Hunting Effect on Individual Deer Stress Level

P15.2 Fortgeschrittenes Praxisprojekt

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Table of contents

List of Figures

1 Summary

2 Introduction

2.1 Background

Apart from the change in populations size, the effects of hunting on wildlife have so far been studied mainly on the basis of behavioral changes. This project aims to investigate the physiological stress response in red deer using non-invasive methods such as the measurement of faecal cortisol metabolites (FCMs). Stress is expected to be higher in proximity to hunting events.

2.2 Data Generating Process

Location of the Bavarian Forest National Park (Green Area)

Figure 1: Bavarian Forest National Park

- A deer roams freely in the Bavarian Forest National Park
- Its **movement is tracked** by a GPS collar
- A **hunting event** happens
- After some time, the deer defecates. The **defecation event**
- Subsequently, Researchers go to the defecation location and collect a **faecal sample**

Huber et al. (2003) showed the following:

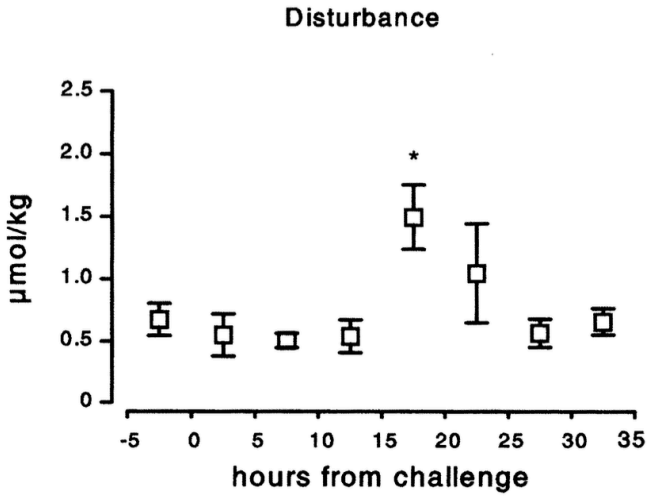

Figure 2: FCM Levels

2.3 Research Question

- **Goal**: assess short-term stress response in red deer towards hunting events at the Bavarian Forest National Park
- What is the effect of temporal and spatial distance on FCM levels?
- Does the time between defecation event and sample collection affect FCM levels?
- Model FCM levels on spatial and temporal distance to hunting activities
- **Expectations**:
  - FCM levels higher when closer in time and space

- FCM levels lower, the more time passes between defecating and sampling

3 Data Analysis

We were provided with four distinct Datasets. In the following subchapters we are going to describe the main features of each data set, but the reproduction data (see Chapter 7) and address any anomalies.

3.1 Hunting Events

The dataset contains the location and time of roughly 700 individual hunting events, spanning from 2020 to 2022. There are three main challenges:

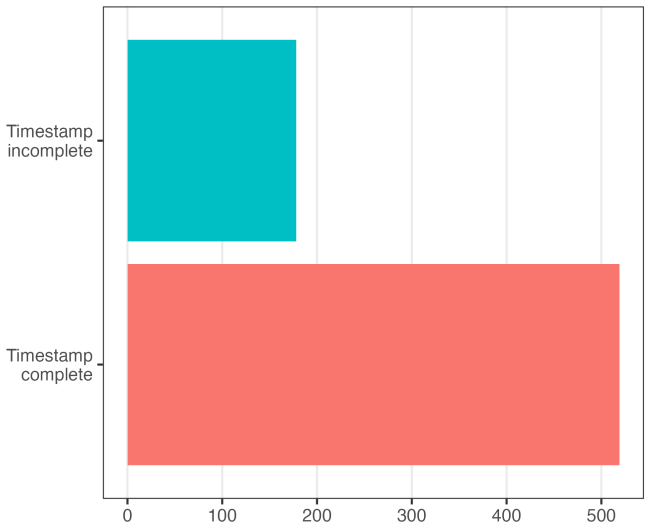

Figure 3: Hunts - completeness of timestamp

i) Just a little over 500 of these events have a complete timestamp, consisting of date and time of day (Figure 3).
ii) The events are not represented as a period of time, but as a as a single moment in time. Additionally, as shown in Figure 4, there appears to be seasonality in the occurrence of hunts.
iii) Similiarly to ii), the events are only associated with a single spatial point. The locations of the events with complete timestamps are illustrated in Figure 5.

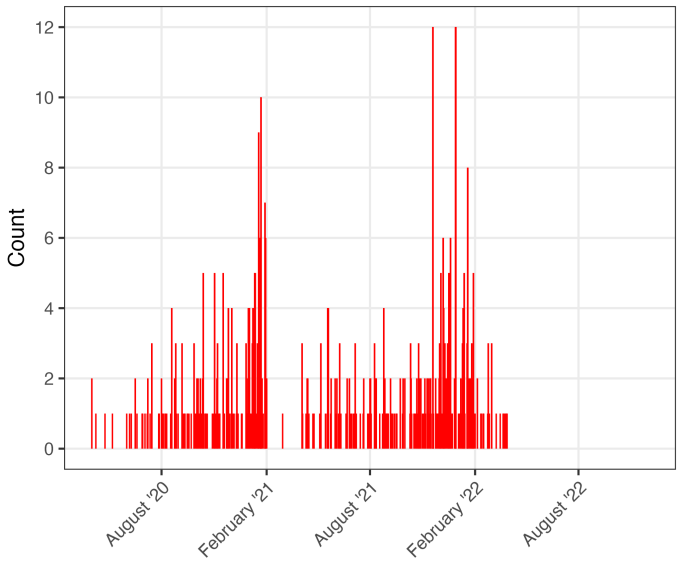

Figure 4: Hunts - Daily Count

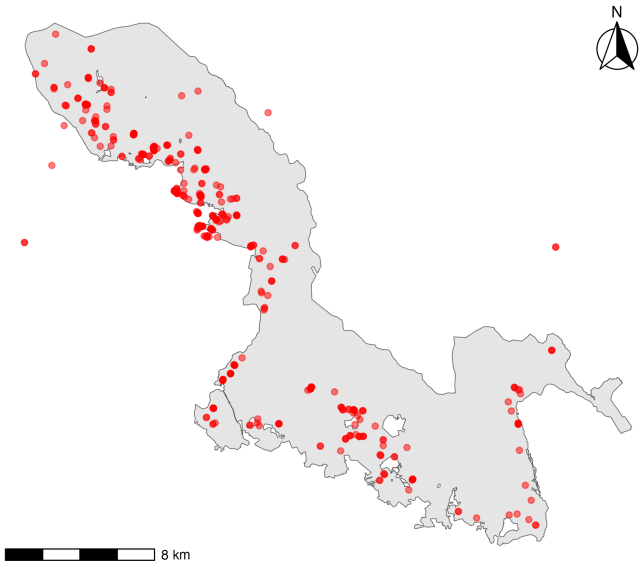

Figure 5: Hunts - Locations

3.2 Movement Data

There are **40 collared deers** which movements have been tracked completely or partially between February 2020 and February 2023. Some collars stopped working before the end-date, some deers got collared *within* the timespan of interest. The location of each individual deer is **tracked on an hourly basis**. The Movement of four randomly selected deer is visualised in Figure 6. During the winter months, the deers roam in one of four enclosures within the national park.

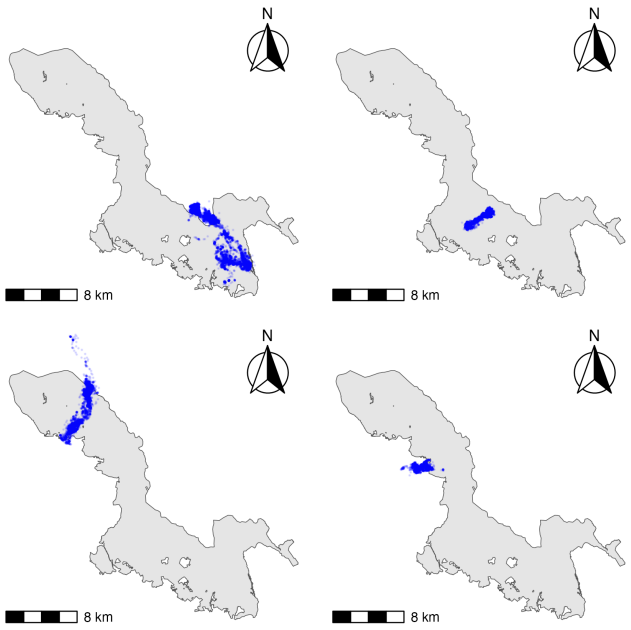

Figure 6: Deers - Locations of four Deer

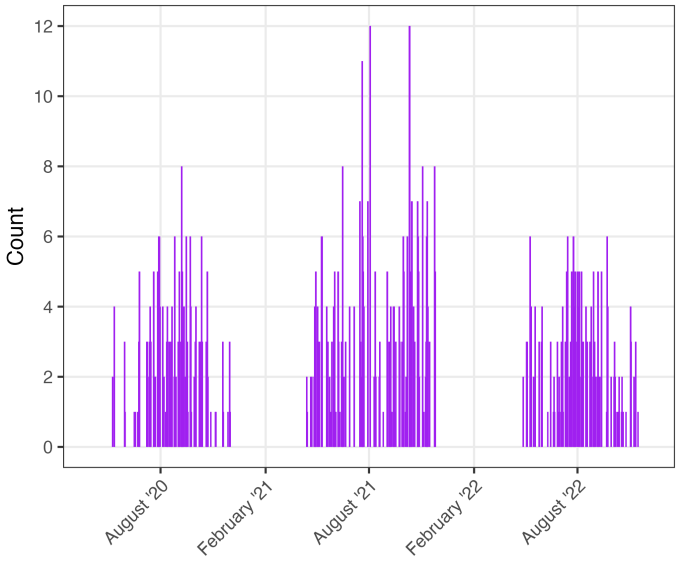

Figure 7: Sample - daily count

3.3 Faecal Sample Data

The faecal sample dataset contains information on **809 faecal samples**. Most importantly, the FCM-level (in nanograms per gram [ng/g]), the location of the sample, as shown in Figure 8, the associated collared deer, the approximate time of defecation and the time of sampling. The samples were taken at irregular intervals, but with obvious seasonality (see Figure 7) from 2020 to 2022.

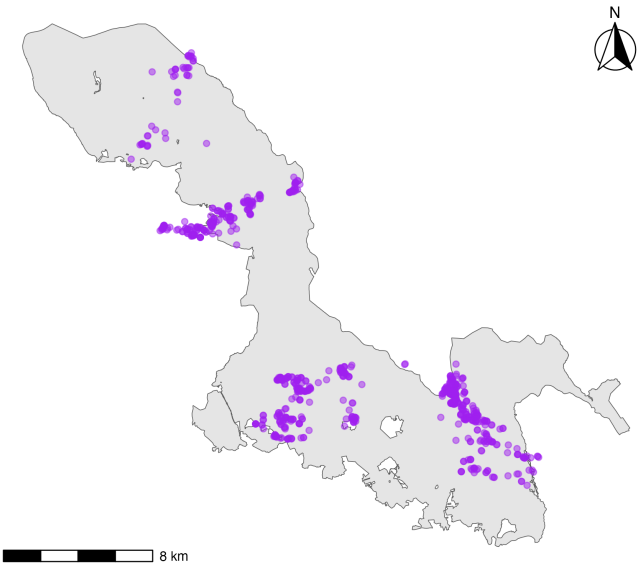

Figure 8: Samples - Locations

4 Data Preprocessing

4.1 subtopic 1

4.2 subtopic 2

5 Model Selection

5.1 subtopic 1

5.2 subtopic 2

6 Model Evaluation

6.1 subtopic 1

6.2 subtopic 2

7 Conclusion & Outlook

7.1 subtopic 1

7.2 subtopic 2

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Huber, Susanne, Rupert Palme, Wolfgang Zenker, and Erich Möstl. 2003. “Non-Invasive Monitoring of the Adrenocortical Response in Red Deer.” *Journal of Wildlife Management* 67 (April): 258–66. https://doi.org/10.2307/3802767.