Unravelling bat species' response to environmental structure and patterns of occupancy in a Mediterranean landscape

The importance of vegetation structure for bats
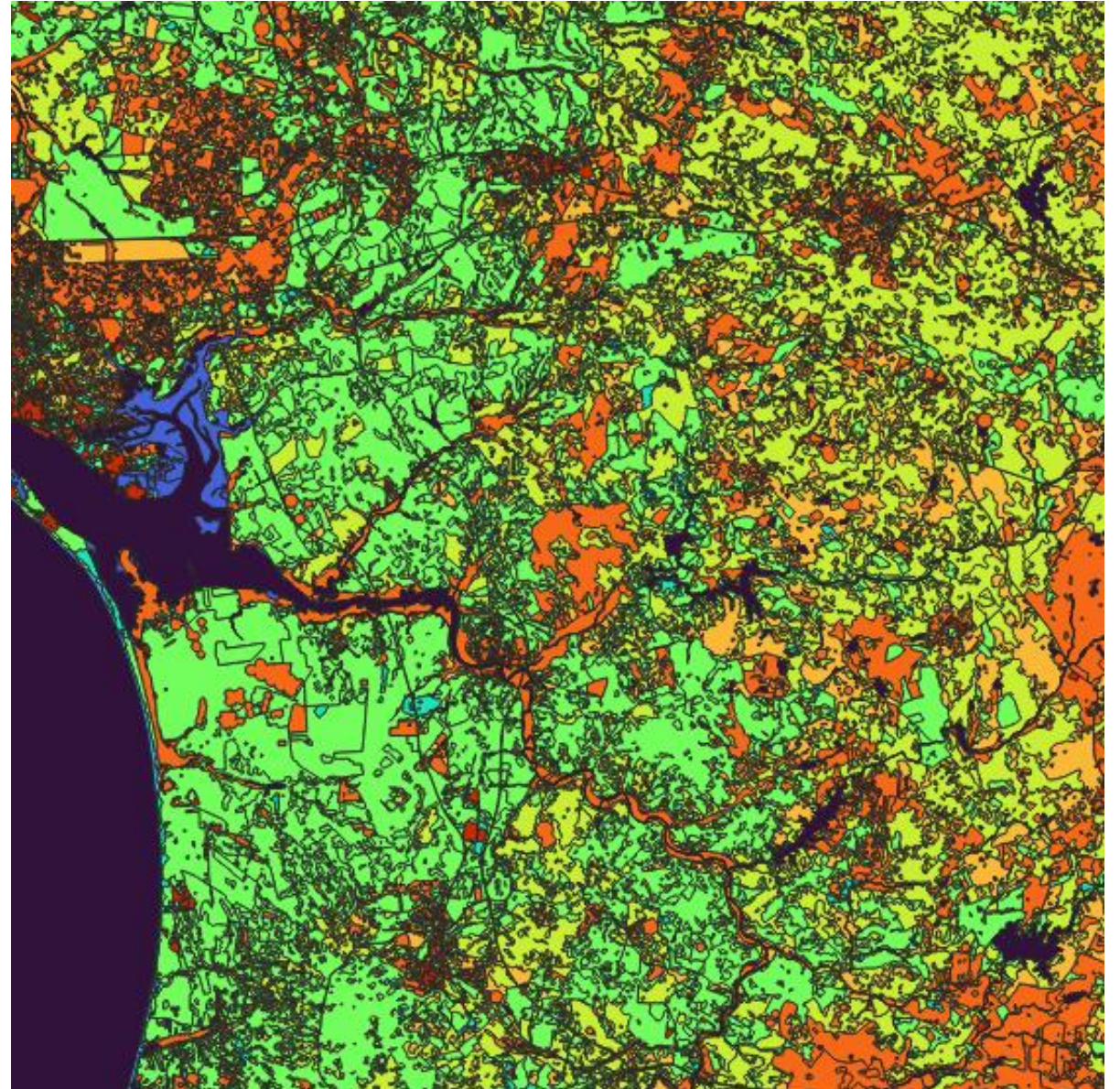
IUFRO Forest Environment DIV 8 Conference 2023

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MED

fct Fundação para a Ciência e a Tecnologia

UNIVERSIDADE DE ÉVORA

Land cover & wild species

- Land cover change

- Broad scale

- Reduced habitat and resources
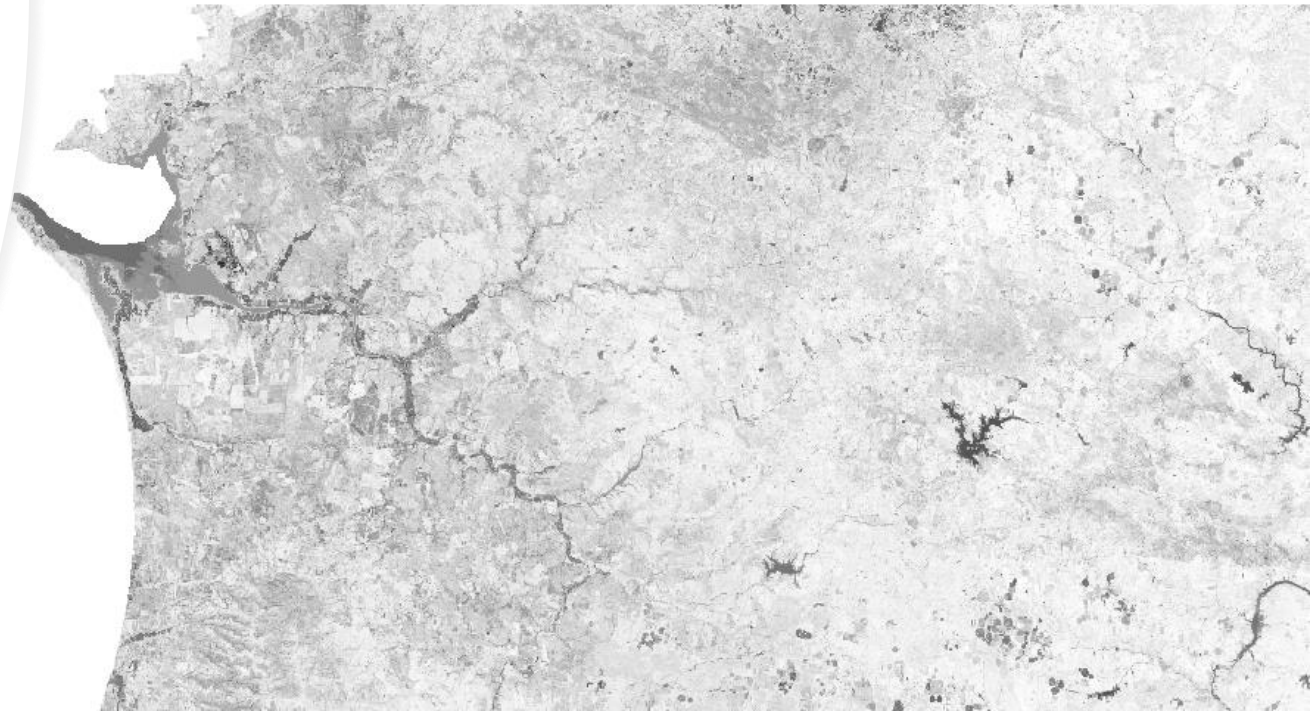
- Composition & structure

Remote sensing & vegetation structure

Characterizing forest structure

Vegetation data from remote sensing

- Multispectral

- High-resolution

- Broad-scale

- Integration

Bats on the landscape

- Several species with variable distribution
- Acoustic detection
- Studying bat species occupancy
- Using repeated sampling to distinguish occupancy and detection

Questions & Hypothesis

1 – Questions	What are the different landscape characteristics that have a significant explanatory effect on bat occupancy and detection?	Does anthropogenic land-use influence bat occupancy and assemblage?
2 - Hypothesis	Vegetation metrics will be a determinant variable for modelling bat species occupancy	Anthropogenic features will have a negative effect on bat species' occupancy

Field work and analysis

Legend (cos):
- Acoustic samples
- Water
- Wetlands
- Non-vegetated area
- Shrubland
- Forests
- Agroforestry areas
- Pastures
- Agriculture
- Built-up area

0 25 50 75 km
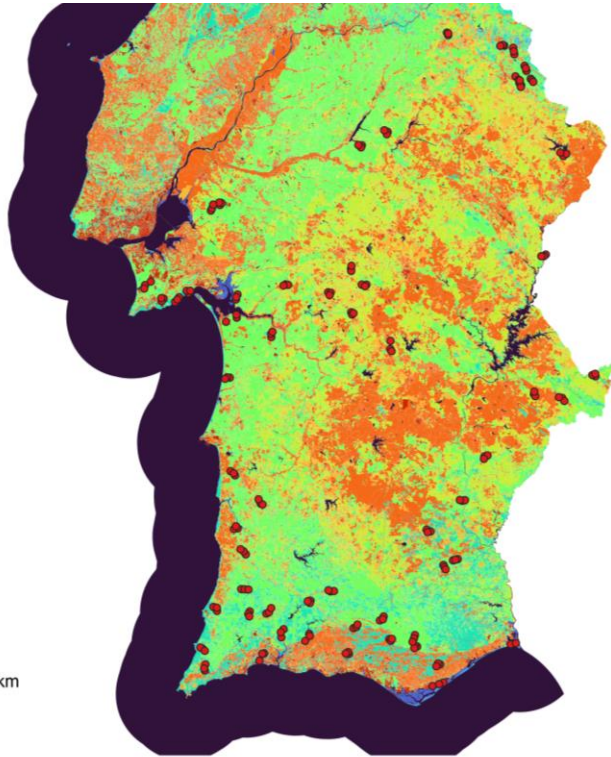
Step 1

Acoustic detection with spatial replicates

Step 2
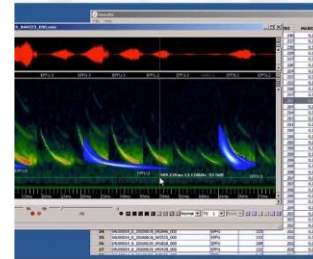
Classification of species occurrence

Step 3
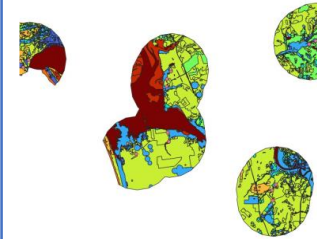
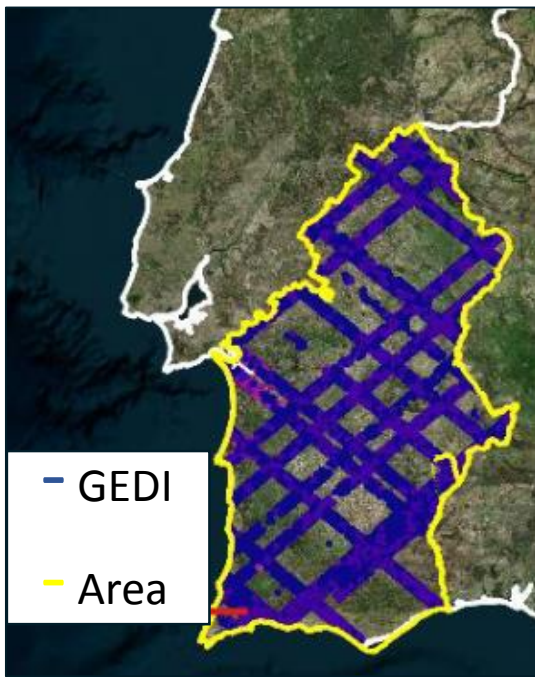Assessment of occupancy and detection covariates

Step 4
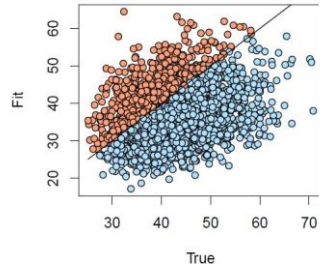
Model evaluation and prediction of species distribution

Model development

Model

- **Occupancy**
  - **Vegetation structure**
    - Canopy height
    - Enhanced vegetation
  - **Land use**
    - Distance
    - Proportion
    - Edge
  - **Climatologies**
- **Detection**
  - Julian day
  - Moon phase
  - Land Surface temperature
  - Water distance
  - Canopy height

Buffers :
-2000m
-1500m
-100m
-500m
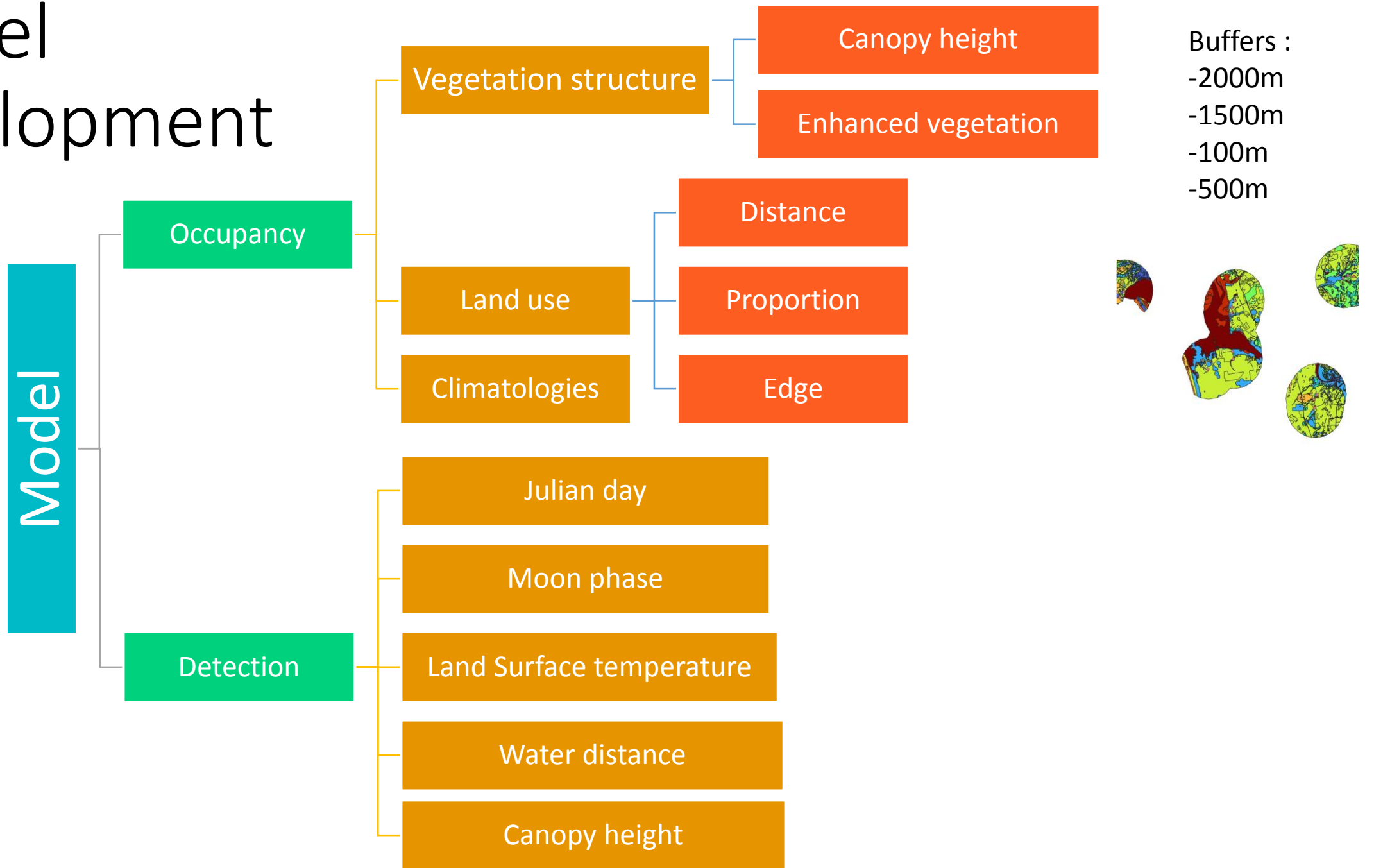
CH from remote sensing

- -GEDI footprint

- -Search for relative heights (RH) metrics as a proxy of vegetation height
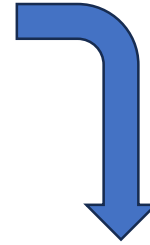
Random forest algorythm
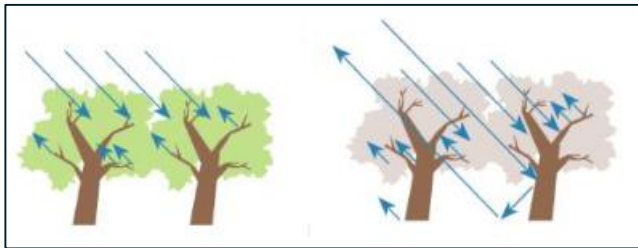
- Synthetic Aperture Radar

- Sentinel-1 & ALOS/PALSAR-2
- Topography

GEDI

Area
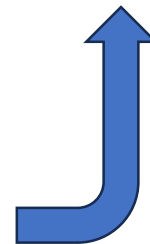
Parameter estimates & Canopy Height response curves
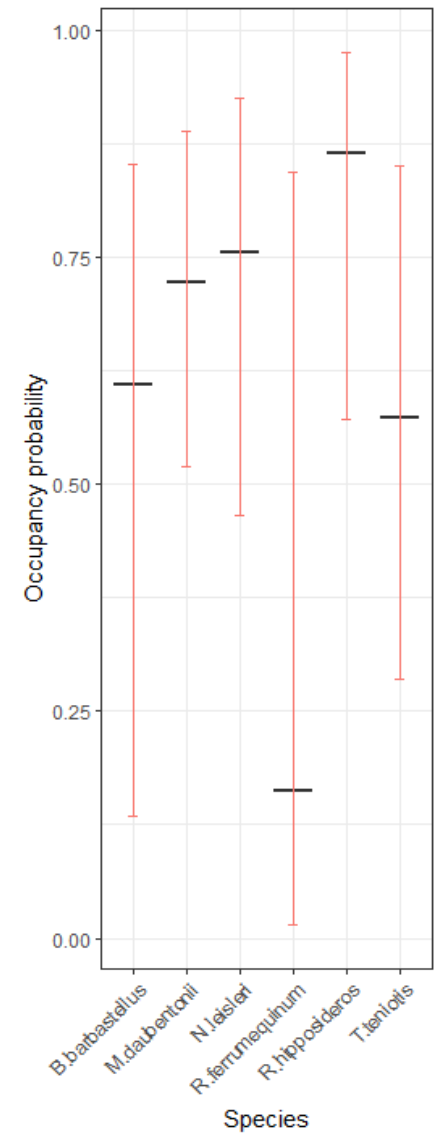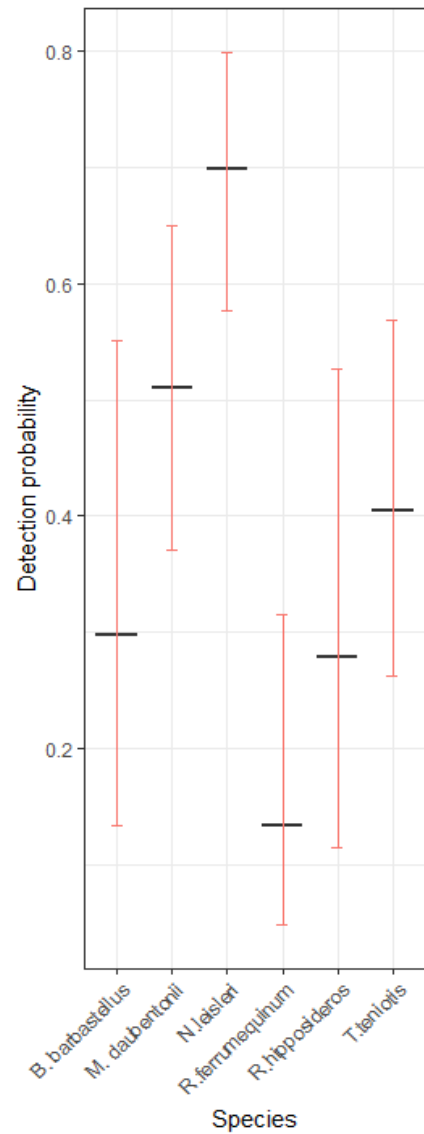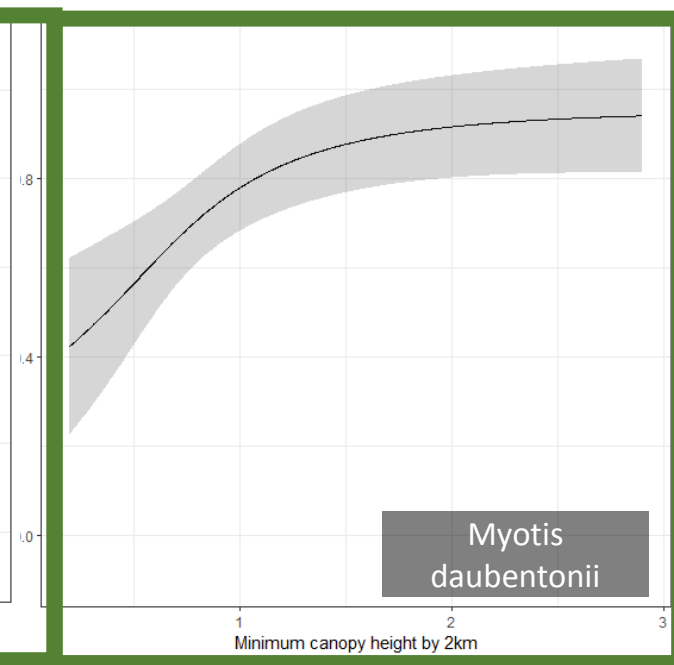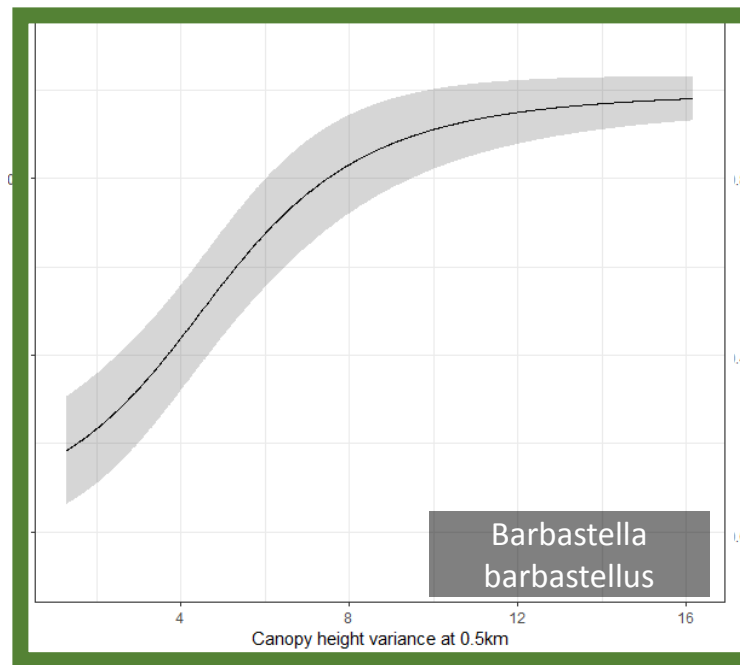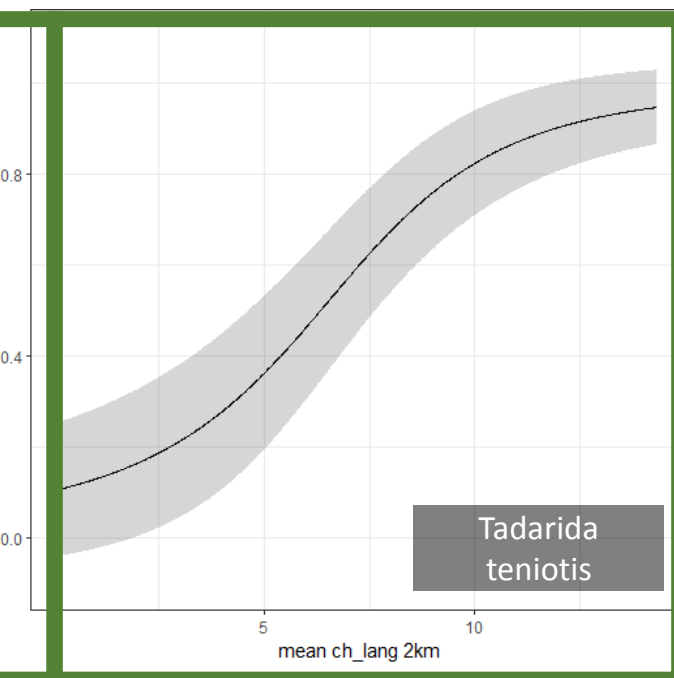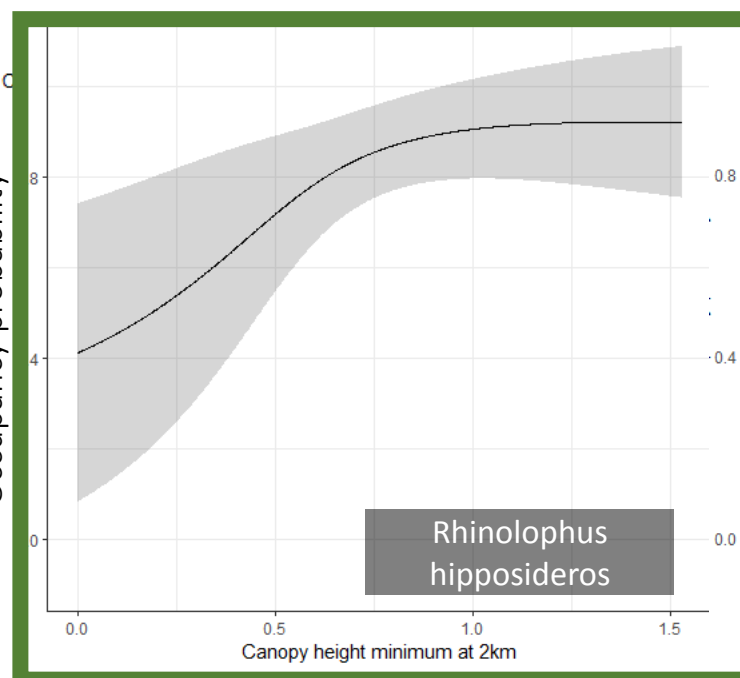
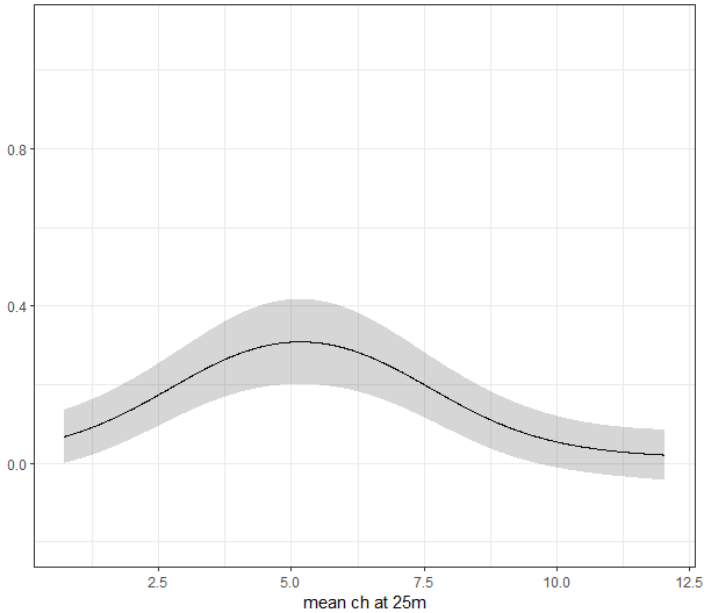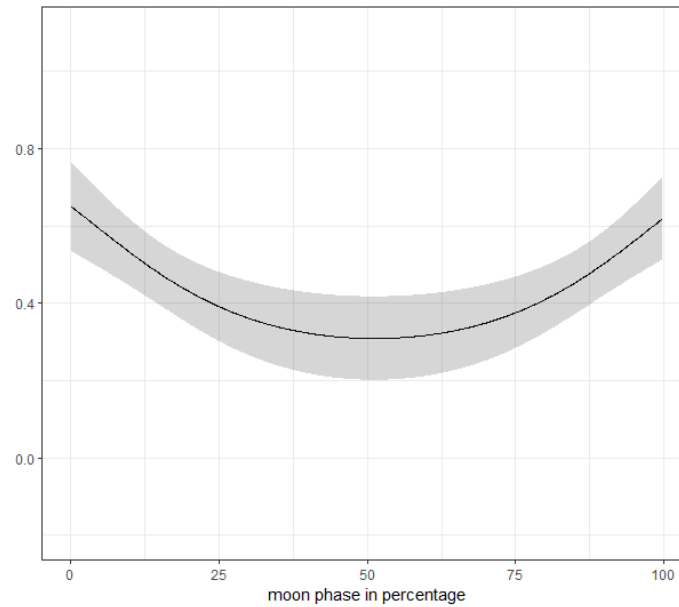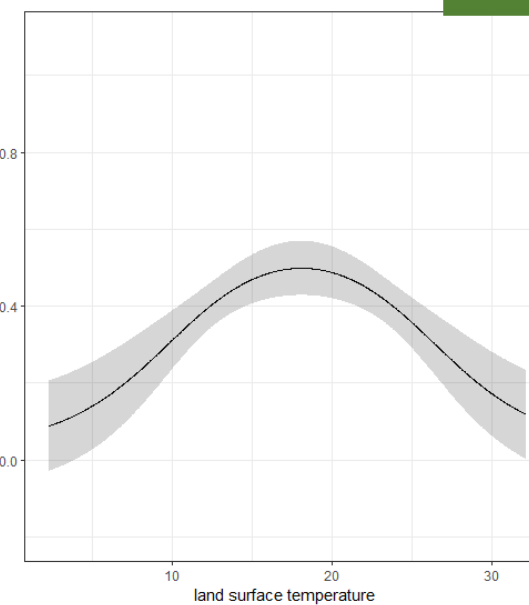# Model and species' response curves -*Barbastella barbastellus*
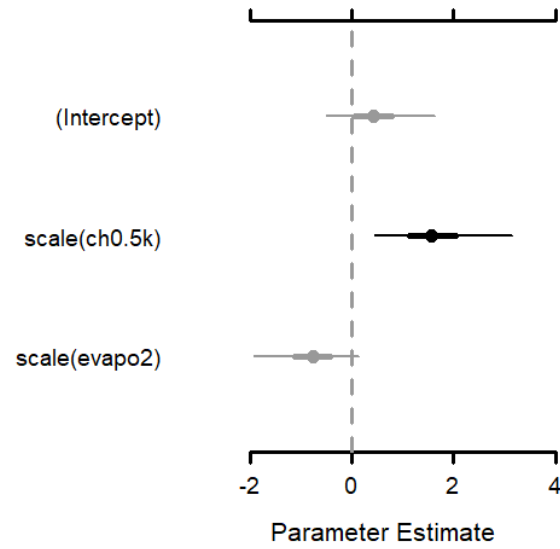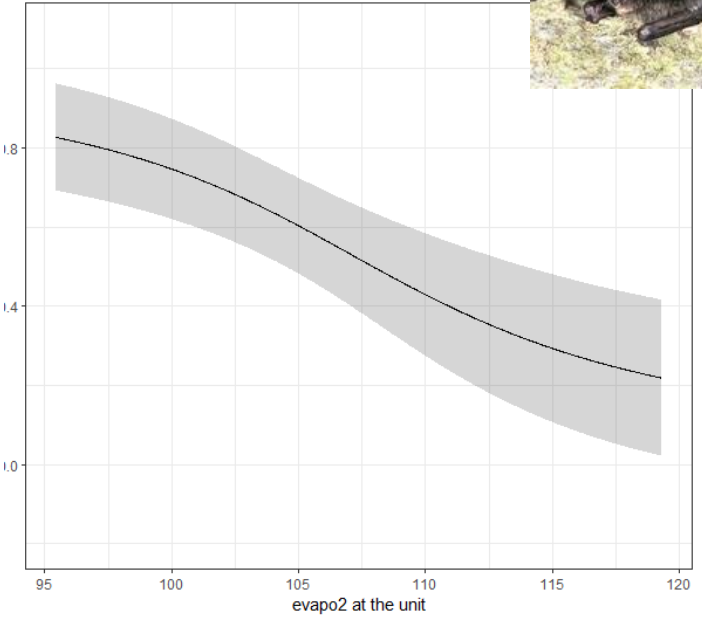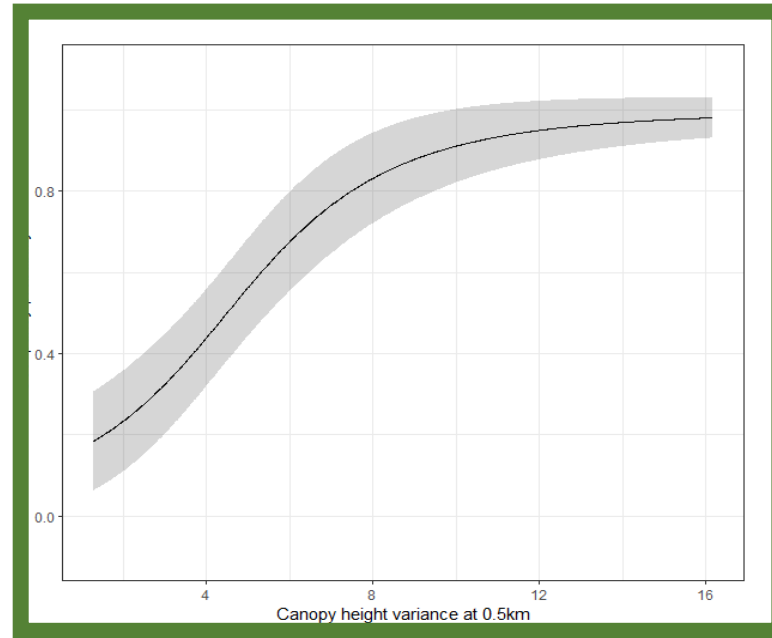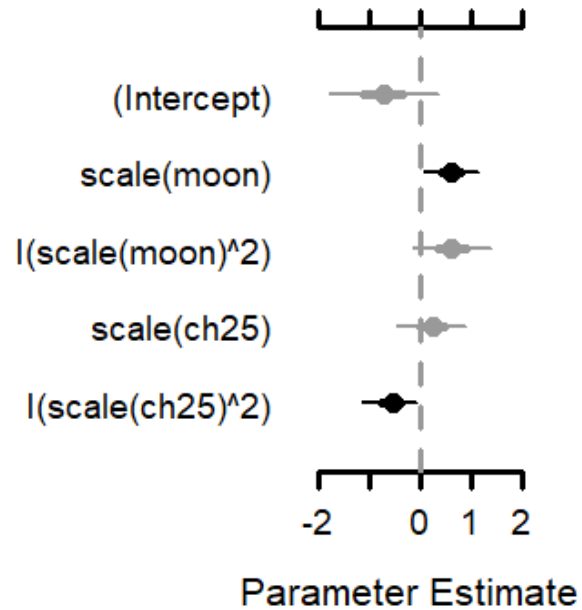
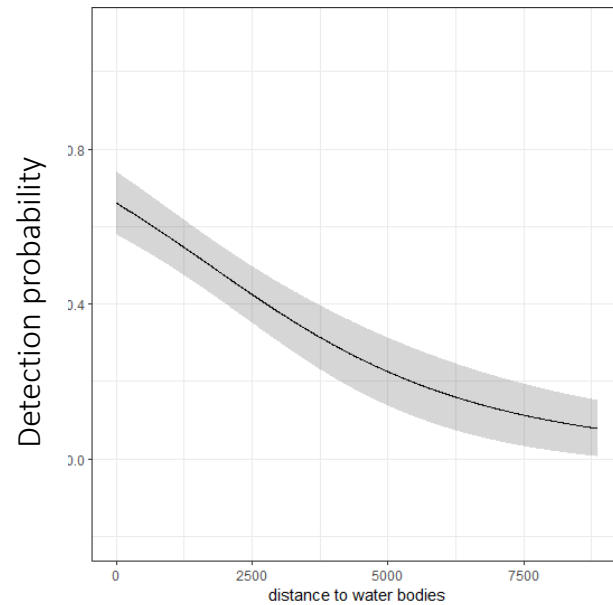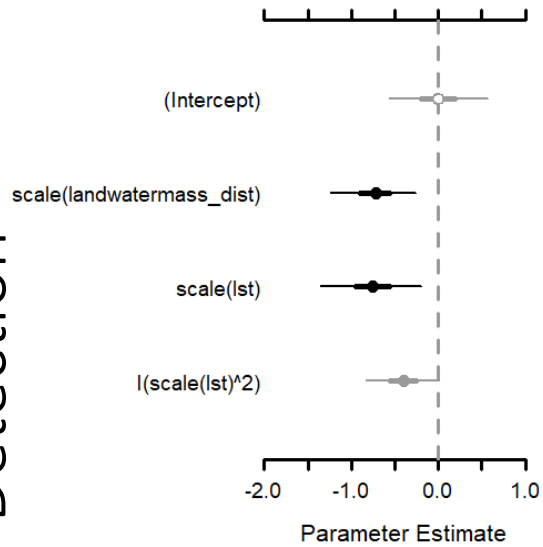# Model and species' response curves - *Myotis daubentonii*
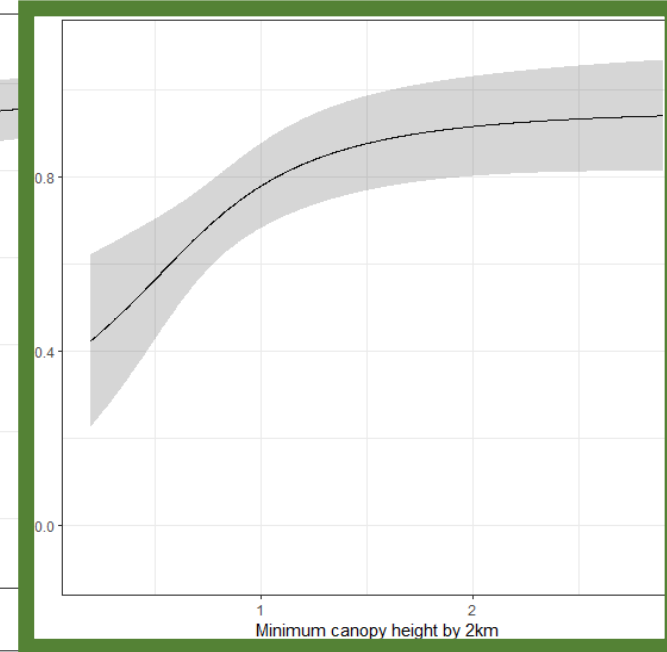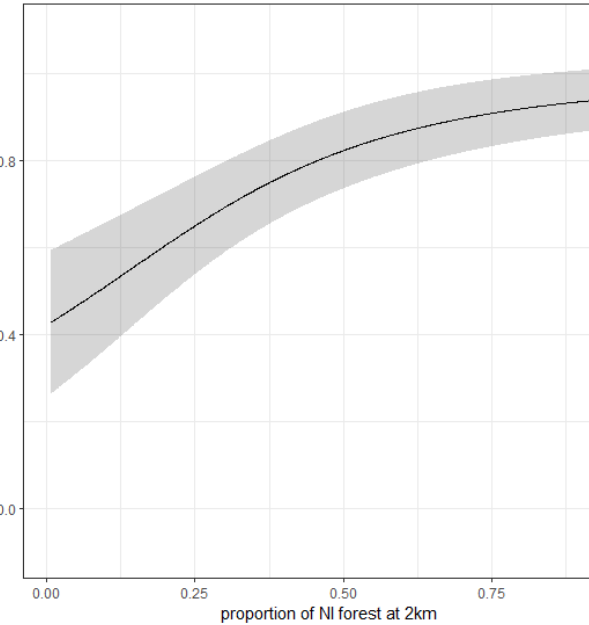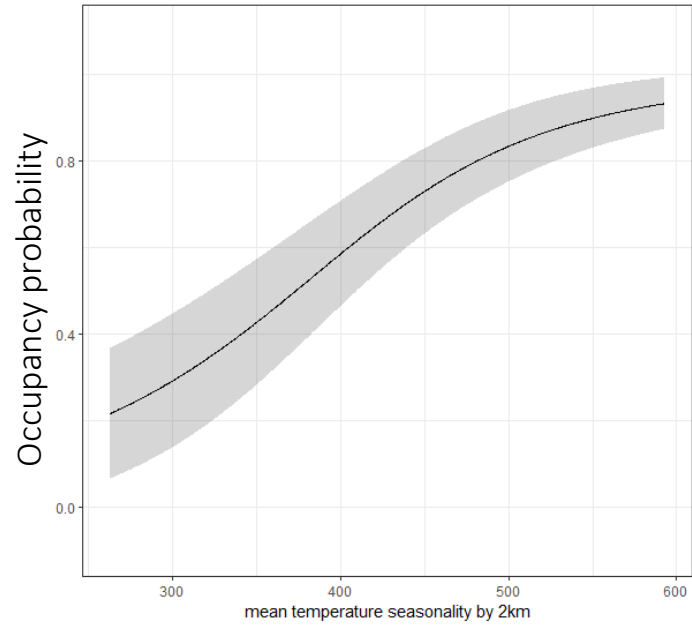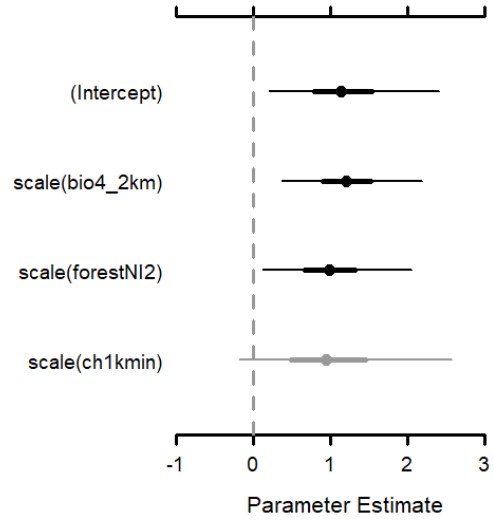
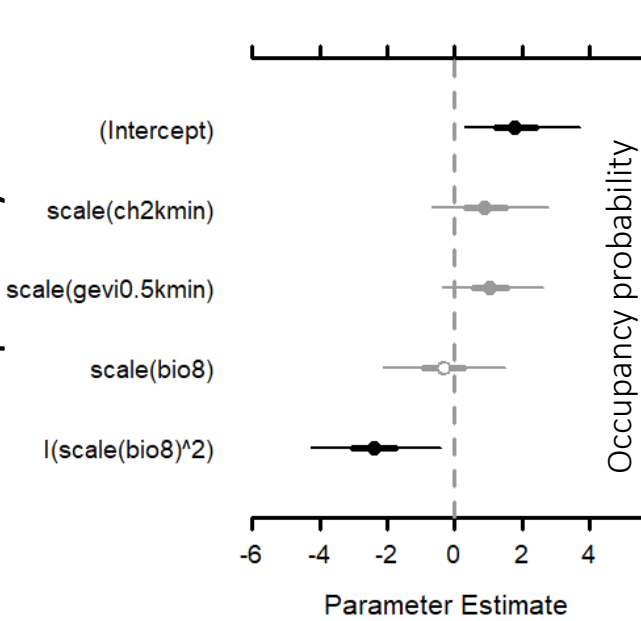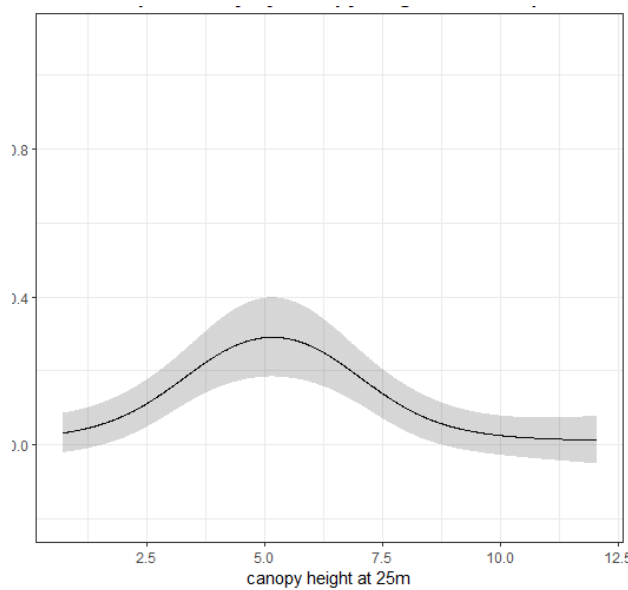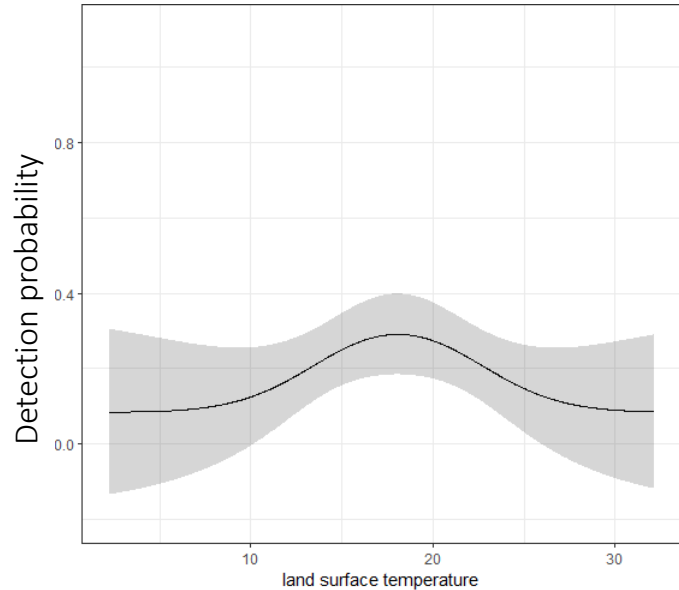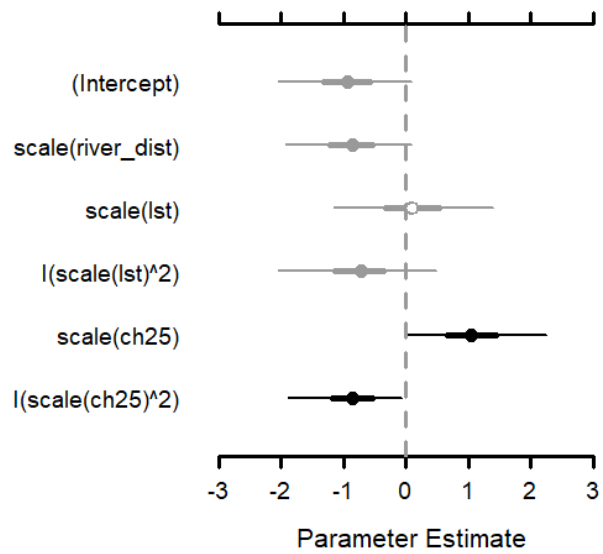# Model and species' response curves - *Rhinolophus hipposideros*
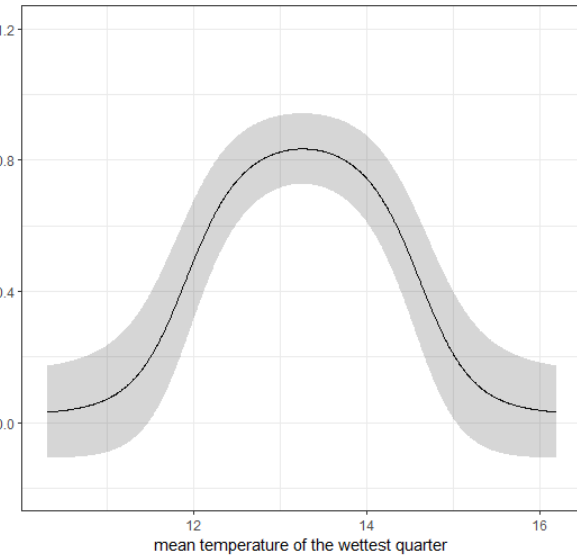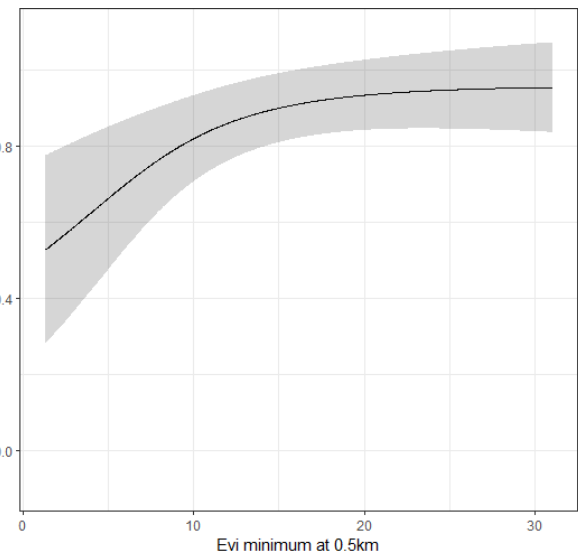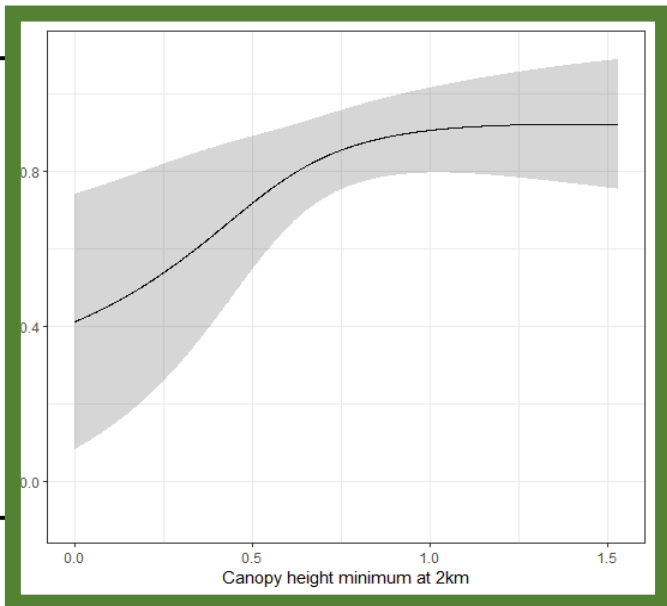
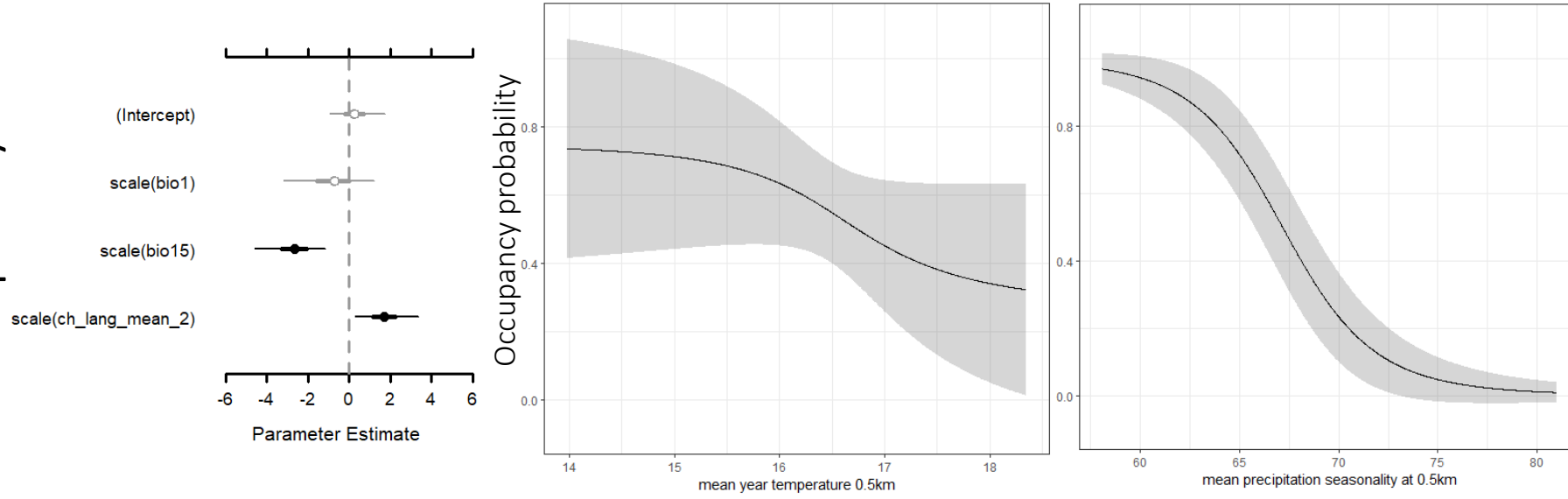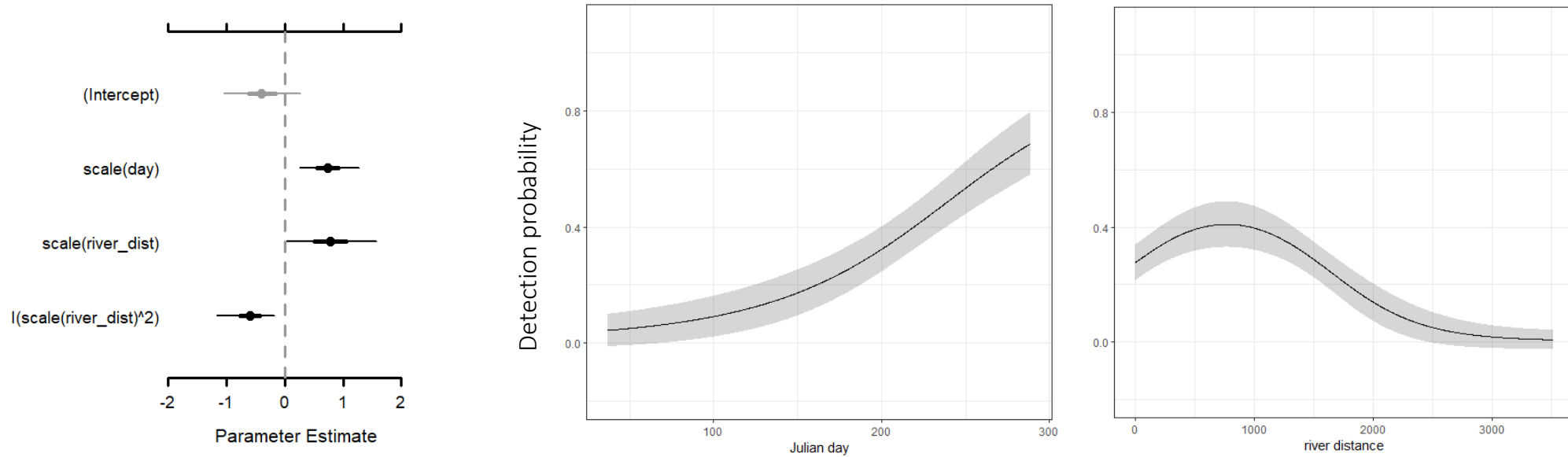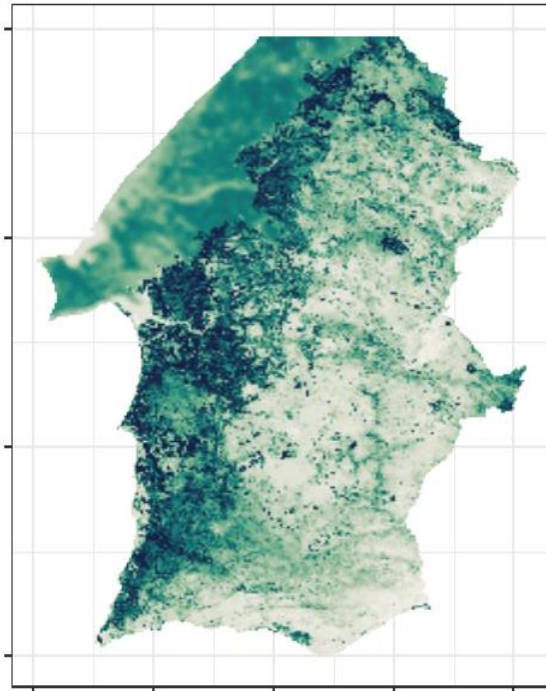# Model and species' response curves - *Tadarida teniotis*

Species occupancy probability maps

Barbastella barbastellus

Rhinolophus hipposideros
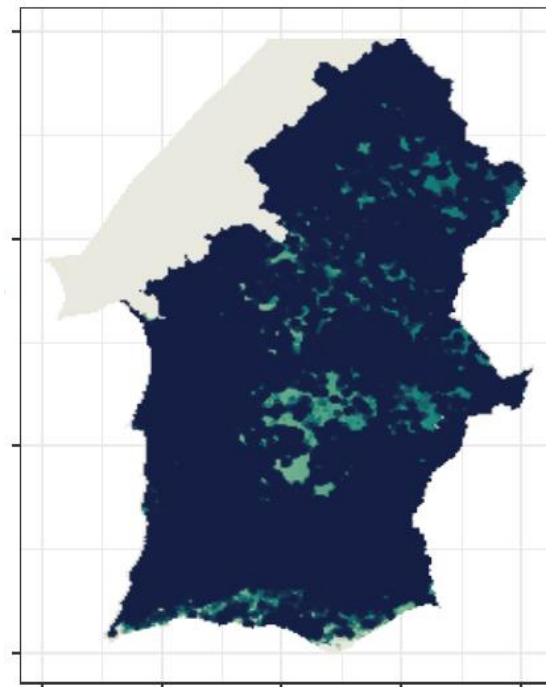
Myotis daubentonii

Tadarida teniotis

Occupancy probability

1.00
0.75
0.50
0.25
0.00
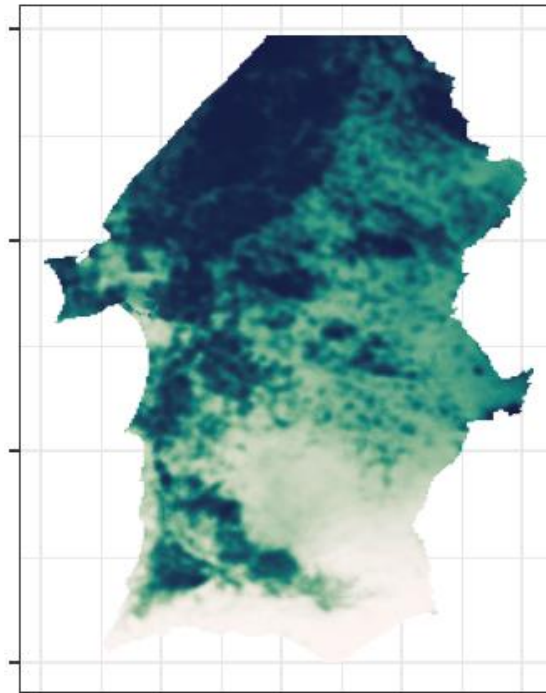
Discussion and conclusions

- For some species, CH is a good descriptor for occupancy probability

- Forest and shrubland were the only significant land-use types

- No anthropogenic land cover explained bat occupancy

- Detection was smaller than one for all species

- Integrating projections for future land cover and vegetation structure with the models will allow us to predict the change in distribution