Prioritizing road sections for wildlife fencing based on road mortality hotspots and coldspots

INTRODUCTION

Roads have many negative effects on wildlife:
- habitat loss
- reduced habitat connectivity and animal movement
- increased air and water pollution and noise
- increased wildlife mortality by vehicle collisions (roadkill).

In order to reduce roadkill, mitigation should include wildlife fencing (Rytwinski, et al. 2016).

We used roadkill data from 3 roads: 1 from Quebec (HWY175) and 2 from Brazil (BR-101 and ERS-386) to answer the following research questions:

Research Questions:
1. Are there thresholds in the effect of fence length on the expected reduction in road mortality?
2. How can sections of roads be effectively prioritized for wildlife fencing?
3. How should different scales be considered?

RESULTS

Mortality percentage vs. fence length for medium-sized mammals at 1000 m scale

Consider the scale - FLOMS

- FLOMS = Few-Long-Or-Many-Short (fencing)
- The FLOMS trade-off: Is it better to have a few long fences or many short ones?
- Analysing hotspots at smaller scales (100 m) compared to larger scales (1000 m) can change results
- At smaller scales, a shorter amount of fencing appears to reduce the same amount of mortality than at a larger scale.

DISCUSSION

The spatial pattern of hot-, warm-, and coldspots of roadkill allows for prioritizing road sections for mitigation:
- e.g. hotspots should be fenced and, ideally, adjacent warmspots as well.
- Fencing certain sections will be more effective than fencing others:
  - Fencing hotspots will be most effective, while fencing coldspots will be least effective.
  - In some cases, however, coldspots may need to be fenced as well
    - e.g. if they are between two hotspots, because animals may move along the fence and cross the road at the end of the fence (fence-end effect), and a coldspot can then become a hotspot.
- Fences are barriers to animal movement, therefore wildlife passages should also be installed (Jaeger and Fahrig 2004), possibly at hotspots occurring at the 99% C.I.

Our Adaptive Fence Implementation Plan consists of 13 steps to follow in order to prioritize road sections for wildlife fencing:

1. Collect roadkill data
2. Identify target species based on roadkill data and/or trends of population size/viability
3. Choose several scales for analyses appropriate for those target species
4. Identify hotspots and coldspots at several scales for several confidence intervals (e.g., using Siriema)
5. Assess at which scales the results are informative and decide if more scales should be considered
6. Decide how much road mortality should be reduced
7. Determine the stability of the hotspots and coldspots (Fรวบรวม
8. Identify the amount and priority locations for wildlife fencing based on information from all informative scales
9. Fence the relevant sections of the road
10. Evaluate the success of the fencing
11. Determine if the hotspots and/or coldspots have shifted or new one has appeared, as in step 4, using the new data
12. Repeat steps 9-11 as needed
13. Maintain wildlife fences

METHODS

Road BR-101 is a major road connecting Rio Grande do Sul state to other states in Brazil:
- 2 lanes (at the time, now 4)
- 100 km survey length
- January 2003 - January 2004
- medium-sized mammals (from weasel and mink species to Canadian lynx)


CONCLUSION

• There are no thresholds in the effect of fence length on reduction in road mortality:
  - There are no abrupt changes between hot-, warm-, and coldspots: the transition is gradual.
  - This is shown by using different scales of analysis and different C.I.s.
• Hotspots have high priority for fencing and coldspots have low priority:
  - Hotspots occurring at 99% C.I. have the highest priority.
  - Coldspots occurring at 99% C.I. have the lowest priority.
• Larger scales of analysis should generally be used for animals with larger home ranges and smaller scales for animals with smaller home ranges (e.g., deer vs. porcupines).
• Hotspots might change over time, especially if a new hotspot emerges at the end of a fence ("fence-end effect").
• The FLOMS trade-off and the fence-end effect should be considered: Longer fences are recommended where feasible.

Therefore, the Adaptive Fence Implementation Plan requires adaptive management (steps 10 - 13).

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