

SHORT TERM SCIENTIFIC MISSION (STSM) SCIENTIFIC REPORT

This report is submitted for approval by the STSM applicant to the STSM coordinator

Action number: CA18201

STSM title: Climate change effects on population dynamics and genetic diversity of *Silene acaulis* in High Tatras

STSM start and end date: 15/01/2020 to 16/02/2020

Grantee name: prof. Olav Skarpaas

PURPOSE OF THE STSM

My Short Term Scientific Mission was planned to contribute to conservation of threatened plants for the 21st Century. Our study species, *Silene acaulis*, is a facilitator cushion plant growing on wind exposed rocky areas in alpine and arctic environments. Its cushion form is acting like a windshield, creating better conditions for other organisms that can live within the individual. It can help co-occurring plant species by bringing more nutrients or also providing environment for them to be able to germinate easier. We have been collecting population data for 7 years in two Slovak valleys in High Tatras, creating a dataset to use for predicting population performance in the future. The purpose was to focus on population dynamics of the species and learn how to use Integral Projection Models (IPMs) for our data with help of prof. Olav Skarpaas, as population modelling is a great tool for showing the importance of conserving specific life stages of the plants, that could help the population to survive and reproduce.

DESCRIPTION OF WORK CARRIED OUT DURING THE STSM

From the first day I have been learning more about IPMs, in the beginning by reading articles and working to understand the processes behind it. I have never worked in R Studio before, so I had to get familiar with programming environment as well. Then I tried to carry out analyses and create figures with generated data from IPMpack, which is very helpful to use to create IPM matrices and to understand what are they showing to us. After I got familiar with the R package, I edited our own dataset of *S. acaulis* to adapt it to the specific data format of IPMpack. Finalizing the dataset took a long time, as there were 3702 entries and I had to make sure everything is done properly. Olav Skarpaas and other researchers (e.g., Eva Lieungh, Peter Horvath, Michal Torma, Lasse Keetz) from the Natural History Museum (NHM) were very helpful and provided advice if I was struggling with something. After finishing the editing, I was finally able to insert our dataset into the programme and start analyzing the data on my own and customizing the output. The IPMpack consists of many functions that can be used, so I was going through a vignette for the package and looked at all the possibilities. After developing some models and thinking about the information they were providing, I started reading more about the species trying to understand the processes that are happening due to different climate conditions. I also started retrieving climate data from meteorological stations around Slovakia, as those will be used as variables to see how much climate affects population dynamics.

Another great aspect of my STSM were people and networking. Everyone at Natural History Museum was so helpful and willing to show me what are they working on or give advice about how to solve some problems that appeared. It was nice to experience this friendly working environment and to see how this institution works.

We organized a workshop on demography and distribution modelling during the last days of my STSM, focusing on presenting and teaching IPMs (by Joachim Paul Töpper) and various distribution modelling methods (by Olav Skarpaas and Eva Lieungh), as well as encouraging people from different backgrounds to discuss and share their ideas. The content of the workshop reinforced my learning of population modelling and provided me more ideas to work on in the near future. I was one of the organizers, together with Olav Skarpaas, Joachim Paul Töpper and Eva Lieungh, so I could see how to prepare a workshop and what are the important things to prioritize. I met other great researchers from different countries currently operating around Norway and learned about their interests and work.

DESCRIPTION OF THE MAIN RESULTS OBTAINED

Main results include edited dataset of *S. acaulis* and many figures obtained in R with the help of IPMpack. The analyses gave important basic information about the population biology and viability of the species: individuals of *S. acaulis* are growing slowly, some of them shrinking, but almost all of them surviving. Mostly only the young seedlings die, probably because they are small and more sensitive to various effects. To keep local populations alive, it seems to be most important to conserve the big cushions, which are more probable to reproduce as they are getting bigger with higher chance to survive, therefore creating more seedlings. The next step is to link population processes to climate. *S. acaulis* is well equipped for harsh environments with strong wind and lower temperatures and distribution models suggested that the optimal habitats for the species may be moving northwards with climate change. For the regional and global conservation of *S. acaulis* it is important to know if and how the species might be able to track these habitat changes or adapt to new local conditions.

Some of the results were more abstract than seizable. I have learned to work in R, understood some processes behind IPMs, found out more about my study species from the IPM analyses and outputs, got familiar with distribution modelling, helped with organizing a workshop, but most importantly been in a scientific environment and met so many researchers, PhD or Master students, scientists or professors, who gave me their opinions and thoughts, which will surely help me in my future scientific work.

FUTURE COLLABORATIONS

My plan is to cooperate with this group of people in the future, as they are working on similar topics as I would like to and I felt like fitting in. We will have possibilities to meet for example at the PopBio Conference 2020 in Prague. I would like to participate on some field work or course during the summer to help with data collection or simply to learn more myself.