How to predict bat problems in road projects

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The problem

• Many species of bats are affected by roads
• Bats are also highly protected – Important to identify conflicts (EIA)
• 19 species in Sweden. Probably 10 of these are negatively affected. Of these 7 are red-listed.
• Positive impact might be increasing edge-area.
• The most likely and obvious reason: avoiding open space (predator avoidance)
• In Sweden two species have been studied in more detail: Myotis brandtii and Myotis mystacinus
• Important to predict bat occurrence
Study area

- 59°40′N, 17°10′E
- Hemi-boreal, forest area
Study area
Study species: *Myotis brandtii* and *Myotis mystacinus*

- Small, forest species, occur sympatric in south Sweden
- *M.bra* is a common species, *M.mys* is less common
- Colonies in building
- In general low abundance of bats compared to central Europe
Methods

1. Automatic surveys of:
   - Roads
   - Gaps
   - Wildlife passage
   - Control sites

2. Manual survey of roads

3. Radio-telemetry
Surveys with auto-boxes

D500, Pettersson Elektronik AB
Radio-telemetry
Radio-transmitters from Holohil
Receivers from Followit
Radio-telemetry

• Triangulation from listening points
• Following the bats in the forest by running after it. When found: Mark the positions with GPS.
Did any bats cross the road?
So, they did not use this open space
But this semi-open habitat was preferred
We conclude that...

- Brandt’s bat (*Myotis brantii*) and Whiskered bat (*Myotis mystacinus*) avoid big roads and railroads, but also other open areas during the period of pregnancy and lactation.

- However, all open areas are not avoided, and probably the road is a stronger barrier.

- Wildlife passages (under or above the road) might be very efficient in connecting foraging habitats for bats.

Does this matter – Sweden is a forest dominated country?

- All forest habitats are not preferred habitats.

- Fragmentation means that fewer sites will be available as colony sites.
Is it possible to predict bat problems?

Yes, by using a habitat suitability model
By the model we should be able to answer questions about:
• Where to expect conflicts?
• Where is mitigation needed?
• Do we need any compensation (is it possible to compensate)?
• Where do we need more detailed investigations?

A habitat model must include movements and work on a landscape scale
Our goals with the model

Translate a real landscape to bat habitat index in order to predict:

• species diversity
• abundance
• colonies
• movements
• seasonal variation
Creating Bat Habitat Index in several steps

- Insect abundance (habitat quality)
- Movement (Permeability, connectivity)
- Colonies, key-habitat (spring)

Bat Habitat Index (BHI)
Selection of sites in two steps:
1. Random selection of 1000 sites.
   Divided into groups based on:
   BHI value
   – Mean value within 30 m
     • High, medium, low
   – Mean value within 200 m
     • High, medium, low
   • Distance to main road
     – <2000 m, >2000 m
   In total: 3 x 3 x 2 = 18 groups
2. Stratified random sampling procedure
   ➔ 50 sites
Evaluation of the model

- In total 50 sites
- Four nights/site (200 samples)
- 23 nights in July
- Pettersson D500 auto-box and batsound
Evaluation of the model

Response variables

• Species richness: 1. total number, 2. regular species, 3. very regular species (sample size = 50)

• Activity: 1. Total, 2. Forest species, 3. Aerial hawking, 4. water-surface specialist (sample size = 200)
Evaluation of the model

Response variables

- Species richness: 1. total number, 2. regular species, 3. very regular species (sample size = 50)

Number of very regular species ~ BHI_200
p-value: 0.00576  **

Number of very regular species ~ BHI_30
p-value: 0.00931  **

Number of regular species ~ BHI_200
p-value: 0.0403   *

Number of regular species ~ BHI_30
p-value: 0.04403  *
Evaluation of the model

Response variables


p-value: 0.055

p-value: 0.002
The model works well for predicting activity of forest species, and number of regular species.

Combining connectivity (flight-friction) with habitat quality give better prediction compared to just using habitat quality.

The scale is important: mean value within 200 m give better prediction than within 30 meter.

There were no extra impact of the road (besides barrier) at the scale we used.
Evaluation of the model
Conclusions

• The model predicts bat occurrence

• Objective, standardised, transparent. Includes the whole landscape and connectivity

• Can easily be adjusted to specific assumptions, other sources of geographic information and new insights about bat ecology
Evaluation of the model
Conclusions

- More knowledge about different species concerning flight-paths, foraging area, connectivity, food selection
- Production of insects of the right type
• Possible conflict area

• “Safe” areas with low qualities

• “Risky” areas with high qualities

The model is ready to use!
The importance of landscape context
Thank you

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