One of the biggest challenges in ecology is to understand and predict the impact of climate change on species and populations. It has been reported that species react in variety of ways to changes in environment caused by global warming. For example, larger fluctuation in temperature during the growth season and increased ambient temperature in many geographic regions affect dates of birds arrival to breeding sites and insects hatching time and breeding dates. All these events are called phenological events and these are closely linked to reproductive success. Also, many species colonise new areas that had not been colonized in the past due to harsh climatic conditions. However, there is no doubt that understanding and predicting the impact of climate change is complicated by the fact that organisms live in complex multi-species communities, and temporal changes in population size or abundance and competitive ability of different species can alter the consequences of rapid climate change. Despite this, our knowledge on these topics is limited.

In this project, I will study how climate change impact competition in damselflies that share the same habitats but differ in phenology and rates of range expansions. Damselfly larvae live in freshwater habitats and are key predators that also show cannibalistic behaviour. Larva is the only stage when growth occurs. Hence, damselfly larvae have significant impact on local and regional aquatic biodiversity through investment into their growth. Flying adult is a reproductive and dispersing phase. It is therefore appealing to study both stages since investment in traits such as growth and development during larval stage is closely linked to adult traits related to mating success and dispersal.

I will answer these questions by running two laboratory experiments. In the first, I will use widespread European common spreadwing damselfly. I will observe how larvae that have different time windows available for growth and development (damselflies collected in northern and central Europe), and individuals that differ in hatching dates interact with each other in terms of aggressive behaviour. During their larval phase I will note survival, growth rate and development time until switch to adult flying stage (=emergence). After emergence, I will measure damselflies fat content (energy storage) and condition of immune system – traits responsible for activity endurance and resistance against pathogens. In other words I will check whether and to what degree advanced hatched individuals are superior over no advanced individuals in traits listed above.

In the second experiment, I will add a blue-tailed. This damselfly that has more restricted distribution than common widespread but is rapidly spreading its range to the north as the climate worms. In few years the blue-tailed will share the same habitats with northern common widespread. Here I will grow advanced common spreadwing originating from northern Sweden with advanced and no advanced hatched blue-tailed damselfly from central Sweden and vice versa according to phenology. This set up will allow me to observe if and how intense the two species are advantageous or superior over each other in growth and predation during their larval stage, and energy storage and pathogen resistance system after emergence.

The results will allow to draw important conclusions and connotations. Firstly, they will clarify how species that share the same habitats but differ in phenology and range expansions respond to changes in species-species interactions caused by global climate change. Secondly, the results will elucidate effects of complex between-species interaction in newly established populations by quickly invading species. Thirdly, these information will have conservation connotations as they will inform whether climate change will promote competitive exclusions and local species extinction or relax these competitive interactions leading to stable local species diversity.