IMPACT OF ARTIFICIAL LIGHT ON ARTHROPODS : A VIEW FROM THE GROUND

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Introduction

In recent decades, artificial lighting has **increased** to become **ubiquitous**. It's estimated that 80% of the world's population lives under a sky polluted by artificial light. Ecological studies are multiplying and show that there is a **major impact of ALAN** (Artificial Light at Night) **on ecosystems**. But most studies **are** looking at sky-level pollution and **scarcely to** the **impacts at ground level**.

ALAN's effets on species and their environment are vast and **poorly known**. The **sencitivity** of light by the animal kingdom is **variable** which leads to a great **spectrum** of biological responses. For instance resulting in **different behaviours in response to ALAN** such as flight, attraction, disorientation or reducing mating.
Most studies assessing ALAN impacts on arthropods are performed in laboratories. Therefor, field experiements are required to improve our understanding of ALAN impacts in the context of complexes ecologicals systemes.

The **objective** was to understand the **impact of ALAN on epigeal arthropods comunities** in an **urban grassland ecosystems**.
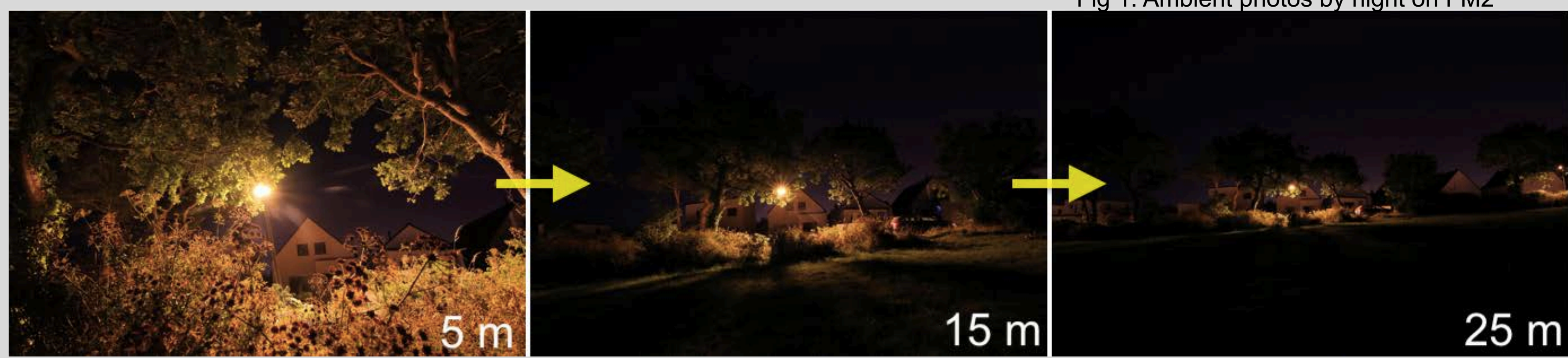
Light Pollution Assessment

Fig 1. Ambient photos by night on FM2

5 m   15 m   25 m

The limitation of the field luxmeter led us to measure light pollution by taking ambient photos at night. Photographs were taken every 10 meters from a lamp street. All photographs were taken with a Canon EOS 2000D camera and a Tokina 11-16mm lens with identical settings for each photo. The settings were: F9.0, 5s, ISO 800.
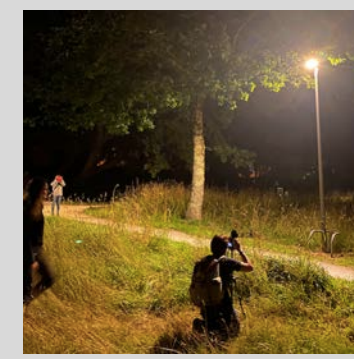
Light Pollution mapping

Fontaine Margot sites

Mapping of the theoretical footpring lighting on Fontaine Margot
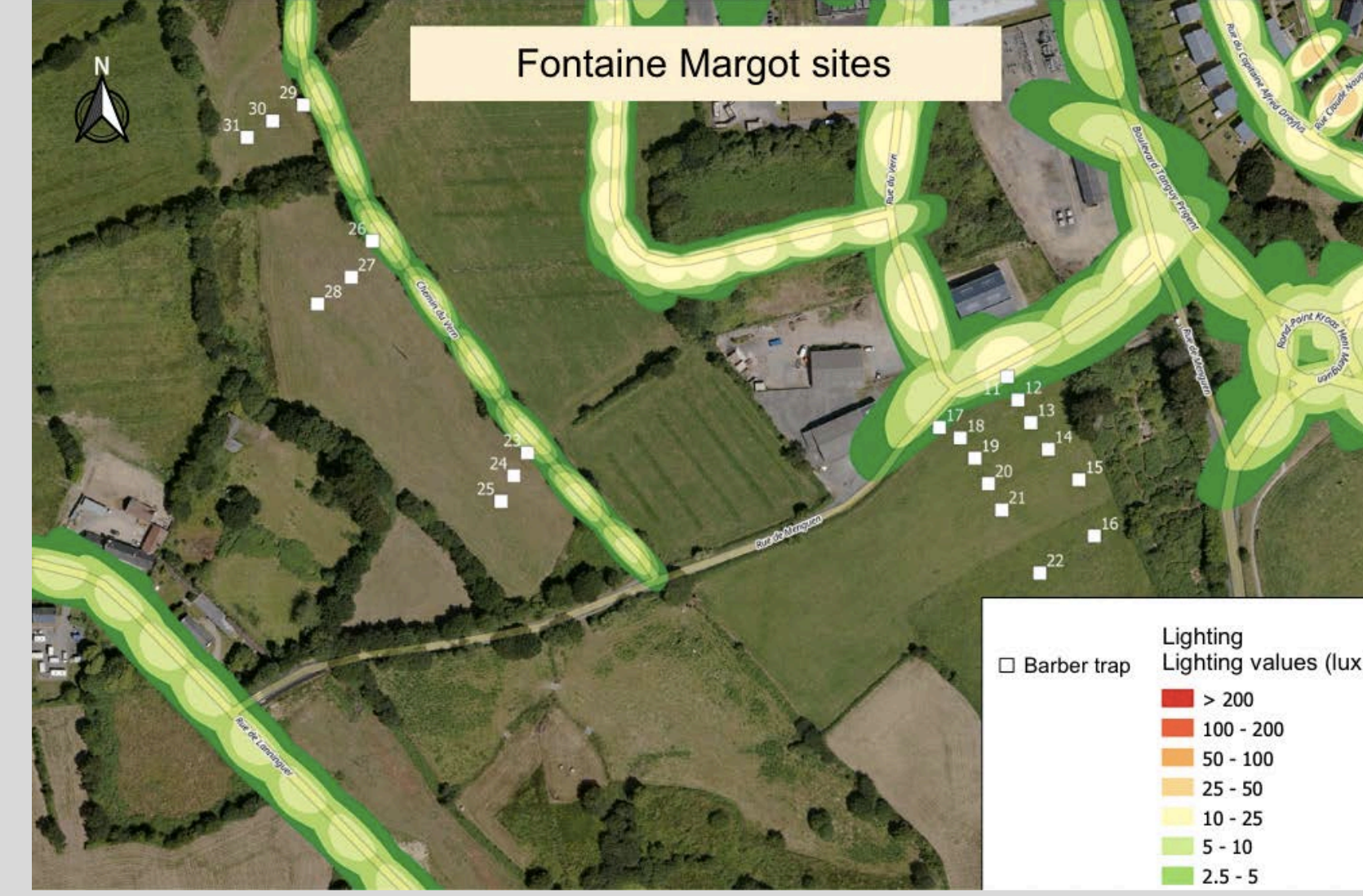
Mapping of the theoretical footprint of artificial light at ground level has been carried out (Qgis).

To obtain this result, the data used are the shape of the light beam and the technology of the lamp.

Then, the orientation of the lamp, the geometry and the height are taken into account to obtain the theoretical projection of the lamp post on the ground.

Sites

Fontaine Margot 1 (FM1)
Mesotrophic urban grasslands
↳ used at grazing

Fontaine Margot 2 (FM2)
Mesotrophic urban grasslands
↳ used at mowing

Gouesnou (G)
Urban park with wetter grassland

➤ Vegetation surveys were conducted using the quadrat method. Thus, a quadrat of 4m² was carried out at the level of each pitfall traps. For each quadrat different parameters were taken into account (total vegetation cover (%), cover for each species present (%) and average height). This allowed to confirm the homogeneity of the habitats

Evaluation of arthropods

Pitfall trap   Sweep net transect

10 m

Artificial light gradient
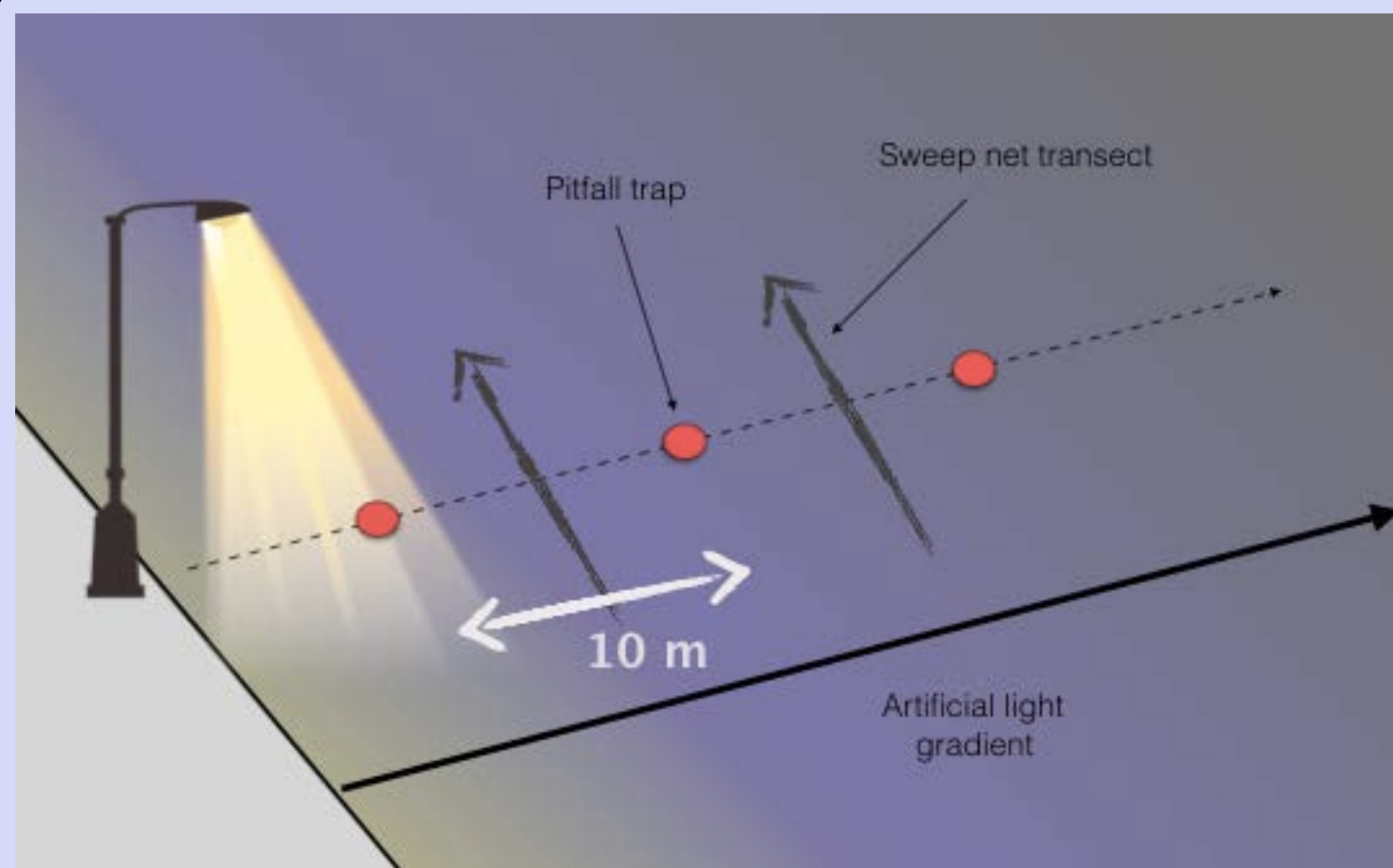
Schema of arthropods evaluation protocol

‣ Assessment of epigeal arthropod communities using pitfall traps along an artificial light gradient:
30 traps were set up (FM1 = 12; FM2 & G=9) from May to August 2022 (15 weeks of sampling) and spaced 10 meters away each other.
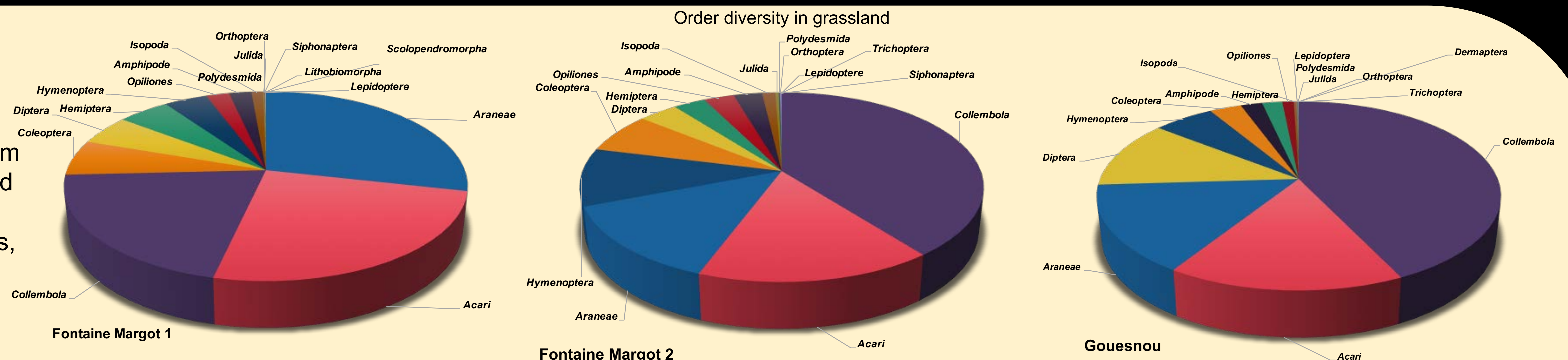
‣ Sweep net transect (10 sweap over 10m) between pitfall traps were conducted twice in the season, at nitght, resulting in 44 samples.

➤ Sampled individuals were determined at different taxonomic levels.
All individuals were determined at the order level. For spiders and beetles the determinations were made up to the family level. Only 8 weeks of studies will be presented.

Results & Discussion

Pitfall traps collected **28 856** individuals from **19** orders of arthropods. Mostly represented by springtails, followed by arachnids with mites and spiders, then insects with beetles, diptera and hymenoptera.

Order diversity in grassland

Fontaine Margot 1

Fontaine Margot 2

Gouesnou

Light gradient   + → -

Recurent pattern between sites (abundance)

	Gouesnou/Fontaine Margot 1	
Coleoptera		
Opilliones		

	Fontaine Margot 1 / Fontaine Margot 2	
Diptera		
Isopoda		

■ Arthropods orders

There is no observed impact of light pollution. Statistical tests (Anova) didn't reveal any significant differences in abundance through to the light gradient. The same results were observed for both species richness and diversity (Shannon).

‣ **Nevertheless, trends are observed** at the scale of each site, and recurent pattern are visible.

‣ However, **opposite trends** are observed. Amphipods shown an increased abundance closer to the light source on the Gouesnou site, whereas the opposite is observed on the Fontaine Margot 2 grassland.

■ Beetle families
Different families were found on the different grasslands.
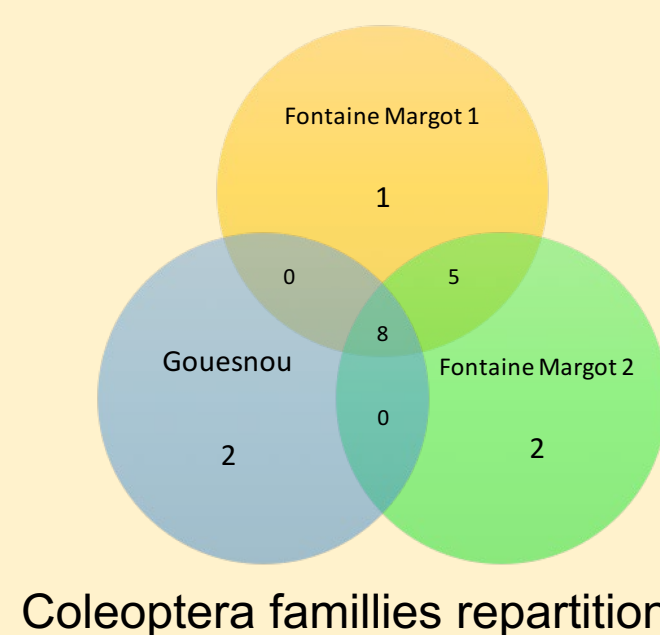Statistical tests didn't show any differences of either richness, diversity or abundance to the light gradient.
‣ **Trends** were observed

Coleoptera familles repartition

➜ **Staphylinidae** had a greater abundance closer to the light at G and FM1 sites.

➜ **Curculionids** had a greater abundance closer to the light at FM1 site while the opposite is observed on the FM2 site.
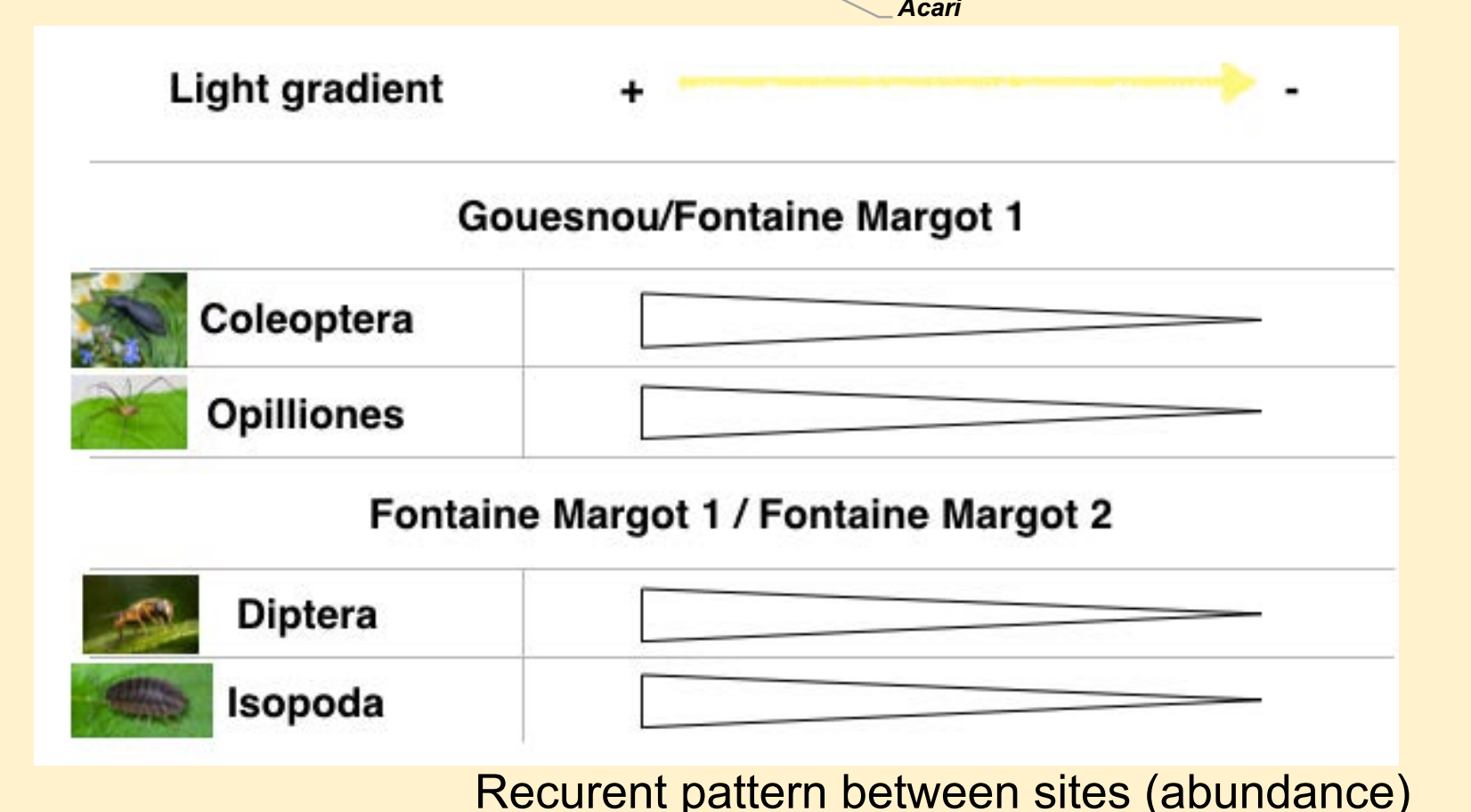
■ Spiders families
Among the spiders families 5 were found on each grassland. There are Lycosidae, Tetragnathidae, Linyphiidae, Pisauridae and Thomisidae.

‣ No significant difference were observed in the abundance of spiders depending on the distance from the light.

➜ Yet, **Lyniphiids** had a greater abundance closer to the light at FM1 site, whereas they seemed to FM2 site.

Perspective

In order to reach a better understanding of the community patterns link to ALAN a more robust dataset is required. To achieve so, more data are to be added to the study through the treatment of the remnant samples left unidentified (7 more weeks of pitfall trapping, sweet net, berlese, interception, web traps).
Likewise, the lack of observed pattern could be link to the taxonomic resolution of the study. Pushing the identification further particularly in beetles, spiders and diptera might reveal pattern link to ecological differentiation not present at order level.
Finally, a functional approach through the consideration of variation of trophic guilds might reveal pattern of ecological disruption link to ALAN should be looked into.