

Micro-environmental and host factors driving tick distribution and prevalence of tick-borne-diseases in Mediterranean insular ecosystems

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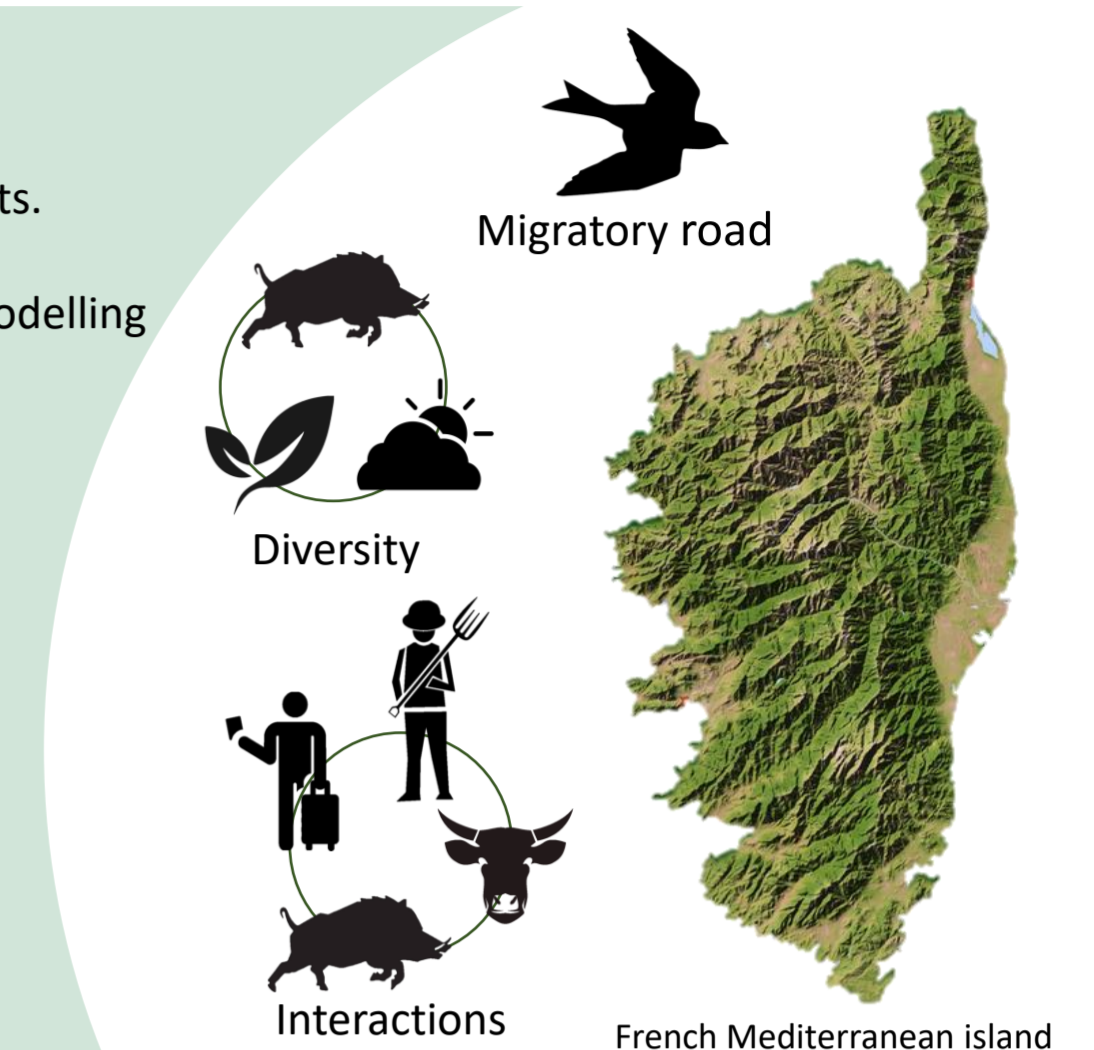
Introduction

There is limited data on the main determinants of exophilic tick abundance at small spatiotemporal scales, where ticks interact with their hosts. However **biotic and abiotic factors** of micro-environments are essential to determine the distribution of specific tick's niches in an ecological community because they constitute the key to their survival and development in an ecosystem. These factors are generally not included in modelling systems, and it may represent **an obstacle to understand the transmission dynamics of tick-borne pathogens**.

Corsica's ecological and climatic diversity, as well as its geographical location in the Mediterranean, make the island a favorable place for the development of many tick species, but also for the introduction of **new ones** and therefore **new pathogens**.

Objectives

- Characterize the **habitats** of different tick species and their **ecological niches** in Corsica,
- Study the **distribution** of different tick species,
- Identify the **circulation of pathogens**, especially viruses, in the island (viruses of interest and diversity of tick microbiota)



Methodology & Results

From March to September 2023

Phytosociological surveys were carried out in **43 municipalities** all over Corsica.

For each municipality, **3 types of environments** where ticks are known to live were investigated in spring and in summer



Forest



Meadow

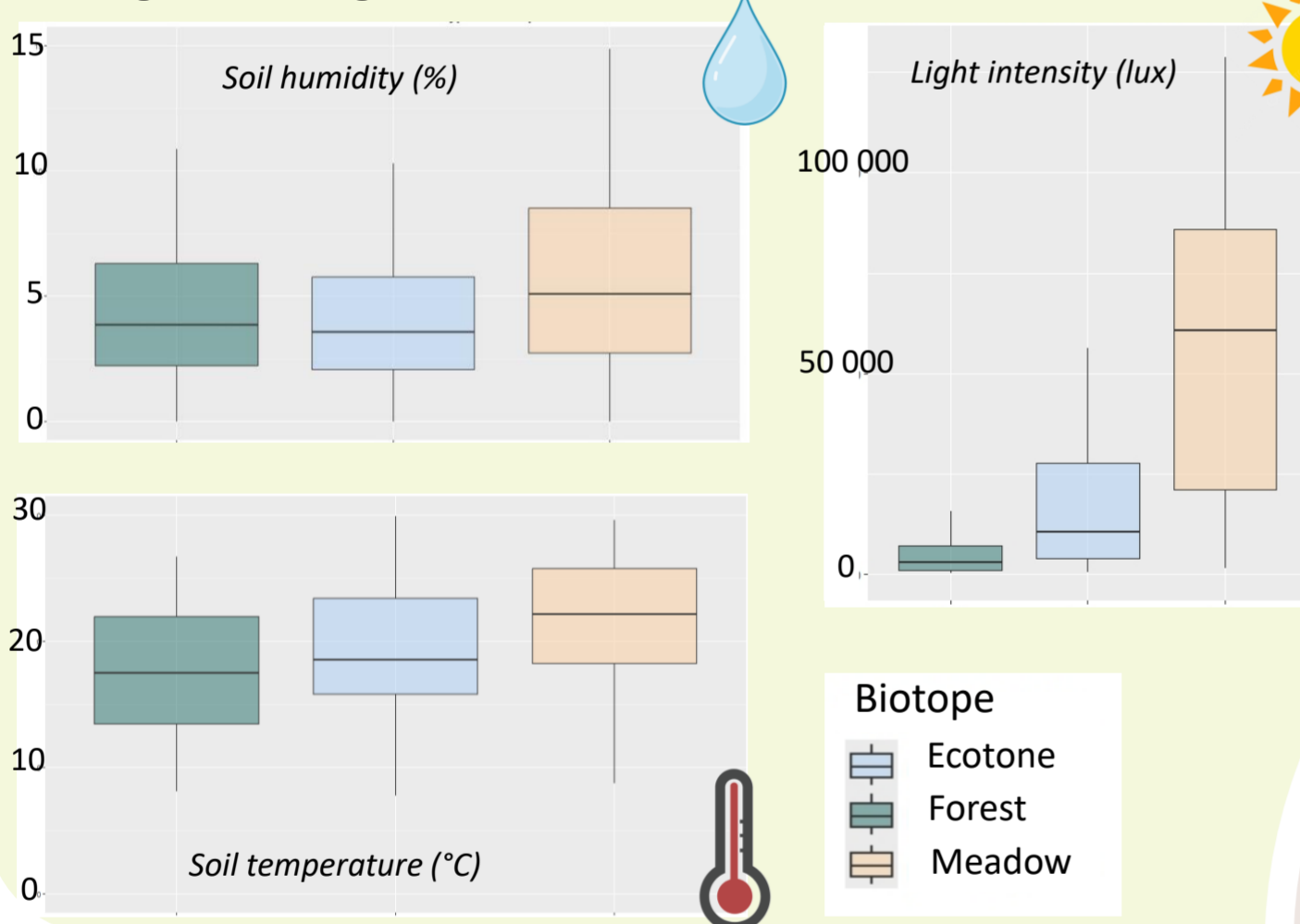


Ecotone

Characterization of micro-environments by using **12 variables** :

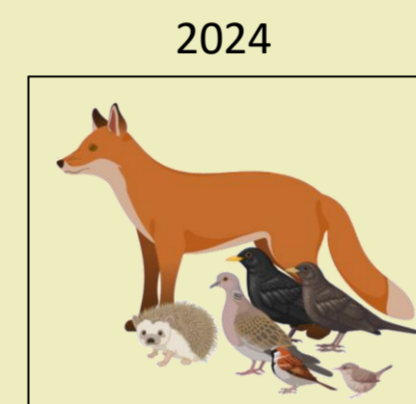
Abiotic datas : Light intensity, first soil cm temperature and humidity

Biotic datas : Plant litter depth, ungulate tracks, presence of a path, plant species, stratum, coverage, clustering



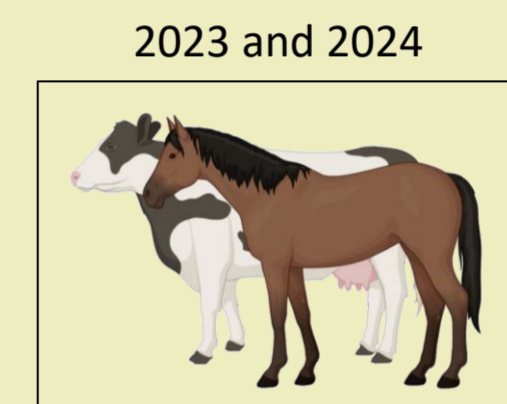
The meadow's abiotic parameters have a **higher variability** and therefore constitute a **less stable habitat** than the forest and the ecotone.

Ticks are collected from the **environment**, from **domestic and wild animals**.



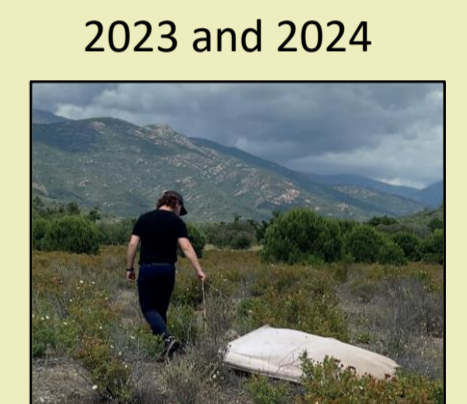
Migratory birds and small wild mammals

50 ticks



Horses and cattle

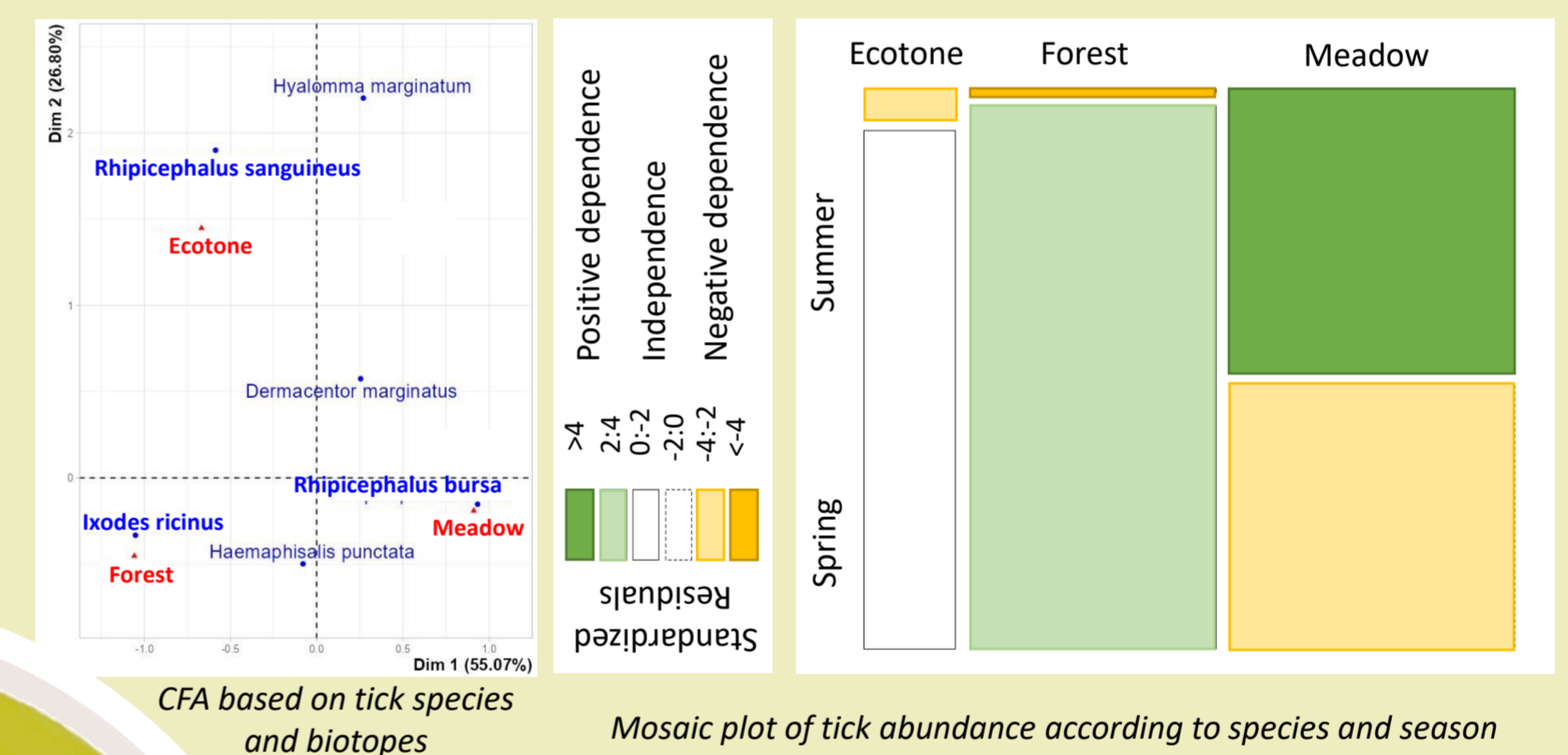
5 533 ticks



Tick dragging method

275 ticks

Overview of **species and their distribution**

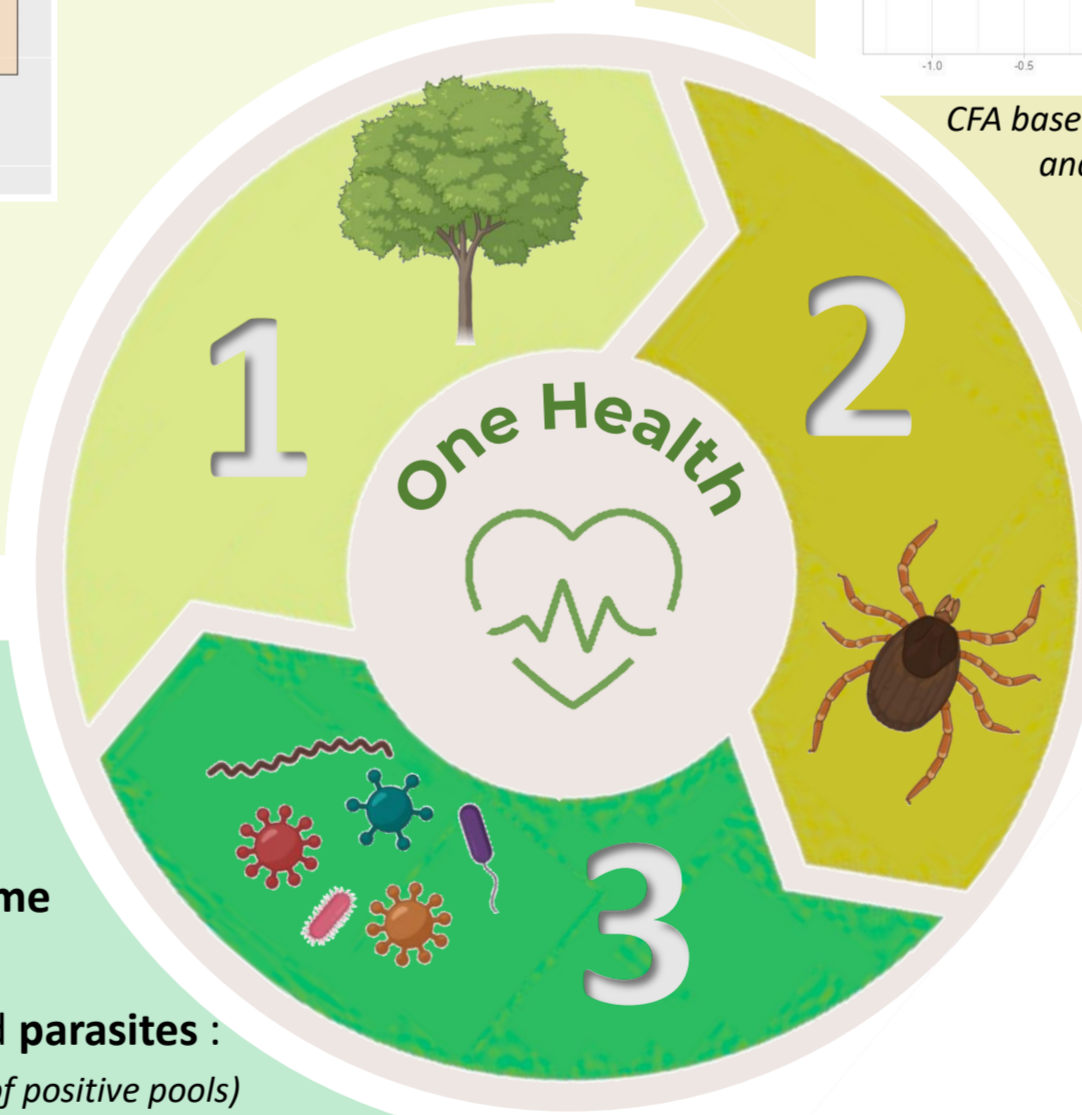


3 species seem to be affiliated with a specific **biotope and season** :

- *Ixodes ricinus* is found in forests during the spring season,
- *Rhipicephalus bursa* is found in meadows during the summer season,
- *Rhipicephalus sanguineus* is mainly found in ecotones in spring, although there is no dependency between the presence of ticks in spring and the "ecotone" biotope.

Ticks will be analysed using 3 different ways :

- By **molecular detection** (qPCR) for the presence of **tick-borne viruses** of public health interest : CCHFV was not found
- By using **New Generation Sequencing** (NGS) to analysed their **virome** and than assess their viral species diversity
- By using **microfluidic chips** to detect the presence of **bacteria and parasites** : among the 36 searched pathogens, 10 were founded ($n = \text{number of positive pools}$)



Conclusion

The study of **vector-borne diseases** in this century is becoming increasingly important. The **distribution and survival** of pathogen vector species depends on a large number of **biotic and abiotic factors** in our environments. Over time, the impact of global change on the environment is becoming increasingly apparent. The consequences of these changes on the **distribution and speed of adaptation** of pathogen vectors make it a **real public health issue**.

In this context, the **One Health approach** is fundamental to understanding the **mechanisms involved in the emergence of tick-borne pathogens and diseases**.

The environmental data collected, combined with pathogen data, will be used in models to **map areas at risk of host-vector-pathogen interactions** in Corsica. Mapping will help in public health decision-making and in the **prevention and control** of vector-borne diseases