Climate changes that have been taking place during the last century significantly affected populations of many species around the world. This caused much scientific attention towards investigations of mechanisms of species' responses to such events. One of the ways to learn about those mechanisms is to reconstruct reactions of species to climate changes that took place in a distant past, when Earth witnessed many profound climate changes of various magnitudes. One of the methods to reconstruct these responses is a multidisciplinary approach comprising analyses of DNA obtained from paleontological materials (ancient DNA) and direct radiocarbon dating of the remains used for the DNA extraction. The main goal of this project is to reconstruct evolutionary history of field (*Microtus agrestis*) and common voles (*Microtus arvalis*) during the last 50,000 years and to correlate it with available paleoclimate proxies. This will allow studying the impact of climatic oscillations of different magnitude on population dynamics of vole species. Recent studies of genetic diversity of contemporary voles populations has suggested that both species might be more susceptible to climate changes than previously thought and such investigation may reveal complex demographic history. We will also investigate whether both vole species has survived Last Glacial Maximum at high latitudes in cryptic northern refugia. This was suggested on the basis of distribution of contemporary genetic diversity but the evidence is not ultimate.

To achieve these goals we will analyse sequences of mitochondrial DNA fragment obtained from palaeontological remains of ca. 150 individuals of each species. The paleontological material will come from various archaeological sites across Europe dated to the last 50,000 years. About 70 specimens will be radiocarbon dated to anchor the reconstructed events in time. To reconstruct evolutionary history of vole species we will employ several methods that make use of DNA sequences sampled at different time points to estimate time of population splits and timing of population declines and expansions. Other methods will be used to choose between different demographic scenarios. To estimate the impact of climate changes on reconstructed demographic events we will compare the inferred timing of those events with palaeoclimate proxies. The most important one is the record of oxygen isotope changes from Greenlandic ice cores. This record very accurately reflects changes in global palaeotemperatures. Additionally we will use pollen diagrams obtained from peat bogs and lake sediments that allow for a detailed reconstruction of vegetation changes through time.

Recently, Late Pleistocene evolutionary histories of several extant and extinct species have been reconstructed in details, however large mammals such as woolly mammoths or cave bears got most of the attention. Frequently studies attempted to answer the question whether the extinction of large mammals at the end of last glaciation was caused by human hunting or climate changes. Small mammals are more susceptible to climate changes, and impact of humans on their populations is negligible, thus they are a superior subject for studying the influence of climate changes on demographic processes. Both vole species are widespread in Europe and are important elements of temperate environments and demographic changes in their populations had bottom up effects on whole ecosystems. Comparison of reconstructed evolutionary histories of the two vole species with mentioned paleoclimate records may provide very important clues how temperate small mammal species responded to environmental changes.