Effects of Artificial Light At Night (ALAN) on grassland arthropods:

A Campus case study in Freising Germany

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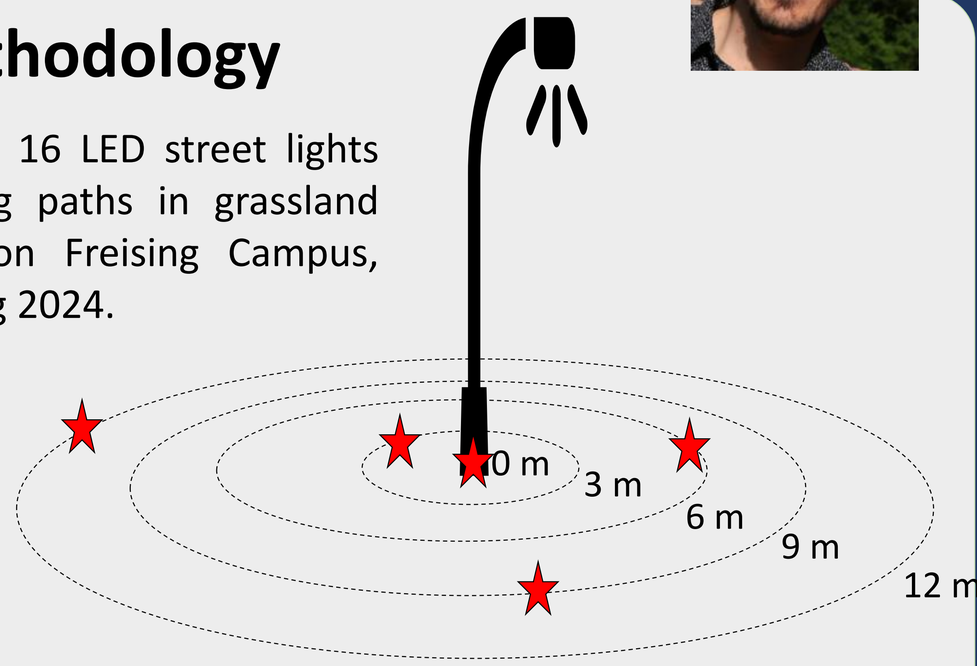
Introduction

- Artificial Light At Night (ALAN), the illumination of previously dark areas, is rapidly increasing world-wide. Street lights, among others, create **a mosaic of varying light intensities** in the landscape, as light intensity is negatively correlated with distance from the light source.
- In the past two decades, it has become abundantly clear that ALAN can affect humans and animals alike**. One shortcoming** is that many ecological studies that investigate the effects of ALAN on invertebrates only focus on abundances, not the resulting processes (e.g. predation).
- Here, we use the **light mosaic generated by lights on the Freising Campus** of the Technical University of Munich to test whether distance from a light pole affects arthropod abundance, and attack rates of plasticine dummy caterpillars by predators.

Freising Campus, Technical University of Munich. Picture: TUM

Methodology

We selected 16 LED street lights placed along paths in grassland vegetation on Freising Campus, during spring 2024.

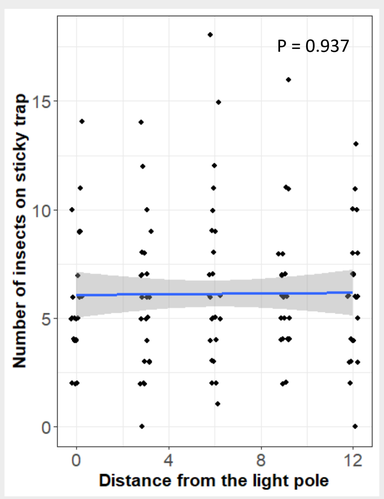


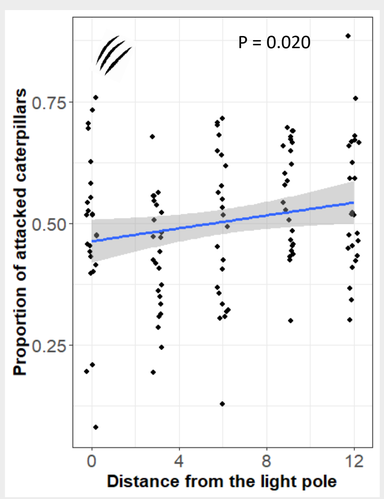
Around each light source, we imagined a series of circles with a radius of **0, 3, 6, 9, or 12 m from the light source**, and for each sampling, a random location on each circle was chosen to use in our samplings, generating a good coverage of the light mosaic.

From early **May (ongoing until late October)**, a random set of three light poles was selected and investigated each night, occurring three nights a week. We sampled arthropods near the soil using **yellow sticky traps**, and placed cohorts of **plasticine dummy caterpillars** in a one square meter patch, to investigate bite marks caused by slugs, arthropods, shrews, rodents, or birds.

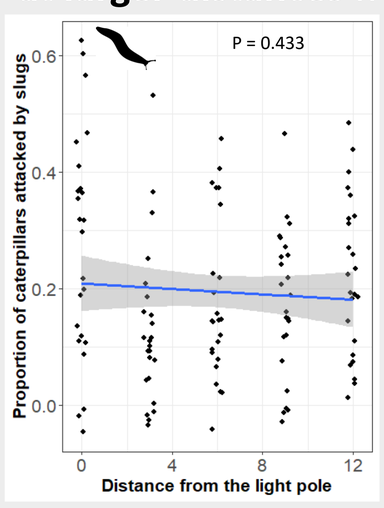
On each sampling point, we also measured **vegetation height** and the percentage of **bare soil** in the used square meter as covariates.

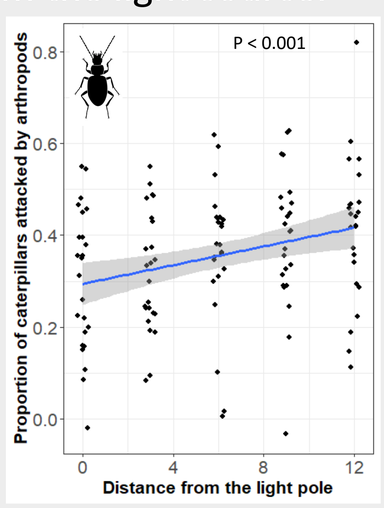
Results

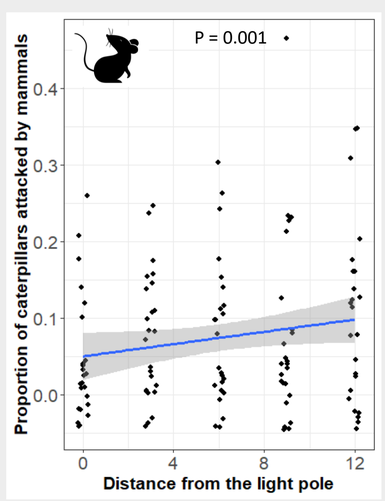




Sticky traps collected predominantly flies overnight, but there was no significant effect of distance to the light. In contrast, dummy caterpillars were significantly **more frequently attacked at larger distances** from the light source.







Bite marks identified on caterpillars revealed that slug attack was not affected by distance to the light, whereas **soil-dwelling arthropods and small mammals** attacked significantly more frequently at larger distances from the light.

Discussion

Our study over the course of the summer season shows that ALAN had **no significant effect on insect numbers** on traps, but affected attack rates in dummy caterpillars. Remarkably, we did not find an effect of the distance of the sampling location to the light source on arthropod abundance. One reason may be that we recorded mostly flies, which may have landed on traps before full darkness. It could be that the duration of one night does not yield enough (other) insects, or it might be that other (larger) arthropods may escape the traps.

Our finding that attack rates, particularly by arthropods and small mammals (shrews and voles), suggests **that higher light intensity has negative effects on predation rates** on dummy caterpillars.

Our sampling is ongoing and we aim to extend our dataset until fall, providing further replication throughout the year. An interesting addition is that standing vegetation was mown early September, allowing for additional tests of the role of canopies in the impact of ALAN.

Conclusion

Our ongoing investigations will further unravel the role of the standing vegetation (and its removal), lunar cycle, and seasonal effects on insect abundance and predator activity in the Freising Campus setup. However, our preliminary results already suggests that **light mosaics at small scales may potentially disrupt predation dynamics**.

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