EVOLUTIONARY ECOLOGY

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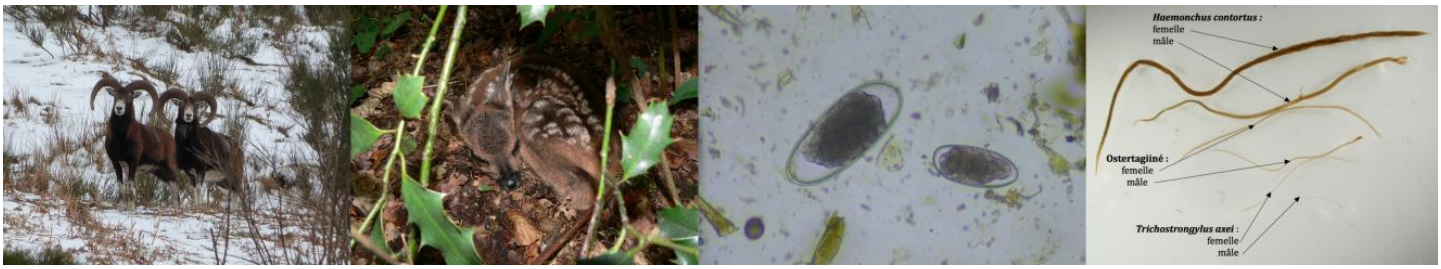

My research focuses on the relationships between animals, their environment and parasitism. It focuses in particular on **animal responses to the many constraints and changes in the environment** (weather conditions, availability of habitats, parasitism) and **in human activities** (tourism, hunting, livestock farming), and their **consequences for the health and dynamics of animal populations**. More recently, I have developed a number of research projects on the **transmission of parasites between domestic and wild animals**, as well as on the problems of **parasite resistance** to antiparasitic drugs.

- *Eco-epidemiology of parasitism*

In a population in equilibrium with its environment (e.g. no over-density), the level of infestation of individuals within the same population is highly variable, with the majority of individuals being lightly parasitised and a small proportion heavily parasitised and heavily contaminating the environment and other animals ('super-excretors' or 'super-spreaders'). Identifying the factors behind this individual variability in susceptibility to pathogens and their spread (and therefore the risk of them contaminating other individuals) is a major issue for the health and management of wild and domestic species.

Over the last few decades, wild ungulate populations have increased in density and species are increasingly overlapping. At the same time, they are facing changes in their environment (climate, habitats and available food resources). In addition, most of these species are hunted, sometimes with strong hunting pressure and selection of the animals shot, which can lead to phenotypic and genetic changes in the population. The increased density of individuals and the overlapping of species are conducive to the transmission of pathogens between individuals. Similarly, poor body condition of individuals (e.g. high density, lack of resources) makes them more susceptible to parasitism.

Hosts are not the only ones affected by environmental change. These changes also affect the dynamics of parasite populations. The movement of people and animals and/or their interactions can lead to changes in existing parasite populations, such as the arrival or exchange of new species or treatment-resistant strains. In a world of variable environmental conditions and ever-increasing constraints, it is important to determine the causes of changes in the balance between the host and its parasites, as well as the consequences for the dynamics of host and parasite populations, in order to propose the most effective solutions.

› *Resistance to anthelmintics and cross-transmission of parasites between domestic and wild ungulates*

Gastrointestinal strongyles are cosmopolitan parasites of ungulates, causing production losses, clinical disorders and major economic losses in livestock. The development and use of antiparasitic molecules has been a major advance in animal health, initially leading to better control of parasitism and its medical and economic impact. However, their widespread and repeated use throughout the world has encouraged the development of parasite strains resistant to the main families of antiparasitics available (e.g. benzimidazoles [BDZ], macrocyclic lactones [LM]), with resistance levels that are sometimes very high and worrying for the livestock industry, particularly in small ruminants. BDZs have very high levels of resistance in small ruminants, but resistance to LMs and multi-drug resistance are increasingly being described.

As a result of ongoing global changes, contact between wildlife, domestic animals and humans is tending to increase. This means that wildlife can be contaminated by pathogens from domestic animals, including parasites that are pathogenic and/or resistant to anthelmintics, and in turn participate in their dissemination.

In recent work, we have been able to show the presence of BDZ-resistant parasites in significant proportions in ibex, despite the fact that sheep had been absent from pastures for several months. These results show that resistant strains are maintained in the environment and/or in ibex from one year to the next in the absence of sheep. This raises the question of the role of wildlife in the dynamics of resistant parasite strains: are they victims of contamination of their environment by domestic animals or are they more "responsible" for maintaining resistant strains (reservoir role)? Understanding the role of wildlife in the dynamics of resistant parasites at the domestic animal-wildlife interface is an important issue for integrative resistance management.