Homework Gonçalo Matias

Code

Question

What is the effect of forest certification (FSC scheme) on mammal's activity pattern?

Variables

Dependent

- Activity pattern of each mammal species (probability density function of the distribution that describes the probability of an animal location being taken within any particular interval of the day)

Independent

- Season (wet/dry)
- Habitat type (Eucalytpus/Native)
- Forest certification type (Eucalyptus FSC/Eucalytpus Uncertified/Proteted area)

Protocol

Sampling design

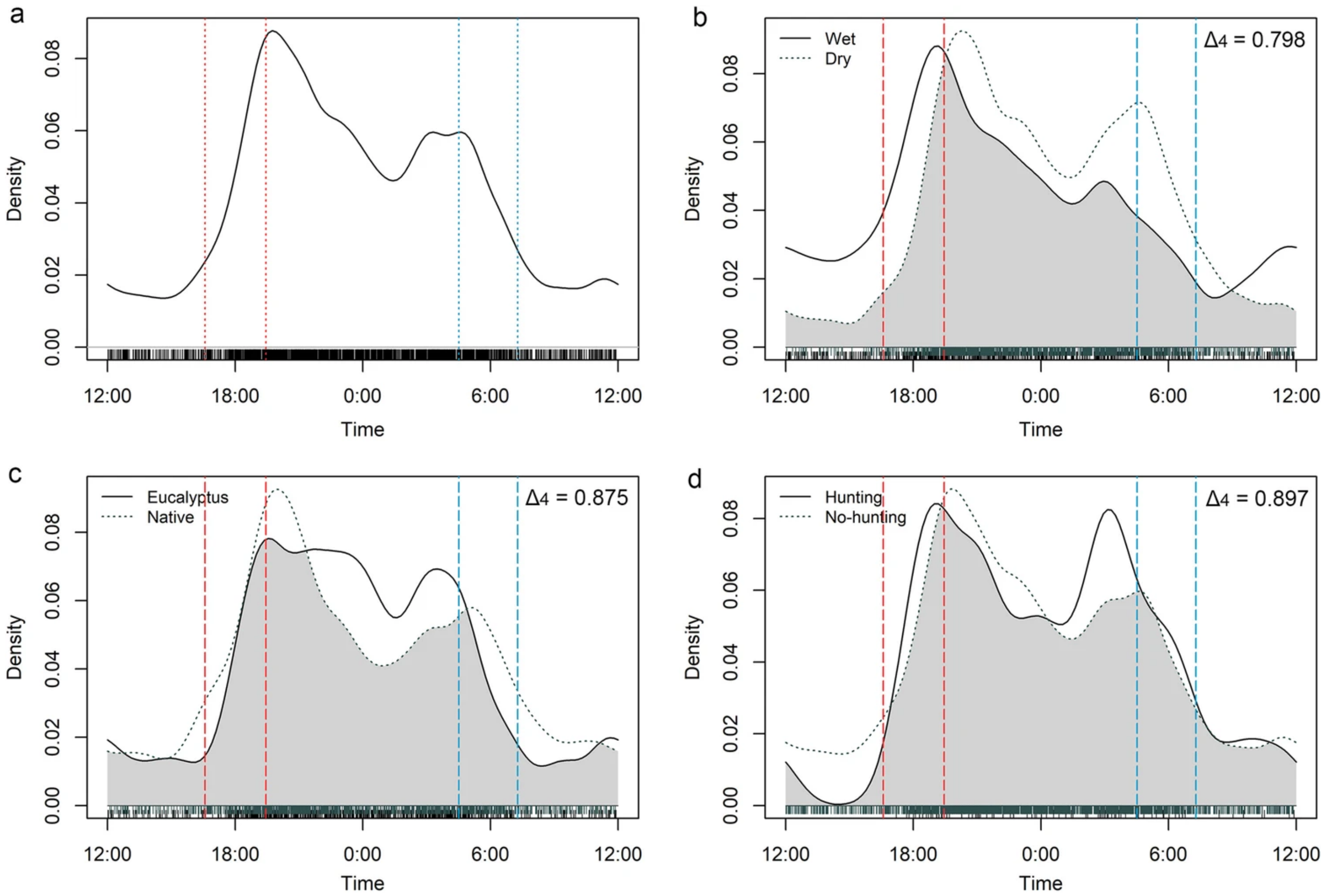
I will implement a camera-trapping scheme across nine sampling areas in Central Portugal. These sampling areas will include six Eucalyptus-dominated landscapes (three areas with FSC certification and three without) and three native vegetation control areas (e.g., protected areas with native species). In each sampling area, I'll set a grid of 25 camera traps, 1 km apart, active for 30 consecutive days per season (wet, January–May 2023-2024; dry, June–September 2023-2024). Cameras (Cuddeback Model H-1453) will be set at a height of 50 cm by attaching them to tree trunks or wooden stakes. Each camera will register species presence at a minimum of 30-s intervals between consecutive photos. I'll record the day and legal (standard) time of each photo capture and only consider independent detection events for analyses, i.e., photos separated by a minimum interval of 30 min (Boitani 2016). Each detection event will be converted to solar time (i.e., time according to the position of the sun in the sky relative to one specific location on the ground).

Data analysis

Activity patterns will be estimated for each terrestrial mammal species based on the approach of (Ridout and Linkie 2009). I will use camera-trap data to generate kernel density curves (example in Fig. 1) to illustrate mammal's activity patterns, which will be determined for the overall dataset, as well as for three pairs of data subsets: 1) wet and dry season; 2) Eucalyptus plantations and native habitats; and 3) Eucalyptus FSC, Eucalyptus non-FSC, and protected areas. Next, to compare activity patterns between paired data subsets I will estimate the coefficient of overlap Δ (Meredith and Ridout 2014), which ranges from 0 (no overlap) to 1 (complete overlap) (Ridout and Linkie 2009). To estimate Δ 95% confidence intervals, I'll use a bootstrap approach on 999 replicates (Meredith and Ridout 2014). To facilitate qualitative analysis of results, I'll adopt a categorization of overlap approach (Monterroso, Alves, and Ferreras 2014): low overlap = $\Delta \leq$ 50th sample percentile; moderate overlap = 50th percentile < $\Delta \leq$ 75th percentile; high overlap = $\Delta >$ 75th percentile. All analyses will be conducted in R (Team et al. 2013), using the R-packages overlap (Meredith and Ridout 2014) and circular [agostinelli2013r].

I also aim to assess if mammal community will display any preference for a specific period of the circadian cycle (day, 1 h after sunrise to 1 h before sunset; sunset, 1 h before sunset to 1 h after it; night, 1 h after sunset to 1 h before sunrise; sunrise, 1 h before sunrise to 1 h after it) by estimating the Jacobs selectivity index (JSI, ranging from −1 (avoidance) to 1 (preference); (Jacobs 1974) for the overall dataset and paired subsets. I'll use a bootstrap approach, based on 999 replicates, to estimate JSI (mean and standard deviation, SD) per period. Differences between JSI estimates per period will be tested using t-tests (Zar 1999).

Figure 1. Example of an activity pattern of wild boar (Sus scrofa).



Why this approach?

This results will allow me to identify behavior changes associated with the management of the plantations (including those actions linked to certification vs non-certification) and how this influences the population's temporal structure. Overall, with this task, I also aim to identify the most critical phase of eucalyptus plantation's cycles to species life cycle periods (e.g. breeding season), to inform managers of adequate management actions to minimize impacts.

Citations

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Monterroso, Pedro, Paulo Célio Alves, and Pablo Ferreras. 2014. "Plasticity in Circadian Activity Patterns of Mesocarnivores in Southwestern Europe: Implications for Species Coexistence." *Behavioral Ecology and Sociobiology* 68 (9): 1403–17.

Ridout, Martin S, and Matthew Linkie. 2009. "Estimating Overlap of Daily Activity Patterns from Camera Trap Data." *Journal of Agricultural, Biological, and Environmental Statistics* 14 (3): 322–37.

Team, R Core et al. 2013. "R: A Language and Environment for Statistical Computing."

Zar, Jerrold H. 1999. *Biostatistical Analysis*. Pearson Education India.