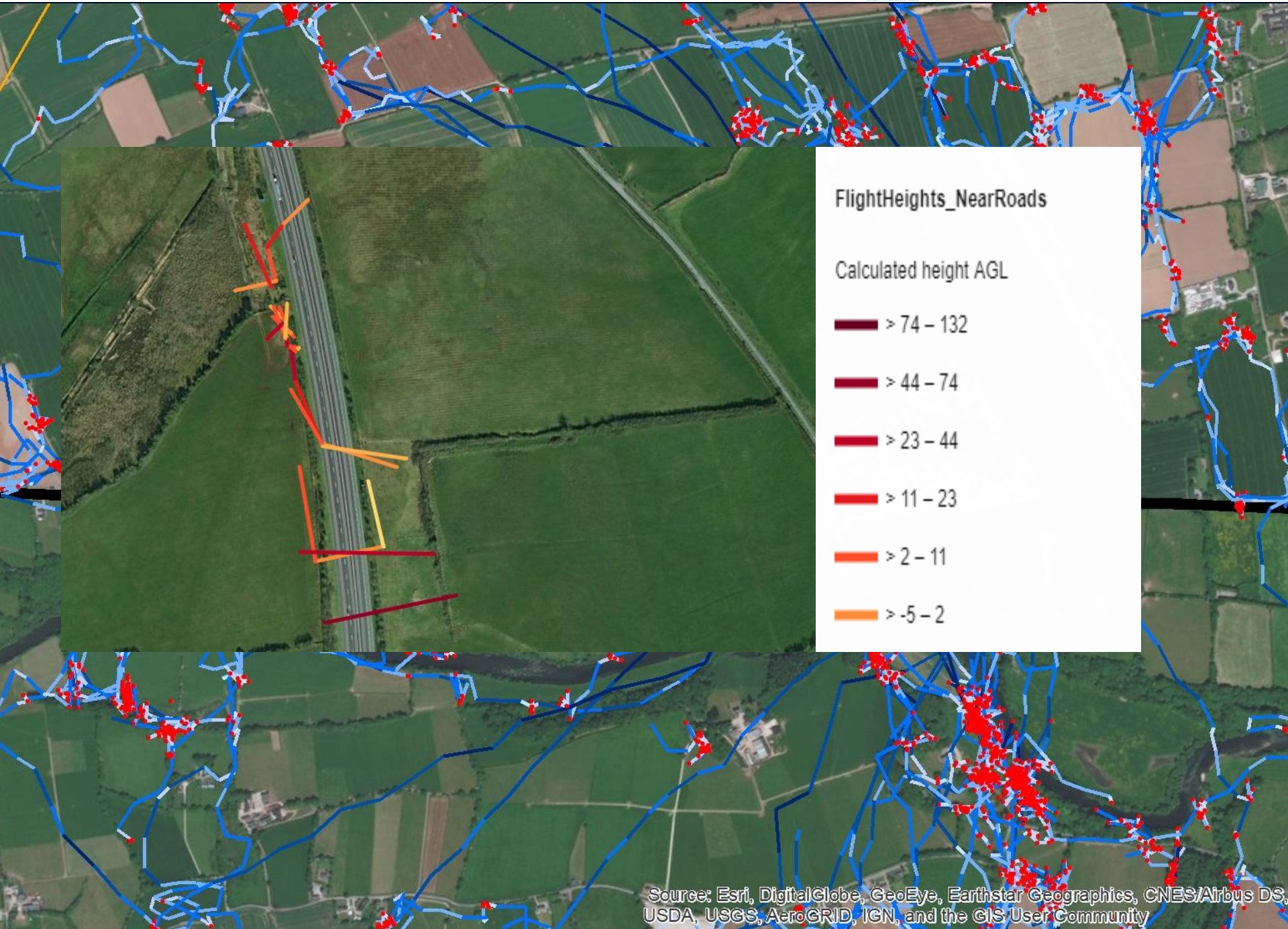
Meldrum Female



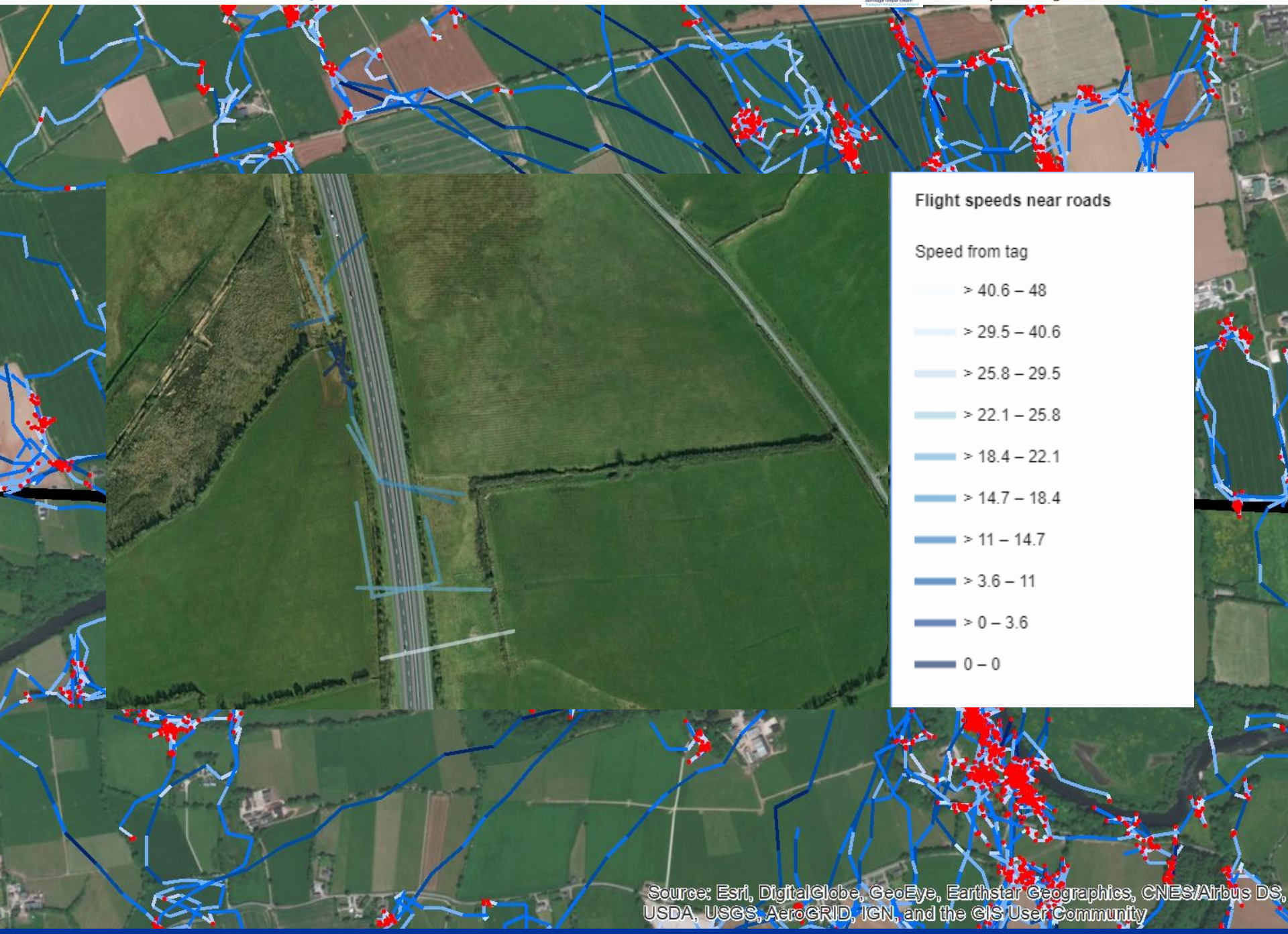




Activity budget of 10 Barn Owls fitted with GPS tags, illustrating the proportion of time each night that these individuals spent stationary (STAT), in hunting flight (HUNT) and in transit between areas (FAST). Means and standard deviations are illustrated.


FlightHeights_NearRoads
Calculated height AGL
> 74 – 132
> 44 – 74
> 23 – 44
> 11 – 23
> 2 – 11
> -5 – 2
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Barn Owls & major roads



Barn Owl Survey Standards:

http://www.tiipublications.ie/library/RE-ENV-07005-01.pdf

https://www.youtube.com/watch?v=yYzEzW7PFdE&t=13s

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