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: Influence of habitat and climatic conditions on population dynamics of endangered Species
STSM start and end date: 12/10/2020 to 08/01/2021
Grantee name: Dr. Alrun Siebenkäs

PURPOSE OF THE STSM:

Minuartia smejkalii is a plant endemic to the Czech Republic (Dvořáková 1988). Its highly specific habitat requirements (shallow serpentine soils, rocks, crevices, or open very light pine forest grassland patches) and very limited occurrences that are also threatened by habitat destruction, have led to it being a very endangered and protected species (listed under Annexes II and IV of the European Habitats Directive (www.eea.europa.eu) and IUCN Red List (Bilz 2011)).
One of the actions of the LIFE for Minuartia Project (LIFE15NAT/CZ/000818) included planting seedlings of *M. smejkalii* into existing populations to increase their size and re-introduce the species to locations, where former populations have gone extinct.
The survival rates and performance traits were analysed to assess differences depending on localities and genetic heritage (via traits of mother plants of the transplanted seedlings) to promote the establishment of further plantings for possibly taking adapted conservation efforts and answering the research questions:

1. What is more important for the establishment success of *M. smejkalii* seedlings: legacy from mother plants and characteristics before planting or characteristics of the habitats?
2. How do self-established and transplanted seedlings differ from each other?
3. Which implications can be derived for future conservation efforts for *M. smejkalii*?

DESCRIPTION OF WORK CARRIED OUT DURING THE STSMS

As planned in the proposal, I familiarized myself with literature with regards to seedling establishment, serpentine species, transplantation, population reinforcement and specific other conservation practices. I compiled, cleaned and prepared the trait and survival data of *Minuartia smejkalii* from five populations covering up to four years for statistical analyses. I analysed the population data in R using different statistical models (generalized mixed-effects models, generalized models, linear mixed effects models) to answer the research questions.
I was lucky that, given the circumstances (lockdown due to the COVID pandemic), I could at least meet some of the people working with the project and see one of the locations where the species is planted in a park at "The Waterhouse" (Vodni dum) to raise awareness of its specific habitat and threat.

Additionally, I had the opportunity to visit one of the sites where the species was planted to reinforce its populations and even help with new transplantations. Although this was not originally considered in the proposal because of the uncertain situation, it helped me tremendously in gaining a more intimate knowledge of the species' specifics, localities, habitat characteristics, and how the data I have been analysing was collected.
A manuscript draft is in preparation to be submitted for publication in a peer-reviewed journal in the following months. Depending on the COVID situation, the results will potentially also be presented at the Popbio conference.
The data was also prepared to be included in models estimating the population development in future years under different climatic conditions, which will be analysed in the coming months.

DESCRIPTION OF THE MAIN RESULTS OBTAINED

In four of the five populations seedlings emerged from seeds from the transplanted individuals. In the beginning of the study, *M. smejkalii* was extinct at one location and basically extinct at another. Two years after first reintroduction, the population at the former locality consisted of over 1400 individuals and 121 at the other locality (in both cases less than planted). However, at two of the other localities, the reinforced parts of the populations increased throughout the years due to seedling recruitment, resulting in now three to four times the number of transplanted individuals.

What is more important for the establishment success of *M. smejkalii* seedlings: legacy from mother plants and characteristics before planting or characteristics of the habitats?

Mother plant identity affected seedling size, relative growth rate and number of flowers, but not seedling survival. This was partly due to the size and number of flowering stems of mother plants, but these traits explained only a small part of variation due to mother plant identity. Larger mothers with more flowering stems produced smaller, slower growing individuals which also had fewer flowers.
In conclusion, for the survival of planted seedlings, mother plants were not important, but for growth and flowering in the first year after transplantation, while across years initial seedling size and especially age were more important for individual size and flower numbers. Except for on the number of flowers, population differences had a larger effect than initial size.

How do self-established and transplanted seedlings differ from each other?

More than twice as many individuals survived the first year when they were transplanted. Transplanted individuals were larger at time of transplantation than self-established seedlings at first recording and one year after the initial measurements. However, self-established seedlings had more than double the number of flowers. For both transplanted and self-emerged individuals, variation in the observed traits was due to the same main factors (population identity or initial size), except for the number of flowers.

Which implications can be derived for future conservation efforts of *M. smejkalii*?

The transplantation of seedlings grown in the common garden is a promising method to help the threatened species, as some of populations also showed seedling establishment from seeds from transplanted plants. However, there were many differences due to the different habitats and populations, which showed a varying performance. Establishment success also depended on the year of transplantation, the size of transplanted individuals and features of the mother plants from which seeds were taken. This may help improving transplantations because specific mother plants could be preferred as seed sources to optimize the success of conservation actions because there were trends that seedlings from smaller mothers with fewer flowering stems performed better (bigger and more flowers). The applied method of planting repeatedly in successive years is necessary as an insurance for the survival of seedlings in case of exceptional weather conditions or other factors reducing establishment success (i.e. the drought in 2018).

FUTURE COLLABORATIONS (if applicable)

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