Ticks are parasites that can transmit diseases to humans, pets, livestock and wild animals. With approximately 900 species described worldwide, they can transmit the widest range of pathogens of all parasites in the world. Over the last decades, the number of ticks has strongly increased, and their range is expanding both northwards and upwards on mountains. Three factors are believed to be responsible for this: climate change, changes in land-use and the availability of animals on which ticks can feed. Aside from an increase in the number of ticks already present in Europe, ticks coming from places outside of Europe are increasingly surviving and establishing in Europe, potentially bringing new diseases with them. In Europe, the most common tick-borne diseases are Lyme's disease (caused by the spirochete bacteria *Borrelia burgdorferi*) and tick-borne encephalitis (caused by the TBEV virus). Both diseases have strongly increased in diagnosed cases over the last decades, and are expected to continue to increase in the future.

An important host species for ticks to complete their life cycle, is deer. The numbers of deer have increased worldwide, and studies have shown that when deer are removed from an area through hunting or prevented from entering an area by placing fences, both the numbers of ticks and the number of cases of tick-borne diseases are reduced. However, hunting animals for this purpose raises ethical concerns, and placing fences in nature has a range of side-effects to other wildlife species.

Grey wolves are the main predator of red deer in Europe, and research has found that when wolves are present in an area, deer behave differently by avoiding the areas with wolves, trying to find safety elsewhere. This creates varied patterns of deer in the landscape, and can reduce the number of animals ticks can feed on. As wolves are increasingly settling in places in Europe where they went extinct before, their arrival will affect how deer behave, which may result in a change in tick numbers, and the resulting disease risk.

Additionally, wolves regularly kill deer for food, and will leave parts of the killed animal behind. Ticks use several signals to locate a host, and CO_2 from a breathing human or animal is one of the most important. As a decomposing animal also creates a lot of CO_2, it may be that ticks are attracted to the remains of a dead animal, mistaking it for a live host. Dead animals killed by wolves could create a temporary hotspot of ticks. As several other species of scavengers will visit a cadaver, this could create a transmission route for ticks to parasitize animals and transmit diseases further.

This project aims to investigate three main goals:

1. As wolves can change the behavior of deer, we plan to investigate how the changes in deer distribution affect the numbers of ticks in the landscape. We will collect ticks in different areas ranging from places with many deer, to places with little or no dear in the Białowieża Primeval Forest, and compare the number of ticks we can find there. We do this by dragging a white flag over the ground vegetation. Ticks will mistake the movement for a passing animal (or human) and grab on to the flag. We can then collect the ticks for identification.

2. Deer are considered poor carriers of certain diseases transmitted by ticks, and we aim to find out how changes in deer distribution can affect the number of ticks that are infected with the most common tick-borne pathogen in Europe: *Borrelia burgdorferi* (which causes Lyme disease). We will use the ticks that we collected with the flag and test them in the laboratory for the presence of the bacteria using a PCR test.

3. Wolves regularly kill animals for food, and we plan to discover if ticks can be attracted to the remains of a decomposing animal. We will perform an experiment in the Bavarian forest of Germany, where hunted deer will be laid out in the forest. We will collect ticks at different distances from the animal and mark them with a small drop of paint. We will then release the ticks and capture them again with the flag at a later date. This way, we will be able to determine if ticks have moved closer to the cadaver.

We expect this project to help us understand how the presence of wolves, can change the numbers of ticks in the landscape, as well as the effects on the risk of Lyme disease on humans and animals. As wolves are likely to continue to spread to other areas in Europe, the results of this study can help to predict what the effect of wolves arriving in a new area might be on the danger of ticks, by changing the behavior of an important host: the deer. We also expect to find out if animals killed by wolves can attract ticks, and form a temporary hotspot with more ticks present, and if this is a risk to scavengers visiting the cadaver.