LIFE Project Number

LIFE15 NAT/CZ/000818

Final Report

Covering the project activities from 07/07/2016 to 30/06/2021

Reporting Date

30/09/2021

LIFE PROJECT NAME or Acronym

LIFE for Minuartia

Data Project

Project location:	Želivka SCI and Hadce u Hrnčíř SCI
Project start date:	07/07/2016
Project end date:	31/12/2020 **Extension date:** 30/6/2021
Total budget:	735 940 €
EU contribution:	551 954 €
(%) of eligible costs:	75%

Data Beneficiary

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This table comprises an essential part of the report and should be filled in before submission

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Obligatory elements	✓ or N/A
Technical report	
The correct latest template for the type of project (e.g. traditional) has been followed and all sections have been filled in, in English *In electronic version only*	✓
Index of deliverables with short description annexed, in English *In electronic version only*	✓
Final report: Deliverables not already submitted with the MTR annexed including the Layman's report and after-LIFE plan Deliverables in language(s) other than English include a summary in English *In electronic version only*	✓
Financial report	
The reporting period in the financial report (consolidated financial statement **and** financial statement of each Individual Beneficiary) is the same as in the technical report with the exception of any terminated beneficiary for which the end period should be the date of the termination.	✓
Consolidated Financial Statement with all 5 forms duly filled in and signed and dated *Electronically Q-signed or if paper submission signed and dated originals* and in electronic version (pdfs of signed sheets + full Excel file)*	✓
Financial Statement(s) of the Coordinating Beneficiary, of each Associated Beneficiary and of each affiliate (if involved), with all forms duly filled in (signed and dated). The Financial Statement(s) of Beneficiaries with affiliate(s) include the total cost of each affiliate in 1 line per cost category. *In electronic version (pdfs of signed sheets + full Excel files) + in the case of the Final report the overall summary forms of each beneficiary electronically Q-signed or if paper submission, signed and dated originals**	✓
Amounts, names and other data (e.g. bank account) are correct and consistent with the Grant Agreement / across the different forms (e.g. figures from the individual statements are the same as those reported in the consolidated statement)	✓
Mid-term report (for all projects except IPs): the threshold for the second pre-financing payment has been reached	NA
Beneficiary's certificate for Durable Goods included (if required, i.e. beneficiaries claiming 100% cost for durable goods) *Electronically Q-signed or if paper submission signed and dated originals* and in electronic version (pdfs of signed sheets)*	✓
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This table, page 2 of the Mid-term / Final report, is completed - each tick box is filled in *In electronic version only*	✓

**signature by a legal or statutory representative of the beneficiary / affiliate concerned*

1. Table of contents

Content

2. List of key-words and abbreviations

Key words
endemic species, environmentally responsible behaviour, management interventions, forest grazing, species of priority interest, ex-situ conservation, climate change, plant translocation

Abbreviations

Agency European Climate, Infrastructure and Environment Executive Agency (CINEA), formerly as Executive Agency for Small and Medium-Sized Enterprises (Agency)
B1 old mine in Želivka SCI near Želivka stream
B2 part of Želivka SCI on the steep slopes of Želivka stream
CP Central part of Želivka SCI
CSOP The Czech Union of Nature Conservation, Vlašim Basic Organization
DK1, DK2, DK4 and DK5 parts of Želivka SCI on the steep slopes of the Sedlice stream
DK3 part of Želivka SCI near the road to Borovsko
FR Final Report

GA Grant Agreement The rescue of endemic priority plant species Minuartia smejkalii, LIFE15 NAT/CZ/000818
IBOT Institute of Botany of the Czech Academy of Sciences
MtR the Mid-term Report of this project
MŽP Ministry of Environment
NCA Nature Conservation Agency of the Czech Republic
PR1 the first Progress Report of this project
SCI Site of Community Interest

3. Executive Summary

The main aim of the project was setting up sustainable and feasible management of sites with *Minuartia smejkalii* (*M. smejkalii*) populations and to enhance its population size by about 40%. The project was prolonged from 31/12/2020 to 30/06/2021 because of delay in project action caused COVID-19. The project aims were fulfilled. While at the beginning of project the population size was 434 individuals, it increased to 1015 individuals at the end of project. The population size thus increased about 134%. Additionally, M. *smejkalii* spread to other suitable parts, which were created by management interventions.

Under the **A activities**, we annually mapped the distribution of single individuals of the species and their size and flowering under different habitat conditions and used this information for identification of critical phases of life cycle in each population under current habitat conditions and under future climate change. This knowledge was used to guide management interventions (A2). We prepared more than 11 000 seeds and almost 3 000 juvenile plants for enhancement of population size in-situ and for setting ex-situ populations (A3 activity). One of the populations (DK1) produced very few seeds. We thus decided to prolong the activity A3 and C2 to ensure that the population DK1 will be self-reproductive after the project end. Evaluation of genetic diversity of the populations and reproductive ability of inter-population hybrids showed that it is possible to mix populations within regions for ex-situ conservation. The two regions should, however, be kept separately. Rock outcrop was built in the external exposition of the Visitor Centre of Želivka SCI Vodní dům (A4). The action A5 - Rescue planting in private gardens focused on developing the legal framework for the action (its compliance with the Law about Conservation of Nature and Landscape, convention with involved people), preparation of general methodology of Rescue planting in private gardens and addressing of local people to get involved to the program. Totally 20 gardeners were involved (private persons, municipalities, botanical gardens, school). The serpentine rock outcrops were built in the gardens. The people were trained prior obtaining the plants.

Revitalization of habitats (C1 action) focused on suppression of the most important threats such as high competition, dense forests, high humus layer etc. Mowing was applied twice a year on Central part of Želivka SCI on area 6 ha (3 ha were mulched prior to mowing), on 4 ha three times a year instead of forest grazing (1 ha was mulched prior to mowing) from 2017 and B2 on area 0.3 ha from 2018. From 2019 grazing twice per year by a herd of 30 sheep was introduced to the area 5 ha in CP. Manual removing of expansive plants was aimed on suppression of *Vincetoxicum hirundinaria* (DK1, 140 m^2), mosses and grasses (1700 m^2 in DK1, 328 m^2 on DK2, 1 ha on DK4, 300 m^2 on B1 and 200m^2 on B2). We also included manual removal of juvenile *Frangula alnus* in the Central part on area 10 ha, which was repeated every year. On selected patches tested suppression of *Calamagrostis sp.* using hemiparasitic *Rhinathus alectorolophus*. The removal of humus layer was done on almost 1.3 ha. The tree

cutting was abandoned on the sites with south exposure to prevent increasing of temperature and drought caused by climate change. The thinning of dense parts of forest and removing of self-seeded trees was done on whole CP (11.2 ha), part DK1 (0.3 ha), DK2 (1.7 ha), DK3 (0.45 ha), DK4 (0.2 ha), DK5 (0.2 ha). To reduce intensive grazing by wild animals, the 4 most grazed rocks were fenced. To block human access to the B1 sites and stop the dumping of waste, a barrier was placed at a forest path. The long-term conventions were signed with the owner and administrators of project sites.

Enhancement of natural populations (C2 action) was done by sowing of 9 000 seeds and transplantation of 1304 juvenile plants.

Ex-situ population at the Visitor Centre of Želivka (C3 action) was established by sowing of 2294 seeds and transplantation of 1835 juvenile plants. We collected seeds from plants in this ex-situ population and used them for preparation of juvenile plants for **reintroduction** of the species at a locality where it previously went extinct. The reintroduced population was established by transplantation of 2005 juvenile plants.

Totally 20 gardeners (10 for each region) signed the conventions and were involved in the **Rescue planting in private gardens** (C4 action), they obtained between 5-150 individuals, and in total 1543 individuals were transplanted to the gardens. We prepared the final methodology, instruction leaflet for gardeners and the model Plan for *M. smejkalii.*

All D activities started in 2018. Evaluation of **impact of management interventions** (D1 action) showed that the population size increased about 134% (to 1015 individuals without transplanted plants). Some populations are nevertheless still decreasing due to climate change. Target plants increased their occurrence as well as biomass, while the grasses were suppressed. **Enhancement of population size** (D2 action) in the nature by sowing was not successful. In contrary, transplanted juvenile plants had high survival rate 83-95% in the first and 50-60% in the second year after. The survival rate in **ex-situ population** (D3 action) was low due to instability of the rock: 64% after the first year, 16% in the second year and 8.4% third year. Nevertheless, the plants produced seeds with high germination rate. Preserved genetic diversity was comparable to the nature. **Reintroduced** individual had high survival rate 78.2-81.6% after the first and 64% in the second year after transplantation. Plants are flowering, produce seeds with high germination rate and new individuals are established. The planting **success in private gardens** (D4 action) was garden dependent. Large rocks with more individuals had higher survival rate. Action led to dismissing of vandalism and increasing of awareness about species. **Evaluation of ecosystem services** (D5 action) showed that according to MAES and BVM method the project impact was positive, while EWVM method showed negative impact. **Socio-economic impact** (D6 action) focused mainly on tourisms, business, employment, engagement of general public and institution, connection of scientific organization and organizations dealing with nature conservation.

Enhancement of public awareness (E1 action) was based on preparation of promotion items (stickers, posters, postcards, DIY jewels, T-shirts, cups). We regularly updated web sites, social networks and other media. In the Visitor Centre, we prepared two environmental education programs related to the project and placed interactive elements. We installed notice boards, built tourist information point with information panels and propagated areas within the geopark Kraj Blanických rytířů. We organized 4 competitions, a seminar dealing with economic utilization of NATURA 2000 sites, photo exhibition and thematic afternoons. **Dissemination of project results** (E2 action) was done by contact with other project, discussion with locals, by many media outputs (papers, TV reports), presentation on international conferences,

scientific publications, organization of final conference, attendance on many meetings, preparation of management plan and methodology of care, organization of workshop Working with the public in ex-situ plant conservation and printing of instruction leaflet and Layman's report. Many meetings were organized to discuss Rescue planting in private gardens with experts and to select other suitable species.

The future management interventions and care about *M.smejkalii* was described in **After-LIFE plan** (F3 activity).

4. Introduction

The project objective is to rescue the priority endemic species *M. smejkalii* whose worldwide distribution is currently limited only into two locations (Hadce u Hrnčíř SCI and Želivka SCI). **Background:** Population *M. smejkalii* on both sites had been rapidly decreasing (from 1252 individuals in 2011 to 434 individuals in 2015), and in some parts of the Želivka SCI population was already extinct.

Problems (solved): The main reasons for the decline of the population size were human activities associated with forestry leading to formation of dense and shaded pine forests (190,160,162, 990). The forest floor in these forests was covered by high litter and humus layer (990, 420). In these conditions, plants adapted to specific substrates were quickly suppressed and replaced by plants of acid substrates or by competitively stronger plants (971). On one site plants were destroyed by intensive grazing (976) and illegal dump (740, 251). Other problem on both sites were plant collection and vandalism, which lead to direct devastation of individual plants (740, 251)

Objectives: The main aim of the project was to enhance population size of the endemic priority species **M. smejkalii* by about 40% by means of suppression of these key negative factors and setting up sustainable and feasible management of the sites by following sub aims:

1) Revitalization of natural sites by combination of various management best practices on 17 ha
2) Establishment of self-sustainable ex-situ conservation to be used for plant reintroduction on recently extinct site
3) Direct enhancement of particular population size in the nature (Želivka SCI) by sowing of seeds and plant transplantation by about 30%
4) Prevention of vandalism and plant collection by a) adoption of a Swiss approach, which has never been implemented in the Czech Republic and directly involves local people to plant protection and by elimination of creation of black dump at the locality leading to reduction of loss of plants due to these causes by 90%
5) Enhancement of awareness about serpentine phenomenon and NATURA 2000 and dissemination of results on local as well as EU level to 60 000 people by presentation on and organization of seminars, workshops, conference and preparation of an environmental education programme etc.

Which sites were involved

1. Želivka SCI - in part with occurrence of serpentine protected on national level as Hadce u Želivky NPA
2. Hadce u Hrnčíř SCI protected on national level as Hadce u Hrčíř NM

Plus sites of ex-situ sites of conservation, i.e. Visitor Centre Vodní dům and gardeners involved in the Rescue planting in private gardens.

Which habitat types and/or species were targeted
Habitat type: Pine forest on slopes with shallow soil and serpentine bedrock with some serpentine outcrops. Serpentine soil is condition sine qua non for *M. smejkalii* progression. Habitat is only targeted for the benefit of *M. smejkalii*.

Targeted species: **M. smejkalii* -Czech endemic species, whose worldwide distribution is currently limited only to two nearby locations: (i) SCI Želivka and (ii) Hadce u Hrnčíř SCI.
The species is an obligate serpentinophyte and thus it occurs only on serpentine sites. M. smejkalii prefers rock platforms, crevices and shallow serpentine soils and unconnected grasslands in bright pine forests. The species performs the best at sunny habitats with sporadic vegetation. Once the locality becomes overgrown by competitively-strong plants, M. smejkalii ceases to prosper and quite quickly becomes extinct.

Main conservation issues being targeted (including threats)
Main conservation issues included standard management techniques such as mowing and manual removal of expansive plants to suppress the high competition. Additionally, we implemented a non-standard approach – forest grazing to suppress high competition more effectively. The negative effect of forest management was suppressed by removing juveniles of not-target tree species. The removal of the humus layer was done by digger in combination with manual removal. The intensive grazing by wild animals was reduced by fencing. The vandalism and illegal dump was suppressed by building of car barrier and implementation of the new approach – the Rescue planting in private gardens.
Additionally, selected current populations were strengthened by sowing and transplantation of juvenile plants and one population was reintroduced. Ex-situ conservation of the species had been established in the Visitor Centre Vodní dům and 20 private gardens.

Socio-economic context was considered already at project preparation since both areas lay in marginal areas and suffered from unemployment, lack of public infrastructure and depopulation. Therefore we focused on enhancement of soft tourism and business opportunities, building of regional identity or preventing negative behaviour. Special attendance was given to supporting the social prestige of the aging population via Rescue planting in private gardens.

Expected longer term results (as anticipated at the start of the project)
The management interventions were intensive and aimed to restoration of natural ecological processes on the serpentine sites. We thus suppose that habitat conditions on the steep rock will be stabilized and the populations will be able to spontaneously disperse. In contrary, the other parts will need additional interventions with minor extent to prevent expansion of grasses and juvenile trees (disruption of natural succession). The strengthened as well as newly created populations are established to be self-reproductive. We thus expect enhancement of population size (from 434 individuals to 589 in situ and 600 ex-situ), improvement of species trend (to increase in situ and stable ex-situ) and status (to U1 in situ and FV ex-situ). Concerning habitats, only the area of Siliceous rocky slopes with chasmophytic vegetation will increase. Habitat conditions will be improved to U1 and trend will be improving for all target habitats.

5. Administrative part

The project management:
Hana Pánková from IBOT was the main project manager and initiated the management meetings and consortium meetings. We organized 3 types of meetings – internal within each

beneficiary, top management meetings (Hana Pánková and Karel Kříž) and project consortium meetings (whole project team of all partners and stakeholders). The internal meetings of the IBOT team were held regularly once per month or ad-hoc, the project manager was in contact with particular team members every day in the IBOT. We therefore considered the reduction of regular meetings of a whole IBOT team from the foreseen each 2 weeks as reasonable. ČSOP team meetings were held monthly. Meetings of top project management were held regularly every two weeks as foreseen mainly in Vlašim or in the project sites. First project team meeting was held on 25/08/2016 to introduce the project. Project consortium meetings were organized twice per year except 2020, when the meetings were not allowed due to COVID-19. We decided to change the date of consortium meetings in winter and summer to be able to show the impact of the project directly in the field. From each consortium meeting the report and presentation of people are prepared. The consortium meetings took place on 10/2/2017 (attendance 12 people, deliverable PR1 Annex F1a), 29/11/2017 (13 people, deliverable MtR Annex F1.1a), 05/06/2018 (attendance 9 people), 12/03/2019 (attendance 10 people, **FR Annex F1a**), 04/12/2019 (attendance 10 people, FR Annex F1b) and 22/02/2021 (on-line, attendance 8 people, **FR Annex F1c**).

To monitor project progress, we created an on-line shared document with specific sections for each action and Deliverable/Milestone. This document is updated weekly so all partners have an opportunity to check actual ongoing works.

The Partnership agreement with ČSOP was signed on 31/08/2016 (PR1 Annex F1b) and the Partnership agreement with MŽP was signed on 15/09/2017 (MtR Annex F1b). The delay of the signature of the partnership agreement was caused by waiting on signature of "*Decision about provision of subsidy*" (PR1 Annex F1c).

Last year of the project we printed **After - LIFE plan** (300 pcs. in Czech and 100 pcs. of English). After-LIFE contains the management plan after the project end, specifies interventions in particular populations and identifies potential financial sources (**FR Annex F3a** in Czech and **FR Annex F3b** in English). The After-LIFE plan was distributed to the main stakeholders, owners and administrators. The English version is used for foreign organizations interested in long-term management of sites.

The problems encountered: the first problem was the delay of the signature of partnership agreement with MŽP. Other problems were caused by to COVID-19. The pandemic of COVID-19 led to many state prohibitions. The schools as well as offices were closed and the meetings of people were banned. Schools as well as universities were closed for almost the whole year. This situation led to rapid decrease in working capacity since the members of the working team had to stay at home because of care about children. Additionally, we were not allowed to employ student helpers or additional staff because of hygienic regulations. This situation led to delay in project activities. The project was thus prolonged from the original end date 31/12/2020 to 30/06/2021. This change was included to partnership agreements as an amendment (FR Annex F1d and FR Annex F1e).

The partnerships and their added value: The partnership with ČSOP was very important for project implementation since it allowed immediate implementation of scientific results to practice and the rearrangement of management according to species requirements. The cooperation of both institutions was without major problems and led to preparation of new project following the LIFE for Minuartia supported by EEA and Norway Funds.

Communication with the Agency and Monitoring team: Communication with external monitor was based on reports of project progress. Reporting period was one month until 1Q 2019 and one quarter from 2Q 2019 or it was done ad-hoc according to necessity (e.g. preparation of letters for Agency, KPI table, changes caused by COVId-19). External monitor visited every year the project sites (except 2020), discussed the progress and prepared the report about project for Agency. Concerning Agency we obtained the evaluation of visits of

external monitor, evaluation of progress reports and MidTerm Report. We discussed with the Agency the eligibility of cost for GPS navigation and goods needed for forest pasture and project prolongation..

The changes due to amendments to the Grant Agreement.
The only one amendment to the GA was project prolongation from original end date 31/12/2020 to 30/06/2021.

6. Technical part

6.1 Technical progress, per Action

A1 Administrative issues

Foreseen start date: 07/07/2016 Actual start date: 07/07/2017
Foreseen end date: 31/12/2017 Actual end date: 27/5/2019

A1.1 Processing of permissions from the Law on Conservation of Nature and Landscape (Regulation Nb. 114/1992 Code.) and from the Forest law (Regulations no. 289/1995 Code)

The Law on Conservation of Nature and Landscape

Permissions for IBOT were issued by the Nature Conservation Agency of the Czech Republic (NCA) for activities on the Želivka SCI on 10/11/2016 (PR1 Annex A1.1a) and by the Regional Office Středočeský kraj for Hadce u Hrnčíř SCI on 15/03/2017 (PR1 Annex A1.1b). Permission for management activities on SCI Hadce u Želivky for ČSOP was issued on 26/06/2017 (PR1 Annex A1.1c). The Regional Office Středočeský kraj for Hadce u Hrnčíř SCI asked for the statement of the state organ of nature protection about project impact on NATURA 2000 network according to §45 Regulation Nb. 114/1992 Code, which was issued on 12/04/2018 (MtR Annex A1.1a**).** On the basis of this statement, the permission for management activities on Hadce u Hrnčíř SCI was issued on 04/06/2018 (MtR Annex A1.1b).

Forest law permission for grazing

During the processing of the permission, a new legislative barrier - the Water law (Regulations no. 254/2001 Code) was identified. Forest pasture is not a very common approach in the Czech Republic and neither us, nor Povodi Vltavy, a.s., manager and operator of the drinking water source were clear about how drinking source protected zone rules would be applied. We applied for an official permission with unrestricted time validity for entry to the area for the purpose of implementation of specific managements according to the Water Code 254/2011 Coll. to the Central Bohemia regional authority, which was issued 12/03/2019 (FR2 Annex 1.1a). After obtaining of this permission, official permission for forest grazing was issued by the Central Bohemia regional authority 27/5/2019 (**FR Annex A1.1b**)

A1.2 Public tenders/orders/selection of providers based on methodology of green procurement

Since the budget for particular contracts was under the limit value, we did not realize open tenders. All actions were done by each partner separately. The selection of providers and orders were made on the basis of green procurement rules and the lowest price comparing minimally 3 offers. Tenders were realized for following actions 1) genetic analysis, 2) evaluation of ecosystem services, 3) evaluation of socio-economic impact, 4) graphical and printing services, 5) catering for conference (finally not realized). Price demand: IBOT: laptop, microclimate sensors, camera with fisheye, production of cup, ČSOP: laptop, web design camera, building of touristic point, production of serpentine jewellery (finally not produced), equipment for car.

Equipment bought in addition to proposed items: IBOT In addition to proposed equipment, IBOT:GPS navigation Garmin, ČSOP: Electric fence network, Power source for an electric fence incl. accessories, car (approved by Mrs. Donato 26/10/2018). Electric fence network was originally planned in the proposal. Nevertheless, we asked to change it to fencing from solid metal parts to prevent destruction of fencing by animals. We tested it in nature prior to purchase

and found that it is not possible to use it in the rough terrain. We thus decided to buy the originally planned electric fence network, which is also cheaper and relatively easy for manipulation. We bought totally 800 m of network with accessories. All equipment was used exclusively for LIFE for Minuartia and will be used for continuing interventions (see After LIFE)

A1.3 Tenders for the newly created position

IBOT: We created one new half time job for technician since the preparation of new plants for transplanting was more time consuming then we supposed. During the project student internships were open as bachelor thesis (5 participants - 3 finished, 2 cancelled), master thesis (2 participants – 1 finished, 1 will finish in 2022), postdoc internship (6 participants), practices (4 participants) and internship for high school students (12 participants).

A2 Revitalization of habitats

Foreseen start date: 07/07/2016 Actual start date: 7/07/2017
Foreseen end date: 31/12/2017 Actual end date: 10/12/2020

The management interventions on Central part and B2 were based only on evaluation of habitat quality, while the interventions on other sites combined the data on plant life cycle as well as on habitat quality. The data for evaluation of the life cycle of *Minuartia smejkalii* were collected in 2016-2017 on each site except germination from seed bank, which was tested in 2018. A2.1 and A2.2 action finished in December 2018, but the marking of management plots in the field was finished in December 2020 prior to the removal of the humus layer.

A2.1 Evaluation of fitness of **M. smejkalii* on particular parts of SCI areas

The distribution of individuals was localized by GPS in autumn 2016 for Želivka SCI (PR1 Annex A2.1a and PR1 Annex A2.1b) and in summer 2017 for Hadce u Hrnčíř SCI (PR1 Annex A2.1c). Concerning plant fitness, we measured plant size, number of infertile and fertile stems, number of flowers per stem and capacity to reproduce generatively and vegetatively in July and June on each site and combined these data with data from regular monitoring of NCA. We also collected ripe capsules to evaluate seed production and seed germination rate. The results showed that the seeds have a high germination rate exceeding 80%. The dispersal ability of *M. smejkalii* was evaluated in 2017 by using Petri dishes in the field and by simulations of different dispersal modes in the laboratory. The results from these evaluations showed that the species is able to disperse only on short distance and the majority of seeds fall out near the mother plants (FR Annex E2.5e).

These data were used for determination of critical phases of the plant life cycle for particular populations. The model showed that populations B1, DK2, DK4 and H produced a large amount of seedlings, but they had high mortality in the first year. In contrary, juvenile plants in populations DK1, DK3 and DK5 were able to grow for many years when established. The problem with seedling survival on populations B1, DK2, DK4 and H was probably caused by habitat conditions. In contrary, in each population, plants were able to survive for a long time when already established. Populations with high seedling mortality produced a high amount of seedling while populations with low seedling mortality also produced a low amount of seedling. The one exception is the DK3 population, which produces a high amount of seedlings with high survival. According to these results, specific management interventions were suggested in MtR Annex A2.1d.

As part of our population dynamics modelling, we conducted a survey of available climatic data from various previous projects. The following projects were potentially relevant:http://www.cctame.eu/; https://cordis.europa.eu/project/rcn/92067_en.html; http://climate-adapt.eea.europa.eu/; http://www.copernicus.eu/. We obtained climatic data from the websites of these projects and evaluated their usability for our project. Most of these projects provide different versions of climate projection maps based on different types of models. Although these models are interesting, they are only different versions of the same – i.e. some version of the estimate of the long-term development of the climate. Although different models differ, it was not easy to grasp, which prediction was more appropriate than another. For our purposes, we needed a simple prediction of the future changes of temperature and precipitation in the Czech Republic for several decades. This information is easily identifiable, for example, from the International Panel on Climate Change (https://www.ipcc.ch/). This is the information commonly used, and hence the most logical type of information for our purposes. Although it would be nice to compare the outputs of many different climate models, we thought it would not be appropriate or meaningful.

The main reason for not using a wider range of models for our project was the fact that our population data are only 10 years long (from 2007) and such data do not allow us to study correlations with too many climatic variables. We had therefore had to limit our modelling to a maximum of 2 climatic variables (e.g. average temperature and precipitation in the growing season).

Another limit of wider use of all possible models was the question of the usability of each variant. Our knowledge of plant ecologists did not allow us to assess which of the models was the most correct. In addition, a wide range of emerging models suggested that even their creators do not agree on which model was the right one. That's why we stuck to a conservative approach of using generally accepted models as the most suitable for practical use in our project. Even one data source offered different variants of future developments and gave us the possibility of estimating the uncertainty associated with choosing one particular projection, which we considered to be absolutely sufficient for a specific conservation recommendation based on our results. These data were further used in modeling of critical phases of plant life cycle after management interventions (D1 activity, FR Annex D1.1a, FR Annex D1.1b-d).

A2.2 Habitat quality on particular parts of SCI area

To evaluate habitat quality, we marked at least 10 permanent plots 1x1 m per site and evaluated phytocoenological relevés, list of species, depth of soil horizon, slope, aspect and canopy openness. Close to the permanent plots we collected soil samples to evaluate chemical and physical properties (e.g. nutrients and heavy metal content, water capacity), evaluate amount of biomass litter (needles etc.) and aboveground biomass and placed microclimatic sensor. The autumn and spring aspect of vegetation was evaluated only in 2017. We decided to evaluate the vegetation only in summer since the species composition was the same in each part of year. Additionally, we did not evaluate forest relevés (20x20m) since the vegetation was homogenous and data of phytocoenological relevés were sufficient for our purpose. We supposed that we would put 3 microclimatic sensors (except DK2) on each site, nevertheless because of different types of management interventions, it was necessary to use minimally 2 sensors per intervention per site. We thus bought in the first year 70 pcs of sensors (60 pcs were proposed). Further sensors were bought in 2019 since some of them were destroyed by animal. To avoid other destruction of them, they were fenced.

A 2.3 Set up of plots for interventions

According to evaluation of plant fitness and habitat quality of particular parts, we rearrange the plots for management interventions (MtR Annex A2.1d). We decided to decrease the intensity

of tree cutting (the area was nevertheless the same as proposed). All plots were set up in the field prior to the management implementation to be sure that the marks were visible.

Proposed management interventions were reported as deliverable in the Progress report (PR1 Annex A2.3a, PR1 Annex A2.3b, PR1 Annex A2.3c). Actualized maps of management interventions are attached as a MtR Annex A2.3a for DK1**,** MtR Annex A2.3b for DK2**,** MtR Annex A2.3c for Central part, DK3 and DK4, MtR Annex A2.3d for B1 and B2 and MtR Annex A2-3e for H. Final maps of management interventions are attached as **FR Annex A2.3**.

A3 Enhancement of population size

Foreseen start date: 07/07/2016 Actual start date: 07/07/2017
Foreseen end date: 30/06/2018 Actual end date: 30/10/2020

This action was primarily aimed at enhancement of population size on parts B1 and DK1. Nevertheless, we decided to add population DK2 and DK3. Population DK2 was added to distinguish if the potential low survival or seed germination is caused by methodology or by particular populations. Additionally, the creation of a new population in DK2 was done on particularly shaded parts, which are more suitable for plant survival in context of climate changes. New patch with *M.smejkalii* on suitable part DK3 was done to enhance the area occupied by the species and thus prevent risk of direct destruction of population by animals (e.g. pig).
The population DK1 and DK3 produced very low amount of seeds because of the limited number of individuals. This limitation caused us to have only a limited number of individuals/seeds for enhancement of population size. On the basis of genetic analysis and hybridization experiment we planned establishment of a mixed population on these sites. Nevertheless, after the discussion with NCA we decided to follow the principle of preliminary awareness and did not establish mixed populations on currently occupied sites. We thus continued with seed collection and elongated the action to 30/10/2020. The additional personnel costs were covered by moving the appropriate working capacity of researchers from E1 and E2 activities to technicians and student helpers.
Maps with setting up the plots for population enhancement are attached in **FR Annex A3**.

A3.1 Sowing

The sowing was made only in 2016-2017. The seeds were sown into sowing square plots 0.5m x 0.5m divided into 25 small squares 10x10 cm. The seeds were counted to small bags per 30 seeds. We totally prepared 1944 seeds from DK1, 1432 seeds from B1 and 315 seeds from DK3. To be able to evaluate the success of sowing, we also sowed 5320 seeds on DK2. Prior sowing, we marked sowing plots in the field and removed vegetation from the plots (PR1 Annex A3.1).

A3.2 Planting

The plant transplanting was done between the years 2017-2020. The seeds were germinated on Petri dishes (to maximize the germination rate) as well as directly on the serpentine soil (to select suitable genotypes). The seedlings were transplanted to the pots with the mixture of serpentine substrate from the Bernartice mine and substrate obtained directly in the field after removing the humus layer. Number of obtained individuals in particular years is in the table 1.

	2017			2018			2019		2020	
	Nb. of sown seeds		Total Nb. of juvenile plants	Nb. of sown seeds		Total Nb. of juvenile plants	Nb. of sown seeds	Total Nb. of juvenile plants	Nb. of sown	Total Nb. of juvenile plants
Population	Petri dishes	Soil		Petri dishes	Soil		Petri dishes		Petri dishes	
B1	1349	0	150	250	0	97	x	x	x	x
DK1	1504	0	153	123	98	14	120	7	3000	485
DK2	2537	700	811	x	x	x	x	x	x	x
DK3	459	0	1	x	x	x	1300	223	x	x

Table 1. Nb. of sown seeds and obtained juvenile plants for population enhancement

A4 Ex-situ conservation and reintroduction

Foreseen start date: 07/07/2016 Actual start date: 07/07/2017
Foreseen end date: 30/09/2018 Actual end date: 30/11/2018

This action was delayed because of change in methods for genetic analysis and low number of juvenile plants suitable for hybridization. This action was partly implemented as a bachelor thesis of Jana Vítová (**FR Annex A4a**) and the postdoc internships of Bojana Stojanova, Sissi Lozada-Gobilard and Jinlei Zhu. The results were published in papers: Stojanova et al. 2020 (FR Annex E2.5c), Lozada-Gobilard et al. 2020 (FR Annex E2.5b) and Stojanova 2021(FR Annex E2.5d)

A4.1 Optimization of design of ex-situ population establishment

In 2016 and 2017 we collected leaf samples from at least 20 individuals per population, dried them on silicagel and isolated DNA. Because of unexpected specific sequences in the DNA, we had to change the methodology from microsatellite analysis to NextRAD sequencing. Prepared samples of DNA were sent to SnpSaurus company for sequencing. The results showed that plants from both SCI areas are genetically different and therefore it is not possible to mix them together. In contrary, populations within each SCI area are genetically similar. Concerning these results, the ex-situ population must be established for each SCI area separately, but it is possible to combine seeds from particular populations within each site.

A4.2 Reproduction ability of inter-population hybrids

Hybridization experiment was based on removing the anthers of M. smejkalii and manipulative crossing with pollen from the same individual, same population or other population. Because of low availability of juvenile plants for crossing, we divided this experiment into two years. The results showed that self-crossing as well as out-crossing led to similar production of seeds, which were able to germinate. We therefore decided after discussion with state organs of nature protection, that an ex-situ population will be established from juvenile plants/seeds from different populations in Želivka SCI. Seeds from these plants will be used for reintroduction. Reintroduced population will be thus established also from plants with different origin within a single region.

A4.3 Building a rock outcrop

The rock outcrop was built by the employees of ČSOP in 2016-2017 (deliverable building diary and photos PR1 Annex A4.3). Serpentine rock from Bernartice mine and substrate obtained by management interventions in the field were used. Since we used native soil, many serpentine

species (e.g. *Potentilla crantzii*) started to grow from the seed bank. Since the rock was not completely stabilized, we added an additional mixture of serpentine mine soil and native soil in 2018.

A5 Rescue planting in private garden

Foreseen start date: 07/07/2016 Actual start date: 07/07/2017
Foreseen end date: 31/12/2017 Actual end date: 30/9/2019

The delay was caused by the low interest of people at the beginning of the project**.**

A5.1 Legislative issues

We discussed several possibilities of legal regime to permit the gardeners to keep the *M. smejkalii* plants in their gardens. ČSOP asked for the permission from the Law about Conservation of Nature and Landscape 114/1992 to hold and manipulate with the plants to AOPK for Želivka SCI (MtR Annex A5.1a). It was not necessary to ask separately for Hadce u Hrnčíř SCI since this action was allowed already in permission MtR Annex A1.1a. Currently, the legislative process was based at the beginning on two agreements: 1) gardeners signed an agreement with the CSOP to place the serpentine rocks on their gardens. 2) gardeners sign the convention with the ČSOP about borrowing of plants (PR1 Annex C4.1a, MtR Annex A5.1b). Currently, only one convention is sufficient. All conventions are attached as FR Annex C4.1a

A5.2 Draft of The methodology of rescue planting of *M. smejkalii* and Instruction leaflets for gardeners

To familiarize with the methodology we visited the Swiss company TOPOS (Dr. Karin Marti) and the state authority Amt für Landschaft und Natur, kanton Zurych (Kaspar Spörri) from 12 to 15/6/2017, discussed the methodology of planting, concept of program and work with locals. We also visited the "sampling points" – local gardens, from which plants are distributed to the gardeners and revitalized sites. On the basis of the new information we prepared the draft of the Instructional leaflet for gardeners (MtR Annex A5.2a) and draft of the methodology of rescue planting of *M. smejkalii* (MtR Annex A5.2b**).**

A5.3 Addressing of local people

We first addressed local people on seminars about the project (see E2 action) in Bernartice on 27/11/2016 (attendance 43 people, deliverable attendance sheet PR1 Annex E2.4a) and in Kamberk on 18/02/2017 (attendance 34 people deliverable attendance sheet PR1 Annex E2.4b). Since many people from other organizations dealing with the rare plant species asked us for information about Rescue planting in private gardens, we decided to enhance the number of printouts of leaflets to 500 pcs. and distribute it to people interested in this program on particular actions (PR1 Annex A5.3a). The seminars focusing on Rescue planting were organized as a training course for local gardeners on 19/04/2017 in Kamberk (deliverable attendance sheet PR1 Annex A5.3b). The training was realized continuously prior to transplanting of individuals for gardeners planting individuals from Želivka SCI (deliverable attendance sheet MtR Annex A5.3a).

In 2017, 10 persons or organizations were interested in planting plants from Želivka SCI populations and 3 interested persons for Hadce u Hrnčíř SCI (PR1 Annex A5.3c). Following year only 8 persons were interested in planting plants from Želivka SCI and 10 persons for

Hadce u Hrnčíř SCI (MtR Annex A5.3b). In 2020 the planned capacity (10 gardeners for each SCI area) was fulfilled.

A5.4 Creation of suitable conditions in the private gardens

The serpentine rock outcrops were finished in 20 private gardens, in the Botanical garden of Faculty of Science of Charles University in Prague and in the village square of Kamberk, Pravonín, Libouň, Bernartice, in the garden of Administration of Blaník PA, in the visitor centre Včelí svět and in the Basic, in the village Libouň, Kácov, 3x Kamberk, Bernartice, Hrnčíře, Benešov, Čechtice, in the Botanical garden of Academy of science in Průhonice, kindergarten Christian school Archa Petroupim. The rocks were built on open space with sufficient irradiation. The minimal area was 3x3 m2. The rock was built from stones with different fractions - from large stones, small gravel to fine dust. The large stones were used as a base of rock. This base was filled with gravel and dust. Thismaterial was compacted and covered by 3-5 cm of litter with seed bank form Hadce u Želivky NNM.

C1 Revitalization of habitats

Foreseen start date: 30/11/2016 Actual start date: 01/11/2016
Foreseen end date: 30/06/2021 Actual end date: 30/06/2021

Management interventions started already in 1/11/2016 and were rearranged on the basis of evaluation of plant fitness and habitat quality. The deliverable Photo documentation was attached as PR1 Annex C1, MtR Annex C1 and **FR Annex C1**.

C1.1 Suppression of competitively strong plants

a) Mowing: 6 ha of the Želivka SCI Central part were mown in spring (May and June) and in summer (August and September) every year. In 2018 we started mowing also 0.3 ha on B2. We introduced mulching on 3 ha as a new method as some of the *Calamagrostis arundinacea* bunches could not be sufficiently suppressed by mowing. The mulching had been done only once before mowing. Apart from the regular mowing, 5 ha of CP (Želivka SCI) was mown three times per year as a substitution for forest grazing until 2018. The biomass was raked out and transported to compost.
Totally 6.3 ha, respectively 11.3 ha was mown.

b) Manual removal of expansive plants: The mosses and *Vincetoxicum hirundinaria* was removed from the part DK1 on a total area 140 m2 twice per project. The mosses and grasses were removed on the rocks to allow spreading of serpentine vegetation on area 1700 m2 in DK1, 328 m2 on DK2, 1 ha on DK4, 300 m2 on B1 and 200m2 on B2. Additionally, the tufts of *Sarothamus scoparius* were removed on B1 on area 300m2. To be able to effectively reduce juvenile trees of *Frangula alnus* in the Central part, we decided to remove them manually with the root system every year. Juvenile trees were removed on the whole area 10 ha. The manual removal of expansive plants on DK5 was not necessary since the vegetation was naturaly suppressed by removing trees.

Manual removal of expansive plants was implemented on a total area 11.5 ha.

c) Grazing: The permission for forest grazing was issued on 27/5/2019. Grazing was thus introduced to the Central part twice per year by a herd of 30 sheep since summer 2019 on area 5 ha (**FR Annex C1.1**). The entire grazing area was grazed in mobile enclosures from

electrical networks. This system was chosen for the great unevenness of the terrain. Compared to the situation at the beginning of the project, the motorway administrator replaced the fencing preventing access to the motorway. The old broken fencing was completely replaced by a new solid fence, which is partially buried in the ground. This significantly reduced the risk of sheep escaping on the highway. We added a second barrier - ribbons on a cord - in front of the electric fence to frighten the wild and thus eliminate possible damage of the fence from the outside. Sheeps were grazed in one patch of 0.5 - 1 ha. A second enclosure was constructed next to it and, after grazing, sheeps were driven to it. This was done throughout the site.

d) Experimental suppression of *Calamagrostis* using *Rhinathus alectorolophus*: Since the *R. alectorolophus* is a hemi-parasitic species, it reduces the cover of *Calamagrostis*. Nevertheless, it is not able to parasite on other species occurring on serpentine sites than on grasses from the family Poaceae. This approach was firstly tested on the 3 fenced plots on the periphery of the protected area, which showed reduction of occurence of Calamagrostis. Therefore we sown *R. alectorolophus* on 3 areas in CP. Nevertheless, the forest was too shaded and *R. alectorolophus* had almost negligible germination. The conclusion was thus that this approach is suitable only on open parts of the area.

C1.2 Removal of humus layer (990, 420)

The humus layer was removed by using digger on parts B1 in the bottom of mine and its surrounding on the area 1092 m2, on 6 patches in DK3 (totally 1540 m2), on two forest roads and two old serpentine queries CP of Želivka SCI (8000 m2). One forest road was managed twice since the pulling had been done superficially not to destroy surrounding trees and the non-target vegetation developed again. The second pulling was done intensively to the serpentine background. The humus layer was manually removed on the upper part of B2 (area 1640 m2) and in Hadce u Hrnčíř SCI manually instead of using a digger so as not to disturb the roots of trees. In Hadce u Hrnčíř we thus removed the humus layer with mosses and vegetation on 13 patches, total area 413 m2.
Photo documentation is attached as the deliverable PR1 Annex C1.2 and **FR Annex C1.2**.
Removal of the humus layer was done on area 1.3 ha.

C1.3 Suppression of negative effect of forest management (190,160,162, 990)

On the basis of evaluation of the life cycle of *M. smejkalii* and supposed climatic changes, we decided not to remove trees on parts with south exposition to prevent increasing of temperature and drought. Additionally, the intensive thinning as well as complete removal of trees was replaced by gradual thinning to keep part of each area partly shaded and prevent expansion of *Calamagrostis epigejos*.

The thinning of dense parts of forest and removing of self-seeded trees was done on the almost whole Central part (95%, 11.2 ha) instead of previously selected parts on 4 ha. Trees on the part DK1 were removed from the rocks with occurrence of M. smejkalii, in their surrounding and in jung forest with protruding rock to create gaps suitable for serpentine species on total area 0.3 ha. On part DK2 tree cutting was done mainly on parts near the highway and in the young forests on a total area 1.7 ha. On DK3 expansive non-target trees and juvenile pines were removed on a total area 0.45 ha (half of the total area). Tree cutting on parts DK4 and DK5 was done in very low intensity near the water reservoir in area 0.1 ha

(DK4) and 0.2 ha (DK5). On the part B1 the juvenile trees were removed on the area 0.5 ha and on the part B2 on the area 0.8 ha.

Forest thinning on Hadce u Hrnčíř SCI focusing on removing of Picea between two parts occupied by Minuaria and removing of juvenile trees, total area was 0.6 ha
Photo documentation of action is attached as PR1 Annex C1, MtR Annex C1, and FR Annex C1.

C1.4 Reduction of intensive grazing (976)

At the beginning of the project we put 3 photo traps at the part DK2. The additional two were bought in 2018. The photo traps showed the occurrence of roe deer, fox, hare and wild boar (PR1 Annex C1.4, MtR Annex C1.4a). On the basis of occurrence of these animals the three most grazed rocks were fenced (MtR Annex C1.4b).

C1.5 Building of barrier for cars entry in a part B1 for vandalism removal (740, 251)

After discussion with the owners who refused to place the barrier in the originally planned site, the barrier was placed at a secondary forest path leading to the site B1 from south-west (MtR Annex C1.5). We supposed that the entry of cars to B1 from the asphalt road had been blocked by large stone blocks, nevertheless after the removal of the hummus layer by digger it was not necessary since the barrier appeared naturally.

C1.6 Convention with owners

The convention with the owner Hadce u Hrnčíř SCI – Kamberk municipal - was signed on 24/09/2018 (MtR Annex C1.6). Convention with owner of part Želivka SCI - Bernartice municipality was signed on 07/07/2020 (FR Annex C1.6a) and Forests of the Czech Republic on 29/06/2021 (**FR Annex C1.6b**).

C2 Enhancement of population size

Foreseen start date: 30/09/2016 Actual start date: 01/03/2017
Foreseen end date: 30/06/2018 Actual end date: 31/10/2020

Since the plant population DK1 was too small, it produced a low amount of seeds. We thus elongate this action to be able to obtain sufficient amounts of juvenile plants.

C2.1 Sowing

Sowing was done only in 2017. We totally prepared 1944 seeds from DK1, 1432 seeds from B1 and 315 seeds from DK3. To be able to evaluate the success of sowing, we sown 5320 seeds from DK2 (PR1 Annex A3.1).

C2.2 Transplanting of juvenile plants

Plants were transplanted to nature in autumn 2017-2020. Each individual was marked by an identification label with a number and measured its size prior transplantation to be able to evaluate their survival. Number of transplanted individuals in particular years is presented in

the table below. The photo documentation of plots with transplanted individuals is attached as deliverable MtR Annex C2.2 and **FR Annex C2.2**.

Target site	Number of transplanted individuals				
	2017	2018	2019	2020	Total
DK1	152	14	7	485	658
B1	150	97	x	x	247
DK2	170	x	x	x	170
DK3	1	x	228	x	229

C3 Ex-situ conservation and reintroduction

Foreseen start date: 31/11/2016 Actual start date: 01/04/2017
Foreseen end date: 30/09/2019 Actual end date: 30/09/2020

The delay of action start was caused by delay of A4 action – genetic analysis and hybridization experiment.

C3.1 Initiation of ex-situ protection

Ex-situ protection was initiated by sowing of 2294 seeds (MtR Annex C3.1a). First plant transplantation was done in 2017 by planting 400 juvenile plants from the DK2 population on both serpentine rocks (MtR Annex C3.1b). Nevertheless the rocks were still not stable and many plants dyed in the first year. Therefore we decided to add other individuals in 2018. Since the results of genetic analysis and hybridization experiments showed that it is possible to combine all populations from Želivka SCI, we decided to use plants that originated from seeds from different populations. We thus transplanted 1163 individuals from DK2, 148 individuals from DK5 and 74 individuals from DK4. To enhance genetic diversity of ex-situ population for the future we transplanted in 2020 additional 28 individuals from DK3, 15 individuals from DK4 and 7 individuals from DK5 population, which were obtained by evaluation of seed germination (action D1). Flowering ex-situ population is in the **FR Annex C3.1**

C3.2 Reintroduction of the site B2

Reintroduction by sowing

Since the sowing implemented in C2 action was unsuccessful, we decided to stop this sub-action and reintroduce *M. smejkalii* only by plant transplantation

Reintroduction by plant transplantation

The majority of juvenile plants for reintroduction were obtained from the seeds collected at the ex-situ population. Since the mortality of plants was in the first vegetation season, the seeds were collected in two consequent years. Therefore also reintroduction was divided to two consequent years. The collected seeds were grown in the Petri dishes in the germination box (to maximize the number of obtained individuals) as well as in the serpentine soil in the greenhouse (to keep adaptation). The seedlings were transplanted to the seedling trays (1,5x1.5cm) in the greenhouse. Small plants were in spring to the pots in the garden and prepared for plant transplantation. Plant transplantation was done in autumn 2018 (1225 individuals from DK2 mother plants, 2 from DK3, 69 from DK4, 140 from DK5) and in

autumn 2019 (39 individuals from B1 population, 17 from DK2, 201 from DK4, and 313 from DK5). Totally, 2005 individuals were reintroduced to the B2 part (MtR Annex C3.2, **FR Annex C3.2**)

C4 Rescue planting of *Minuartia smejkalii in private gardens

Foreseen start date: 01/07/2019 Actual start date: 01/06/2017
Foreseen end date: 30/04/2021 Actual end date: 08/03/2021

We were able to start with this project action earlier since the juvenile plants from Želivka SCI as well as some serpentine rocks in the gardens were prepared already in 2017.

C4.1 Establishment of rescue plants in the private gardens

After the signature of the convention about Rescue planting in private gardens (First signature - PR1 Annex C4.1, all conventions FR Annex C4.1a), plants were transplanted to the gardens. Plants were transplanted in 2017-2020 in spring or autumn. Each gardener obtained between 5-150 individuals (see table below). The evaluation of plant survival nevertheless showed that small populations on small gardens are not able to reproduce. We thus enlarged the gardens and transplanted additional plants. One rock - Plants on one rock - Libouň - rotunda were destroyed by high litter produced by neighbouring trees. Therefore we decided to move it to a new more suitable site - Libouň municipality.
Totally, we thus have 20 rocks (10 for each SCI) with 1543 individuals. (FR Annex C4.1b - all gardens).

Serpentine rocks and public interested in ex-situ conservation						
Original site	Name	Internal garden code	Nb. of transplanted individuals			
			2017	2018	2019	2020
Hadce u Hrnčíř SCI	Kamberk municipality	ZP7		50 (spring)		
	Mrs. Zemanová, Kamberk	ZP20				45 (spring)
	Mrs. Zachařová, Kamberk	ZP6		50 (spring)		
	Mr. Otradovec, Libouň	ZP5		5 (spring)	30	
	Libouň - rotunda	ZP4		15 (spring)		
	Libouň - municipality	ZP19			50	
	Mrs Nárovcová, Kamber	ZP12		60		
	The office of Blaník PLA	ZP13		60		
	Pravonín - municipality	ZP14		60		
	Mr. Říha, hotel Hrnčíře	ZP21			71	
	Botanical garden of Institute of Botany, Průhonice	ZP15		150	208	
Želivka SCI	Mr. Smítka, Bernartice	ZP8	50			
	Mrs. Bredová, Benešov	ZP1	50			
	Mrs. Roschelová, Vlašim	ZP11	35		43 (spring)	
	Mrs. Jandejsková, Vojslavice	ZP3	50			
	Botanical garden of Charles University, Prague	ZP10	150			
	Basic and kidergarden chool Archa, Petroupim	ZP2	70			
	Visitor Centre Včelí svět, Hulice	ZP9		10 (spring)	40	
	Bernartice - municipality	ZP18			70	
	Mrs. Michálková - arboretum Kácov	ZP17			70	
	Mr. Hyna, Čechtice	ZP16			51	

C4.2 Development of final methodology and Instruction leaflet

The final methodology was continuously discussed on the face-to-face or on-line meetings of Working groups for rescue planting in private gardens (E2.6). The methodology contains general description of ex-situ conservation (particular approaches, risks, species selection for Rescue planting in private gardens, general organization of Rescue planting, the instruction

for preparation of Rescue planting for particular species, etc.). The final methodology was sent for approval to NCA on 08/03/2021 and approved on 29/09/2021 (**FR Annex C4.2a**). According to our experience with planting Minuartia *smejkalii* in the gardens, the final Instruction leaflet for gardeners was prepared (**FR Annex C4.2b**). We also prepared the model Plan for Rescue planting in private garden for *Minuartia smejkalii* (FR Annex C4.2c)

D1 Revitalization of habitats

Foreseen start date: 01/06/2018 Actual start date: 01/04/2017
Foreseen end date: 30/04/2021 Actual end date: 30/06/2021

The evaluation of habitats as well as plant fitness started the first vegetation season after the management intervention. We used the same plots established in the A2 action and evaluated the same parameters. The results were published in the book Ecology Restoration (FR Annex E2.5g)

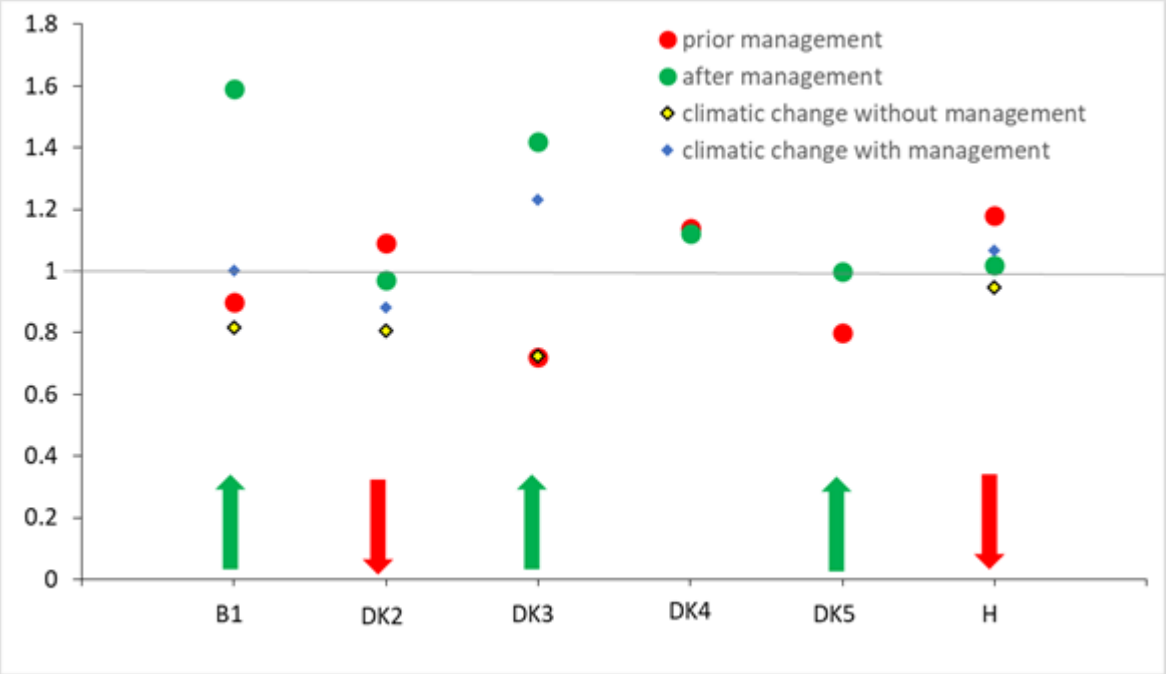
D1.1 Evaluation of fitness of *M. smejkalii on particular parts of SCI areas

The evaluation of plant life cycle was based only on naturally occuring individuals to be able to compare the situation with the years prior plant management interventions. Each individual was marked with a label with a number. Additionally, the position of each plant was marked to the graphic paper to be able to find it next vegetation season.
Every year the number of flowering and non-flowering stems, number of flowers per stem and number of seeds per capsule were counted and plant size was measured. Additionally, seed germination was evaluated.
On the basis of these data we modeled plant life cycle and its critical phases by two different approaches (see **FR Annex D1.1a**). The model was developed in the frame of bachelor, seminar and diploma thesis of Karolína Hrušková (FR Annex D1.1b-d). The model analysed for all populations together shows that the most important phases of plant life cycle are seed production and their survival in seed bank and survival of middle-sized individuals. Based on these results, we up-dated the model to be able to evaluate each population separately. This model was, however, not applicable for the DK1 population because of the low number of individuals. The project led to improvement of the survival of seedlings (now it is not a critical phase of the life cycle) and reproduction (population DK2 - probably due to fencing of rocks). The analyses suggested that for all populations the most problematic phase is survival of adult plants. This is a problem especially on open sites with southerly exposure. Surprisingly, transition between adult plants and seedlings is a critical phase of the life cycle for population B1 and H.

All plants produced seeds with a high germination rate. The highest germination rate 95.6% was observed for population DK4, while the lowest 68.6% in Hadce u Hrnčíř SCI.
We also compared population growth rate (i.e. whether the population is growing - population growth rate is higher than 1, stable or decreasing - population growth rate is lower than 1) prior and after management interventions (see Graph 1). The results showed the management intervention led to enhancement of population growth rate on the populations B1, DK3 and DK5. Especially population B1 and DK3 rapidly increased their number of individuals. Growth rate of population DK5 is above 1, nevertheless the population is very small and therefore very prone to extinction.
In contrary, population growth rate decreased on the population DK2 and H. Population growth rate of DK2 is very low, which means that the population needs additional

management interventions. For DK4 population growth rate has not changed and it is above 1, which indicates that population has a good fitness, nevertheless the observed decrease in plant survival is warning for the future.

The effect of climate changes was possible to test only for population B1, DK2, DK3 and H. The model showed that including longer period of drought should lead to rapid decreasing of population growth rate in all populations and thus to species extinction. We thus suggested additional management interventions (e.g. plant translocation, restoration of forest) to prevent the extinction. Detailed description of models, their results and management suggestion is attached in FR Annex D1.1a.



Graph 1. Population growth rate for particular populations in long-term horizon prior experiment (red dots), after management interventions (green dots), modelled with climate change without management interventions (yellow diamond) and modelled with climate change with suggested management interventions (blue diamond).

Concerning the number of individuals, the project led to rapid increase in some populations, which corresponds with population growth rate. Number of individuals in particular populations is in the table below. Yellow colour indicates the first vegetation season after management implementation. In 2021 we observed a decrease in the number of individuals on almost all sites. This was caused by heavy rains in the vegetation season, which led to the increase of biomass on the sites. In contrary, wet spring and summer led to an increase of individual number on the rock in DK2 population.

Site	population	Number of individuals (without transplanted)						
		2015	2016	2017	2018	2019	2020	2021
Želivka SCI	B1	42	53	87	142	541	574	276
	DK1	5	7	5	4	16	18	13
	DK2	233	255	181	153	102	149	166
	DK3	2	86	105	144	154	132	122
	DK4	43	78	39	29	89	72	58
	DK5	14	39	40	33	14	25	12
Hadce u Hrnčíř SCI	H	183	363	300	348	508	406	368

D1.2 Habitat quality on particular parts of SCI area

Habitat quality was evaluated on permanent plots 1x1m in each site (including Central Part) where management interventions were implemented. Vegetation composition was evaluated in the spring, summer and autumn only in 2017. The results showed no differences in species composition, so we thus decided to evaluate the data only in summer.

To evaluate the impact of **mowing/forest grazing** we put 13 cadges to the Central part as control plots. The results showed that both interventions led to increase of occurrence as well as biomass of target plants (including *M. smejkalii*) and to decrease of occurrence and biomass of high grasses. Mowing had a positive effect on coverage of mosses. Therefore we suggested the grazing as a more suitable method for management then grazing

The **removal of substrate** had a positive effect on recovery on serpentine vegetation only when it was done intensively - to the serpentine bedrock. If the humus substrate is removed only partly, competitive stronger grasses (e.g. *Agrostis gigantea*) start to spread on such sites. Nevertheless the recovery is a long-term process (apr. 4 years) since the serpentine plants are spreading slowly.

The **tree cutting** was done mainly on area B1 (increase of canopy oppenes about 12%), DK3 and B2 (6%). On the other site canopy openness increased about 0.39-4%. The low values are given by the fact that mainly the shrub layer was removed.

Detailed evaluation of habitat quality is described in **FR Annex D1.2a** and the photo documentation of the final state of revitalised habitats is in **FR Annex D1.2b**.

D2 Enhancement of population size

Foreseen start date: 01/07/2018 Actual start date: 20/03/2017
Foreseen end date: 30/04/2021 Actual end date: 30/06/2021

D2.1 Sowing

Germination of *M. smejkalii* seeds in the field was not successful even though we tried several different approaches for working with seeds: sowing immediately after collection, winter stratification, storage in cold/normal temperature etc. The sowing plots were checked every two weeks, but we observed only 14 seedlings in one plot in B1. Nevertheless, the

plants spread on this site spontaneously, we were not able thus distinguish if these seedlings were really from the sown seeds.

D2.2 Transplantation of juvenile plants

Evaluation of transplantation success was based on plant survival and comparison of fitness of transplanted and naturally occurring plants. The survival was high in the first year after plant transplantation (82-95%), nevertheless there was a strong effect of year, when the plants were transplanted and also a high difference between populations. The survival rate decreased in the second year (60% for plants transplanted in 2017 and 50% in 2018) and further in the third year (appr. 30%). Comparing populations showed that the highest survival rate was observed in population DK2 (58.8%), then DK3 (43%) and DK1 (42.1). Plants transplanted to the B1 population had the lowest survival rate - only 13.4%. Nevertheless, these plants produce a very high number of seedlings, which compensate for the low survival rate (MtR Annex D2.2). On the contrary, we found a very low number of seedlings in populations DK1 and DK3. This could be explained by genetic causes (e.g. inbreeding depression) or unsuitable habitat. Therefore the second plant transplantation was moved to the other parts of the area, where the conditions are more suitable then in originally planned parts.

D2.3 Selection of appropriate method

Since the sowing was unsuccessful, we thus suggested transplantation of juvenile plants as a suitable approach for population enhancement in the Methodology of care about *M. smejkalii*.

On the basis of the results the Final report about suitable method for population enhancement was prepared (**FR Annex D2.3**) and in more detail as a manuscript of Alrun Siebenkäs (FR Annex E2.5f)

D3 Ex-situ conservation and reintroduction

Foreseen start date: 01/07/2018	Actual start date: 20/03/2017
Foreseen end date: 30/04/2021	Actual end date: 30/06/2021

D3.1 Evaluation of the genetic diversity of new populations and ex-situ conservation

To be sure if newly established populations have sufficient genetic variability, we took leaf samples from 20 individuals, isolated DNA and evaluated them by the same method as in the action A4. We also decided to analyse genetic variability of enhanced populations (D2) and populations in the gardens to be sure that they are genetically diverse and there is no shift in genotype. The analyses indicate that the gardens are not significantly genetically differentiated from their source populations. The two populations established from a mixture of natural populations are significantly differentiated from each other but not their source. Genetic diversity of the garden and natural populations is comparable. Populations established from the mixture of populations do not show increased genetic diversity.

D3.2 Plant fitness

Ex-situ population

We observed no seedlings germinated from sown seeds. Therefore the population was established only by transplantation of juvenile plants. Nevertheless many transplanted plants were destroyed because of rock instability. The survival rate of the remaining individuals was lower than in nature - only 64% after the first year, 16% in the second year and 8.4% third year. After the rock stabilization prior to second transplantation, plant survival rapidly increased to 91% in the first year after transplantation and 37% second year after transplantation. Seed germination was high - 78.6% and a very high number of seedlings was observed on the rocks.

Reintroduced population

Plants fitness was evaluated according to the same method as in the natural populations. Nevertheless some plants were flushed from the unstable parts of rock by heavy rains. Plant survival was thus evaluated only for remaining plants (i.e with traceable label). The survival rate was high for both transplantation in the first vegetation season (78.2% and 81.6%, respectively. This survival rate rapidly decreased in the second year after transplantation to 59% (for transplantation done in 2018) and 24% (transplantation done in 2019). Third vegetation season was only for transplantation done in 2018 and the results showed that the plants are getting stable - 64% individuals survived. These results were, however, affected by the destruction of part of the area by heavy rains.

Evaluation of plant fitness showed that the majority of plants were flowering and producing seeds. We also observed many seedlings on the rocks. We can thus conclude that the reintroduction was successful. The results were published in the CTSG Book (FR Annex E2.5h) and prepared for publication in scientific journals (FR Annex E2.5f). Final report is attached as a **FR Annex D3**)

D4: Rescue planting of *Minuartia smejkalii in private gardens

Foreseen start date: 1/6/2019 Actual start date: 01/04/2018
Foreseen end date: 30/05/2021 Actual (or anticipated) end date: 30/11/2020

The action started earlier since the plants were transplanted already in 2017.

D4.1 Impact on the population in the area

Evaluation of natural populations showed that the plants are dug out neither in Hadce u Hrnčíř SCI nor in Želivka SCI. We found, however, that 5 individuals were dug out on the rock in the village square in Kamberk in 2019. Nevertheless, it is less dangerous for the population than plant destruction in nature. We informed local people through the mayor and such behaviour diminished.

D4.2 Planting success

Plant growth

The planting success was garden dependent. Three populations went almost extinct (two from the Hrnčíře SCI area and one from Želivka SCI). Therefore, we decided to improve these small rocks and transplant new plants there. Further, the survival rate was dependent on the rigorous observation of rules. The traditional gardeners decided to water plants in the summer (despite being asked not to do so) and therefore had the survival rate higher (almost 100%) then botanical gardens (60.7%) or school Archa (41.4%). generally, larger rocks with more

individuals had a higher survival rate then small rocks. We thus assessed the smallest population size planted in gardens to 40 -50 individuals.

Plant evidence
The plant evidence was too hard for the gardeners. On the basis of this knowledge we decided to transfer the monitoring only to koordinator. Local gardeners will monitor only if the plants are flowering (yes/not) and if there is something strange with population (e.g. high mortality, occurence of pathogens etc).

D4.3 Increased interest about habitat problems

To evaluate increased interest about species, nature conservation and NATURA 2000, we distributed the questionnaire to the local people in the first and last seminar and evaluated their answers. Two seminars were organized at the beginning of the project in Bernartice and Kamberk. We introduced them to project sites and species and distributed questionnaires focusing on *Minuartia smejkalii*, serpentine, nature conservation or NATURA 2000. At the end of the project we organized only one seminar connected with the excursion to the Hadce u Želivky NNM. The inhabitants of Kamberk and surrounding villages were also invited. At the end of the excursion the participants obtained the same questionnaire as at the beginning of the project. Comparison of the interest of people showed higher willingness of participants for filling of questionnaires then at the beginning. Also the majority of answers were correct. This could be nevertheless caused by the fact that the only people interested in the project and nature protection were participants at the excursion.
The results are attached in the FR Annex D4.3

Additionally, public awareness was increased directly by the gardeners involved in the Rescue planting in the gardens in the local villages between their neighbours, friends, relatives, etc. Final report about success of locals involvement to rescue planting is attached as **FR Annex D4.**

D5. Evaluation of ecosystem services

Foreseen start date: 07/07/2016	Actual start date: 07/07/2017
Foreseen end date: 30/12/2020	Actual (or anticipated) end date: 26/02/2021

D5 and D6 actions were subcontracted by the same organization (with a different responsible person for each). The evaluation of ecosystem services was based on more approaches: 1) Mapping and Assessment of Ecosystem Services; 2) The value of particular biotopes (BVM); 3) Energy-water-vegetation method (EWVM)

The report describing the state at the beginning of the project was composed by Doc. Ing. Josef Seják, CsC (MtR Annex D5)

According to MAES, the project enhance the value of cultural and maintenance services. Calculated to economic value, the total amount of ecosystem services is 61 000 CZK per ha per year. The majority of ecosystem services (61.5%) respond cultural and habitat services, the maintenance and provisioning services respond to 38.5%. The willingness to pay for non-economical services as a protection of one plant species of people in USA is 5-100 Dolars per year. The benefit transfer to Czech conditions thus suggests that the rescue of M. smejkalii produce the economic value 437 million per year.

BVM method was based on transfer of the particular biotopes on reference point and consequently to the economic value. The current value of biotopes in Želivka SCI was 447 011 856 CZK, Hadce u Hrnčíř SCI 15 448 062 CZK, while the expected value in 2020 is 491 713 042 CZK in Hadce u Želivky NPA and 16 244 200 CZK.

Energy-water-vegetation method (EWVM) was based on efficiency of solar energy utilization by different habitats. The value of the Hadce u Želivky NPA is 714 679 442 CZK and Hadce u Hrnčíř SCI 69 419 900 CZK. Since one of the project actions is aimed at thinning of the forest, the expected efficiency after the project realization is decreasing.

The final report was based on the same methods and used real changes in biotope quality and biodiversity. Using the BVM, it was found that rescue measures in the affected forest habitats of Peri-Alpidic and Boreo-continental serpentine forests near Želivka river improved their quality as a specific environment for specific serpentine species by up to 12%, which in monetary terms represent an increase in their habitat value by CZK 42 million on 34 hectares. At the Hadce u Hrnčíř NPP, where there are production forests, a slightly smaller improvement in the quality of habitats was achieved by up to 10%, which represents an increase of CZK 1.7 million (from CZK 17.3 to 19 million in 2.8 ha). **One Euro of EU project contribution has brought Euro 2.3 in higher biodiversity quality of serpentine pine forests as habitats for survival of critically endangered *Minuartia smejkalii* species**. On the other hand, the rescue of a competitively weak species, tied existentially to serpentine outcrops, and the mere maintenance of an environment for the existence of endangered serpentine herbs, have some ecosystem service costs. The ecological costs (in addition to the own investment and operating costs of the rescue project and other projects) is a certain reduction in the rate of useful use of solar energy compared to the vegetation of competitively successive stages. If the highest rate of useful use of incoming solar energy is shown by natural climax vegetation, which can usefully use up to 2/3 of its potential and transform it into climatically and thermally favourable living conditions for the existence of humans and other heterotrophic life forms, then humanity will have to take responsibility for reducing the rate of solar energy use caused by anthropologizing the natural landscape or by returning succession phases back. The estimated change in the rate of efficient use of solar energy in the areas affected by the project is evaluated by EWVM (Seják et al. 2010, 2018b). With the removal of 2,66% of living biomass at Hadce u Želivky, the annual four ecosystem services (climatizing and water retaining services, oxygen production, habitat for biodiversity) decreased by 2.2% from CZK 565 to 550 million/year, ie. by CZK 15 million/year, on an area of 34 hectares. When 2,2% of living biomass was removed at Hadce u Hrnčíř, the annual four ecosystem services decreased by 2.2% from CZK 47.4 to 46.4 million/year on an area of 2.83 ha, ie. from CZK 1,677 to 1,640/m2/year.
Additionally, a nationwide contingent valuation questionnaire survey to reveal the willingness of the Czech citizens to pay for the rescue of a critically endangered species of *Minuartia smejkalii* was conducted. Out of the total number of 1084 respondents, a total of 746 respondents showed a positive willingness to pay for the rescue of the *MS*, 338 respondents stated zero willingness. Out of the total number of 746 respondents with a positive willingness to pay, a total of 629 respondents expressed their willingness to make a one-time payment with an average of CZK 405 per respondent. With the lowest average one-time payment of CZK 405 per respondent, the amount of the declared willingness to pay for the rescue of the *MS* would reach the value of CZK 1.22 billion, ie. **64 times the funds invested** in the LfM project.

Since the final report contained some mistakes, we were asked by the Agency to correct it. The corrected version is attached as **FR Annex D5**.

D6. Evaluation of socio-economic impact

Foreseen start date: 07/07/2016 Actual start date: 07/07/2017
Foreseen end date: 30/12/2020 Actual (or anticipated) end date: 26/02/2021

The report describing the state at the beginning of the project was composed by Ing. Jakub Vosátka, Ph.D. (MtR Annex D6).

The study evaluated the current socio-economic situation on both areas and estimated the potential impact on particular areas. The project had an impact on tourism, business, employment, engagement of general public and institutions, connection of scientific organizations and organizations dealing with nature conservation. Socio-economic impact of Minuartia alone was very low, nevertheless the protection of sites and enhancement of knowledge about its importance and rarity between local people led to enhancement of attractiveness of the regions. Similarly, the impact of rescue planting in private gardens was an important aspect not only on local level, but also on national level.

Final report identified following significant quantifiable socio-economic impacts of the project:
Tourism impacts - at least 23 tourist attractions have been created. It is assumed that the project contributed to the annual sales increase in the Water House by 27 % from 2016 to 2019.
Business sphere impacts - it is assumed that the project will create a total of 104 contracts with a total value from € 143,787 to € 227,947 until its completion.
Revenues and expenditures of research organizations impacts - two researchers (Institute of Botany of the Czech Academy of Sciences and Czech Union for Nature Conservation Vlašim) had a net financial benefit from the project in the minimum amount of € 251,945 and € 221,212. As expected, the third researcher (MŽP) was a financial donor with a net balance of € -90,613.
Employment impacts - up to 17 job positions (full or part time jobs) were created in the total amount of 6.86 to 7.94 positions with full time working hours.
Nature care plans costs impacts - The total increase in costs in the care plans of both IPAs related to the protection of the Minuartia is expected to be at least CZK 123,000
Information and education of the population impacts - at least 26 information, promotional and educational events were organized. It is estimated that these actions could have had a direct impact on 1,500 inhabitants and an indirect impact on up to 150,000 inhabitants. In total 8 institutions / municipalities were involved in awareness-raising events.
Regional identity and development of gardening impacts - 11 private gardeners and 9 institutions or municipalities participated in the rescue cultivation program.
Since the beginning of the project, compared to previous experiences, **no case of black dump creation or vandalism** (collection of plants from localities) was recorded.
Increased cooperation of institutions for environmental protection - cooperation of at least 13 public or non-profit entities was implemented, resulting in at least 33 joint events (seminars, workshops, conferences) were held.

Thus, although the main goal of the project was primarily focused on the rescue of the Minuartia plant, **many positive ecological, economic and social impacts on the entire region have been identified**.

The study also evaluated the transfer possibility of private gardens rescue program methodology to other EU countries. However, being inspired by the Swiss experience, the project implementation proves the transfer possibility by itself. The study gave examples of how the methodology used in the Czech Republic coincided and differed from the Swiss model. Subsequently, the study concluded that the **methodology** (with necessary modifications) **is transferable into other EU countries**. This conclusion was already assumed from the beginning, as it was one of the intentions incorporated into methodology creation. By transferring this new approach from Switzerland to Czech Republic, our country was the first one in the EU where the methodology was successfully transferred into.

Detailed description of socio economic impact is attached in **FR Annex D6a** (in Czech) and the summary in **FR Annex D6b** (in English).

E1 Enhancement of public awareness

Foreseen start date: 07/07/2016	Actual start date: 07/07/2017
Foreseen end date: 31/12/2020	Actual end date: 30/06/2021

The deliverable Other suitable species for ex-situ planting selected (FR Annex E2.6) is in the approved list of deliverables wrongly placed in E1 action, nevertheless, it should be a part of E2.6 subaction (it is milestone there)

E1.1 Preparation of promotion items

The project logo was selected and the milestone fulfilled on 16/11/2016. The preparation of promotion issues was done continuously. In contrary to promotion issues planned in the project proposal, we decided to rearrange the particular items and use local natural sources, such as serpentine, pictures of landscape or plants. This change was approved in Progress report 1. Since we were not able to find a suitable producer of serpentine representative jewels, we decided to shift the planned budget to the DIY jewel. This change was approved in the MidTerm report.
Photo documentation of T-shirts, cups (produced by sheltered workshop) and information leaflet are attached as (PR1 Annex E1.1), posters, postcards, DIY jewel and the information leaflet about *M. smejkalii*, its localities and the project are attached as MtR Annex E1.1. DIY complete packet with project information is attached as **FR Annex E1.1a**. Photos of posters, postcards and stickers are attached as **FR Annex E1.1b**. Postcards, posters, stickers, t-shirts and cups are distributed personally by the project team to cooperating institutions, partners and at the public events or education programmes. Sets with DIY serpentine jewels and postcards are distributed to visitors of the SCI Information Centre Vodní dům by the staff. Detailed production and distribution of promotion items is describes in FR Annex E1.1c.

Promotion issues were very popular, especially DIY jewels, t-shirts, cups and posters. T-shirts serve also as dissemination tools - other people ask spontaneously for information about species and projects. The species also inspired other people, e.g. jewelers - Mrs. Kudláčková, who produced flowers of *M. smejkalii* as a set of jewels. We thus consider this

action as useful for not only enhancement of public awareness, but also for dissemination of project results.

E 1.2 Website, social media

The domains www.kuricka.cz (2762 unique visitors so far) and www.sandwort.eu (236 unique visitors so far) were registered and the milestone thus fulfilled on 20/09/2016 (PR Annex E1.3a and b). Websites were adjusted according to the findings of the last monitoring visit and both Botanical Institute and ČSOP Vlašim continued to update it regularly. The Ministry of Environment assisted with translations for the English website.The sites will be updated according to modern requirements for mobile responsibility in December 2021 and are going to be used for follow-up projects.

On social media at facebook.com/kuricka, engagement has increased, in six month (April - September 2018), total daily reach of the site's activities reached 8092 users.

On social media at facebook.com/kuricka, total daily reach of the site activities reached 4 275 users. (January 2019 - September 2021). Due to the change of the advertisement and analytics system of Facebook (Facebook Ads -> Facebook Business), there is no data before January 2019, anymore.

Virtual photogallery of the project was set up at https://www.zonerama.com/Kuricka with a total of 1137 visits so far.

Linked-in profile was created at https://www.linkedin.com/company/life-for-minuartia. We use it to attract students to work on the issues linked to the LIFE for Minuartia project in their thesis. The number of connections was lower than expected. This was probably caused by the fact that scientists started to use ResearchGate instead of Linked-in. We thus disseminated information about the project also via ResearchGate.

Social media, mainly FB, had a large impact on contacting people, spreading information about organized actions etc.

E1.3 Environmental education programs for schools

In March 2018, the first educational programme "Get to know SCI Želivka" started to be offered to pupils of 3rd - 5th grade of basic schools, the first run took place in May. The programme takes 60 minutes, it presents the species of European interest in SCI Želivka and includes a commented excursion to the Švihov dam as well as a show of feeding a bat. The programme ran 15 times with 386 pupils so far (MtR Annex E1.3a).

In November 2018, the first run of the second educational programme "Natura 2000 and nature protection" took place. It is aimed at pupils of 7th - 9th grade of basic school and takes 120 minutes. It presents wider nature protection perspectives and methods illustrated at the example of Minuartia and also presents other protected species. New information is tested in a game called Risk!. Three runs of the programme took place with 69 pupils so far (MtR Annex E1.3b).

The running of education programs was interrupted due to COVID-19 from 14.3.2020 till 12.5.2020 and again from 12.10. till 4.5.2021.

The first education program had a strong impact on students since it is very popular. It is a big opportunity to teach the students by using the ex-situ culture of *M. smejkalii* as well as interactive elements. The second program had a lower impact, since the school does not reserve it. We will evaluate the reasons for low interest and update it to get more popular.

E1.4 Enhancement of tourist activities on particular sites

a) Notice boards:
Installed notice boards were updated according to the Agency requirements, the additional costs were paid from the institutional budget of ČSOP. Photo documentation of original notice board in Kamberk and Ecocentre of ČSOP Vlašim is attached as PR1 Annex E1.4, updated notice board and notice board in Vodní dům and in Průhonice nearby a serpentine rock with the ex-situ population (MtR Annex E1.4a).

b) Tourist information point were built in proximity to the DK3 and information panels were placed on the walls. The wooden structure is used regularly by cyclists. We are using the information panels to explain the project and *Minuartia* protection during site trips (MtR Annex E1.4b). In 2019 the large serpentine rock was placed prior to the tourist point to demonstrate the serpentine stone to the tourists.

In the proximity of notice boards, selected project sites as well as tourist information point, the geocaches were placed. They create a series, which guide the visitors across both project sites as well as selected rocks with *Minuartia*

c) Information panels. At the beginning of the project we created a roll-up to present the project on different events in the Czech Republic. We decided to place the information panel instead of B1 part to the tourist information point, which is more frequently visited (MtR Annex E1.4b). The second information panel was placed near the forest tourist road in Hrnčíře SCI (FR Annex E1.4b). Other information panels were placed near gardens with *Minuartia smejkalii* (totally 9 pcs. FR Annex C4.1b). Guest books were placed in the caches near information panels.

d) Interactive panels in the Visitor Centre of Želivka SCI - Vodní dům. Totally 4 interactive elements were was placed in the external exposition of the SCI Visitor Centre - Vodní dům
- collection of 3 serpentine stones with grinded surface and images of *Minuartia smejkalii*, *Potentilla crantzii subsp. serpentini* and *Armeria vulgaris subsp.serpentini* cut into the grinded surface (MtR Annex E1.4c). Children can use paper and pencil to make a "frottage" - copy the plants from the stones to paper. This interactive element is used during education programmes.
- serpentine stone with grinded structure with explanatory table (FR Annex E1.4c)
- metal sculpture of Minuartia flower with explanatory table (FR Annex E1.4d).
- book Jak šel čas s kuřičkou (FR Annex E1.4e)

We put an interactive geocache near Vodní dům. The visitors find the answers to questions in the external exposition and collect the final GPS coordinates of the cache.

All information as well as interactive panels are actively used for organization of excursion or education. Additionally, according to comments in the logbook in geocaches, people are able to understand the information on the panels, since they are written simply and clearly.

e) Propagation of both SCI areas

Both sites were included in the program of soft tourism Kraj Blanických rytířů (milestone PR1 Annex E1.5). Since the Hadce u Hrnčíř NM is a very small area and also the population of *M.smejkalii* is occurring only on small patches, enhancement of touristic activity could lead to its destruction. We thus focused mainly on propagation of Hadce u Želivky NNM, nevertheless, the second area was mentioned. Propagation of web and social media was connected with propagation of the Visitor centre Vodní dům, which was more effective. Additionally, we prepared a short film about the project, which was used as an on-line excursion for the final conference and will be used in the future for propagation of area as well as management approaches since it contains instruction for management.

f) Competitions

The first competition ran in 2017 as a part A-fest – Scientific track. The participants evaluate the life cycle on model sites and estimate the most critical stage. At the end of competition the winners obtained the promotion materials. The total attendance was 200 people.

29/09/2018 we organized competition within the workshop "Drátkování s hadcem". The competition was based on a quiz focusing on the relationship of presented serpentine jewellery, natural rock serpentine rock and Minuartia smejkalii. The winners obtained small pieces of natural rock and promotion materials (cup, T-shirt). The attendance was 160 people (information about action: FR Annex E2.4g).

In February 2018 two competitions for pupils of basic and middle schools were launched: Fine Arts Competition and Creative Writing Competition. The topic of competition was: Natura 2000 and nature in the Czech Republic. About 41 participants sent their pictures to the Fine Arts Competition and 20 pupils participated in the Creative Writing Competition. Winners were awarded project T-shirts, cups and free tickets to visit the SCI Visitor Center and Průhonice Park. More details at: http://www.kuricka.cz/aktuality/detail/2026

The competitions were very popular, many children took part in them. Even if they were successful, we are not able to evaluate the direct impact of them on enhancement of children's awareness. The competitions in February 2018 were based on independent searching of information, which is not possible to evaluate. In contrary, other competitions were based in direct contact with the project team. The people thus obtained the information about species and project, but the long-term impact is not possible to evaluate.

g) Thematic afternoon for general public

Thematic afternoon "Den s kuřičkou" was organized in the Visitor Centre Vodní dům on **23/11/2019**. The afternoon started by a guided visit of inner as well as external exposition of Vodní dům, where the participants obtained information about project LIFE, nature conservation and history of SCI area. After that participants moved to flooded bridges in Sedlice bay and to one project site (DK3), which is accessible to the public. Participants saw management interventions and natural as well as transplanted individuals of *Minuartia smejkalii*. The attendance was limited to 43 participants. Similar thematic afternoon was organized on **13/06/2020**. The participants visited part DK3, DK2 and Central part and obtained information about the project, serpentine phenomenon, *M. smejkalii*, nature conservation and NATURA 2000. There were 13 participants.

Thematic afternoons were successful, mainly the first one since it was connected with the excursion to flooded bridges in Sedlice bay. The second afternoon had lower attendance since

it was organized during the first loosening anti-epidemic measures and people were still very cautious.

h) Photo exhibition in the Visitor Centre Vodní dům was planned to be a part of the thematic afternoon, but we decided to keep them separate, because the program of thematic afternoon was very intensive and participants should thus have only limited time for exhibition. Therefore the exhibition was running in February 2020. Photos from the exhibition are attached as a FR Annex E1.4f.

E1.5 Seminar Economic utilization of NATURA 2000 sites

Seminar took place on 9.11.2018 in the environmental education centre Sluňákov at Olomouc. During the preparatory discussion, we decided to focus the seminar especially at the questions of use of Natura 2000 for promotion of sustainable tourism.
Nature protection professionals, especially from visitor centres, who can promote Natura 2000 species and sites participated. Experience of ČSOP Vlašim promoting SCI Želivka and *Minuartia smejkalii* as well as experience of the central office of the Agency for Nature protection with promotion of nature-oriented tourism were presented.
Several topics linking sustainable management of Natura 2000 and economic utilisation were discussed:
- How to regulate exceed of visitors at the SCIs endangering the target species
- How to promote SCIs and species which are not accessible to public
- How to improve the public image of nature protection
- How to link existence of SCIs with local business activities

26 participants took part in the seminar (MtR Annex E1.5). Representatives of Ministries of Industry and Trade and Regional Development as well as agencies promoting economic development (CzechTourism, CzechInvest) were invited but unfortunately turned the invitation down despite prior expressions of interest.

The seminar was interesting, people appreciated our methods of regulation of touristic activity on sites with banned access such as organization of official excursions, direction to accessible parts etc. Unfortunately, the absence of invited representativeness did not allow to demonstrate this approach to politics. Nevertheless, it met our expectations and the goals for which it was organized.

E2 Active dissemination of project results

Foreseen start date: 01/01/2017	Actual start date: 05/09/2016
Foreseen end date: 30/06/2021	Actual end date: 30/06/2021

The action started earlier because of the Kick-off meeting (E2.2). The deliverable Photos for exhibition is fulfilled as **FR Annex E1.4f** since the exhibition was considered as part of enhancing public awareness. It is in the approved list of deliverables wrongly placed in E2 action.

E2.1 Networking with other LIFE

We are in close contact with all Czech LIFE projects focusing on similar habitats (e.g LIFE09 NAT/CZ/000363, LIFE12 NAT/CZ/000629, LIFE16 NAT/CZ/000639, LIFE17

NAT/SK/000589, LIFE16 NAT/CZ/000001 and especially LIFE Corcontica LIFE11 NAT/CZ/000490 in the Giant Mountains (Krkonoše) and LIFE Orchids (LIFE17 NAT/IT/000596). From 28/08/2018 to 30/08/2018 we made a field trip to the LIFE Corcontica LIFE11 NAT/CZ/000490 in the Giant mountains (Krkonoše). We visited sites of Minuartia concortica as well as managed sites of Gentianella praecox subsp. bohemica. We visited project sites with grazing management and interviewed 5 farmers. Meeting took place in Děčínská bouda farm participating in the project. With the project employees, we shared experiences with inclusion of local residents into nature protection projects, ex-situ and in-situ flora protection and we discussed future cooperation in preparation of LIFE and other projects. Robin Bohnish, the Krkonoše National Park director as well as Ing. Václav Jansa, vicedirector and LIFE project leader were present (MtR Annex E2.1). The meetings with LIFE Orchids are organized on-line and we participate in them regularly. This cooperation will continue in the frame of project LIFE South Moravia. Further we are in contact with foreign LIFE projects (e.g. LIFE Herbages – LIFE11 NAT/BE/001060, LIFE European Red Lists LIFE14 PRE/BE/001 (they visited Institute of Botany 25/01/2017), FRESHABIT LIFE14 IPE/FI/000023, Hydrology LIFE LIFE16 NAT/FI/000583, LIFE Saimaa Seal LIFE12 NAT/FI/000367) and HORIZON projects dealing with climatic change e.g. ERC Formica (ERC Starting Grant 757833). As a result of networking, a COST project OC-2018-2-23140, An integrated approach to conservation of threatened plants for the 21th Century was prepared (main beneficiary Dr. Živa Pečnikar, Slovenia). From 2021 we are in close contact with LIFE16-GIE_EE_000665 NaturallyEST: Piloting Natura2000 communication in Estonia. We cooperate in communication of rare species rescue to the general public in the frame of Citizen Science and plan other cooperation with University of Tartu (e.g. https://nurmenukk.ee/en)

E 2.2 Kick-off meeting

was held on 06/10/2016 in Bruxelles

E 2.3 Layman's report

Layman´s report (**FR Annex E2.3**) was printed in Czech and English language (1000 pcs.) Layman´s report was distributed to stakeholders, municipalities, state organs of nature protection, members of working groups, project partners, projects in our network, etc. The rest will be distributed during diverse actions, e.g conferences, seminars, project meetings etc. Layman´s report received positive feedback since it is well-arranged, contains demonstrative photos, text is simple and comprehensible.

E 2.4 Dissemination of project results to the general public

At the beginning of project the knowledge about the importance of *M. smejkalii* and serpentine phenomenon was very low. People rather considered its occurrence as a burden. Nevertheless, even the first seminars had surprisingly very high attendance. We thus added some extra activities to enhance the awareness. These activities were run as part of nationwide events and thus had extensive propagations and generally organized in the Visitor Center Vodní dům to attract other people and increase the reach of the action.
During 4 years the awareness of the local public increased due to not only our activities, but also spontaneously from people included in Rescue planting in private gardens. We obtained this information from the mayors as well as in the responses in questionnaires. We are not able to measure the direct impact of publications or TV/radio outputs, nevertheless, we

obtained positive feedback from people from the other parts of the Czech Republic asking how they could be involved in the Rescue Planting in private gardens.

a) Discussion with locals:
First seminar was organized on 27/11/2016 in Bernartice, attended by 43 people (PR1 Annex E2.4a) and on 18/02/2017 in Kamberk with 34 people (PR1 Annex E2.4b). The participants obtained a questionnaire about *M. smejkali*i, serpentine, nature conservation and NATURA 2000.
On 18/05/2018 a site excursion to the SCI Želivka took place for gardeners, members and partners of ČSOP Vlašim (see MtR Annex E2.4a).
On 18/06/2021 we organized a seminar connected with the excursion to the Hadce u Želivky NNM. The inhabitants of Kamberk and surrounding villages were also invited. The people were apprised with the project and its results. We also discussed activity after the project end. Generally, the seminars as well as excursions get very popular in the community. Participants obtained the same questionnaire as at the beginning of the project to assess the raising of awareness. There were 12 participants.

b) Media outputs:
Information about project were reported in many media:
journals

- Journal Botanika PR1 Annex E2.4c
- Benešovský deník PR1 Annex E2.4d, PR1 Annex E2.4e, **FR Annex E2.4d**, **FR Annex E2.4g**
- press release PR1 Annex E2.4f
- Jiskra Benešov FR Annex E2.4a
- 21stoleti.cz FR Annex E2.4b
- Pod Blaníkem MtR Annex E2.4b
- AΩ Věda pro každého **FR Annex E2.4c**
- Ekolist - **FR Annex E2.4e**
- Agris - **FR Annex E2.4f**
- Veronika - **FR Annex E2.4i**
- Fórum ochrany přírody - **FR Annex E2.4h**

TV/Radio outputs

- Participation of pupils of MŠ a ZŠ Archa Petroupim in the project was covered by the Czech Television: http://www.ceskatelevize.cz/ivysilani/10265744641-zpravicky/218411000160110
- Academy of Science prepared a promotion spot: https://www.facebook.com/ceskaveda/videos/1533204230134694/
- The Czech Radio Junior covered LIFE for Minuartia event - part of Science Fair of the Academy of Science: https://youtu.be/jzWTaHGfKNo
- The TV-report in magazine The Czech Science was prepared: https://www.youtube.com/watch?v=UqIQrnL6Z74 The report was further published in these media: TV Kinosvět, TV Noe and Aktuálně.cz
- short video about the LIFE project, implemented management interventions and Minuartia smejkalli as an on-line excursion for the final conference. The video will be used also after the project end as a replication tool.

Extra activities:

Thematic weekend for the general public was organised on 10 - 11/11/2017 in the Vodní dům as part of the 2018 **Science fair** (http://www.veletrhvedy.cz/cz/). Visitors learned and experimented botanical research methods in protection of Natura 2000 sites and Minuartia in games, short lectures and assisted workshops. More than 100 visitors visited the weekend.

LIFE for Minuartia was presented at the **Veletrh vědy** (http://www.veletrhvedy.cz/cz/) held on 8.-10.6.2017 (17 000 visitors) and 07-09/06/2018 in PVA EXPO Praha – Letňany (24 000 visitors).

E 2.5 Dissemination of project results to specialists

Dissemination of project results to specialists was an important part of the project. We focused mainly on state organs of nature conservation, forest managers or scientists dealing with rare species. All actions led to enhancement of knowledge about the methods of management and care about species. The specialists were interested in the project and therefore we took part in additional actions. These additional actions came from the interest of other organizations in the project. Concerning presentations, they were aimed to Rescue planting in private gardens. The excursions were aimed at management interventions on serpentine areas, mainly forest grazing, removal of humus layer. One important output of these actions is the expression of interest of forest managers from the Forest of the Czech republic in the official method of care about serpentine forests. This method will be prepared in the following project supported form Norwegian found. The scientists were also interested in the project - we had a lot of requests for internships and included M.smejkalii as an important plant in the international COST action Conserve plants.

a)Management plan for Hadce u Hrnčíř SCI was approved on 06/04/2020. The approved management plan is attached as **FR Annex E2.5a**. The management plan incorporates the experience with management of serpentine habitat and species. The main benefit is enhancement of mown area and soil surface disturbance.

Methodology of care was updated according to the new knowledge and sent to the NCA (**FR Annex E2.5q**). It concludes the knowledge about genetic, hybridization, ex-situ conservation and suggests Rescue planting in private gardens as a suitable method for ex-situ conservation.

b)Workshop "Working with the public in ex-situ plant conservation was held on 18/06/2021. During the workshop possible utilization of Rescue planting in private gardens for other species was discussed. The attendance was 25 participants from different organizations. Attendance sheets and photos are attached as **FR Annex E2.5r**. The seminar had surprisingly high attendance since it was organized at the peak of vegetation season. The interest in participation was higher than at the beginning of the project. At the beginning of the project people solved the concept of the program - if it will be feasible with Czech people. Currently, the discussion moved to the questions, which species could be selected, how to teach the gardeners etc. Each participant obtained the information leaflet. Nevertheless, we are not able to assess the direct impact of the workshop, since it will be manifested in the future.

c) Scientific publications: 6 publications were already published in Journal for Nature Conservation (**FR Annex E2.5b**), Conservation genetic (**FR Annex E2.5c**), Preslia (**FR Annex E2.5d**), Ecological Restoration (**FR Annex E2.5g**), Global conservation translocation perspectives: 2021 (**FR Annex E2.5h**) and Ecology and Evolution (**FR Annex E2.5e**) One prepared as a manuscript (**FR Annex E2.5f**)

d)Presentation of project results on scientific conference: The project results were presented on the46th Annual Meeting of the Ecological Society of Germany, Austria and Switzerland, "150 years of ecology – lessons for the future as a poster in 2017 (PR1 Annex E2.5), 5th European Congress of Conservation Biology in Jyvaskyla both as a poster and talk in 2018 (MtR Annex E2.5a), 49th Annual Meeting of the Ecological Society of Germany, Austria and Switzerland, "Science meets practice" as a poster and talk (FR Annex E2.5i) in 2019, 32rd Conference of the Plant Population Biology, Section of the Ecological Society of Germany, Austria and Switzerland (GfÖ) (as a talk, paid from other sources) in 2019, Botany 2020 (**FR Annex E2.5j**) and final conference as posters and talks (**FR Annex E2.5k-n**) in 2021.

e) Final international 3 day conference was organized on-line in the frame of 33rd Conference of the Plant Population Biology, Section of the Ecological Society of Germany, Austria and Switzerland (GfÖ). The conference started by the section of LIFE programme, the section was introduced by the delegate of MoE as a national contact point for LIFE programme. He introduced the programme - its aims, currently ongoing and past project and opportunity for collaboration. Special attention of this section was given to ex-situ conservation (talks of Zuzana Münzbergová and Hana Pánková). During the whole conference a special room focusing on the LIFE programme was opened (managed by MoE). The rest of the conference was aimed at the Biodiversity and ecosystem functions, (Epi)genetics in plant adaptations, Plant-animal & soil & belowground interactions, Plant performance and physiology and Global change. The project results were presented in the sections Biodiversity and ecosystem functions as a poster (FR Annex E2.5k), Community and population dynamics (FR Annex E2.5l and FR Annex E2.5m and FR Annex E2.5n). See abstract book **FR Annex E2.5o**.
Total attendance was 170 participants.
The conference was a very useful tool for dissemination of project results to scientists. They were interested mainly in the connection between science and practice and involvement of local people to species protection.

f) Instruction leaflet on involvement of local people in ex-situ conservation (FR Annex E2.5p) was printed in May in the volume 100 pcs and distributed mainly during the workshop "Working with the public in ex-situ plant conservation" to the NGO, stakeholders, state organs of nature protection. People were interested in them and evaluated it as a useful tool for adoption of method for other species since it is written as an instruction on what to do if we would like to establish Rescue planting in private gardens for other species.

g) Seminars about ex-situ conservation: The seminar was organized in the Kindergarten and Basic school Archa Petroupim on 25/09/2017 (attendance 25 students) and 19/10/2018 (attendance 80 people - students and their parents, teachers) and for university students on 05/02/2020 in the frame of COST meeting in Institute of Botany, CAS (attendance 88 participants). The seminars were interactive, mainly in the school. The students had the opportunity to touch the species and discuss its growth and care about them. The University students were more interested in methods and risks of ex-situ conservation and their long-term maintenance. .

Additional actions:
Presentations:

- Presentation of project results to botanists of AOPK (01/06/2017, Svatý Jan pod Skalou, 5/3/2020 in Kouty by Ledeč nad Sázavou)
- Meeting of people dealing with rescuing of rare plant species (11-13/09/2017, Krásná Lípa, 10-12/04/2019 in Vápenky)
- Conference of Botanical gardens, Prague (10/04/2018)

Field excursions:
- 23/05/2018: forest managers of the forest direction Světlá nad Sázavou
- 20/10/2018: organization Zvonečník and Platform for Landscape, attendance appr. 50 people

E2.6. Expert participation in ex-situ conservation in private gardens

The first meeting was organized on 24/06/2017. The regular meetings were organized twice per year. Between meetings and in time of COVID-19 regulation, the program of rescue planting in private gardens was solved by email or by on-line meetings. We identified some juridical questions, which were solved by the lawyers of NCA and MŽP (deliverable MtR Annex E2.6). The first question was connected with the protection of the second generation of the plants. Since these plants were not protected by the law, it was necessary to prohibit the trade or their donation in the convention with the gardeners. Second question was about ownership of plants since there was discordance between civil law (the owner of the garden is normally also the owner of the plant) and Law on Conservation of Nature and Landscape (owner of the plant is the holder of permission, in this case different from the owner of the garden). Finally, we prepared with the lawyer of NCA conventions, where the care about plants is specified and actions such as trade or donation prohibited. Since this contract is voluntary, it is supposed to be respected. Additionally, the NCA decided that it will be the holder of the permission and this permission will be transferable to the regional coordinator and gardeners via signed conventions. The final solution is attached as **FR Annex E2.6a**. Concerning selection of other plant species, we started with discussion about the main points, standards are the species rarity, existence (or planning) of the rescue program or regional action plan, knowledge about species biology, possibilities of planting, availability of seeds and attractiveness for gardeners. Additional standards are , existence of regional coordinator, reasonability (species reintroduction, need of ex-situ population). We selected these species (project deliverable **FR Annex E2.6b**) *Artemisia pancicii, Jurinea cyanoides, Adenophora liliifolia, Tephroseris aurantiaca, Tephroseris longifolia subsp. Moravica, Sedum hirsutum* etc.

6.2 Main deviations, problems and corrective actions implemented

Forest grazing

During the processing of the permission, from the Forest law, a new legislative barrier - the Water law (Regulations no. 254/2001 Code) was identified. Forest pasture is not a very common approach in the Czech Republic and neither us, nor Povodi Vltavy, a.s., manager and operator of the drinking water source, were clear about how drinking source protection zone rules would be applied. We applied for an official permission with unrestricted time validity according to the Water Code 254/2011 Coll. to the Central Bohemia regional authority. Consent of the operator Povodi Vltavy is a necessary condition in this process. Finally, Povodi Vltavy and us came to an agreement on how to allow sheep pasture at the site in a meeting. We therefore asked again for official agreement with forest pasture to Povodí Vltavy. One of the

conditions of the permission was that all personnel responsible for the pasture entering the protected zone was registered and listed in the permission document itself. We thus shifted the appropriate budget from external assistance to personal cost, travel cost and equipment.We applied for an official permission with unrestricted time validity for entry to the area for the purpose of implementation of specific managements according to the Water Code 254/2011 Coll. to the Central Bohemia regional authority, which was issued 12/03/2019. After obtaining this permission, official permission for forest grazing was issued by the Central Bohemia regional authority 27/5/2019. Since summer 2019 forest grazing is implemented twice per year.

Removing of humus layer

At the beginning of the project, the humus layer was removed by using digger on forest roads only superficially not to destroy surrounding trees and the non-target vegetation, however, developed again. We thus decided to remove the humus layer more intensively to the serpentine background. This first road was thus pulled again.

Tree cutting

The evaluation of plant life cycle and its modelling in context of global change showed that plants on open sites with south expositions are very vulnerable because of intensive drought and high temperatures. We thus decided not to cut the young pine trees on such sites and allow their further development to create more shaded parts.

Enhancement of population size and plant reintroduction

The first problem was caused by absence of seed germination in nature after sowing, which could be explained by more factors. We thus decided to enhance population size and to reintroduce plants only by transplantation of juvenile plants. Since we were not allowed to collect a lot of seeds per year, we decided to elongate plant transplantation to more years. This was important especially in the case of DK1 population

Genetic analysis

In 2016 and 2017 we isolated DNA from collected leaf samples to analyze genetic variability between populations. Because of unexpected specific sequences in the DNA, we had to change the methodology from microsatellite analysis to NextRAD sequencing and analyze the genetics as external services. Prepared samples of DNA were sent to SnpSaurus company for sequencing. The same approach was used also for evaluation of preserved gene-pool in ex-situ cultures.

6.3 Evaluation of Project Implementation

Methodology applied

Management interventions were based on a combination of traditional and innovative approaches. The project results indicate that for restoration of serpentine sites, very intensive interventions such as removing the humus layer by digger are needed. Concerning tree cutting, specificity of each part, mainly slope and aspect, should be considered. On steepy parts with south exposition the tree cutting should be minimal. In contrast, open gaps are preferred on flat areas, nevertheless, creation of gaps leads to quick expansion of *Calamagrostis epigejos* and mowing or grazing must be continuously implemented. Mowing leads to decreasing biomass

of grasses and shrubs and increasing coverage of target species. Nevertheless, it also leads to increasing coverage of mosses. Therefore grazing is prefered method. In the case that only mowing is implemented, it should be supported by disruption of vegetation to create patches with bare soil for seedling recruitments.

Sowing of seeds/ plant transplantation of Minuartia in the field and in the garden showed that although seeds have a very high germination rate, they are not able to germinate in the field. Therefore we left the enhancement of population size by sowing and continued only by transplantation of juvenile plants. Planting of juvenile plants in the garden was successful, plants were able to grow in normal as well as in serpentine soil. For plant transplantation is, however, better to grow the juvenile plants in the serpentine soil to keep the species adaptations, even if the costs are higher. Plant transplantation to nature was generally successful, although the results were site specific. The survival rate was more than 80% in the first year, but decreased in the second year after transplantation to the values 58.8% (DK2), 43% (DK3), 42.1% (DK1) and 13.4% (B1). Plants on all populations are flowering, producing seeds with high germination and new individuals are established there. Therefore we consider this method as successful.

Rescue planting in private gardens led to the disappearance of digging plants in nature. Five individuals were, however, dug out from the rock in the village square in Kamberk in 2019. We consider this nevertheless as less dangerous for the population than plant destruction in nature. We informed local people through the mayor and such behaviour diminished. Concerning the success of planting, the results were garden specific. The traditional gardeners decided to water plants in the summer (despite being asked not to do so) and therefore had the survival rate higher (almost 100%) then botanical gardens (60.7%) or school Archa (41.4 %.). Generally larger rocks with more individuals had a higher survival rate then small rocks. We thus assessed the smallest population size planted in gardens to 40 - 50 individuals.

The problem was, however, evidence of plant growth by gardeners. We thus decided to transfer the monitoring only to the coordinator. Local gardeners will monitor only if the plants are flowering (yes/not) and if there is something strange with population (e.g. high mortality, occurrence of pathogens etc.).

The results achieved - the objectives and results are presented in a table as attachment **FR Annex 6.3**

Majority of project impact was visible immediately after their implementation (e.g. removal of humus layer, tree thinning, mowing, plant transplantation). Nevertheless the real impact on composition of vegetation or stabilization of populations in nature takes longer time, e.g. development of serpentine vegetation takes 4-5 years, new individuals appear two years after plant transplantation. The only exception is the situation on B1 site, where the removal of humus layer by digger and plant transplantation led to complete change in the site character and stabilization of population already in the second vegetation season. Further, the plants started to naturally disperse to other parts of the site.

The main part of **replication** is based on the Rescue planting in private gardens, transfer of management interventions to other suitable sites or creation of new populations of *M.smejkalii*. Concerning Rescue planting in private gardens, we took part in many seminars or discussions dealing with ex-situ cultivation and explained the concept of this program. Within the working group we selected other suitable species and suggested implementation of this approach to their rescue program. Additionally, we are partners of COST action (applied in 2018), which focuses

on ex-situ as well as in-situ conservation. Regarding management interventions, we have a project in partnership with University of Oslo and share with them our knowhow.

Concerning **dissemination activities**, the strongest impact on the general public had actions organized in the Visitor Centre Vodní dům, Facebook, publications in regional journals and excursions. General public preferred such approach since it is interactive and allows them to experience the serpentine phenomenon. Since it is not possible to directly measure the impact of these activities, it is possible to observe them on the sites - the vandalism disappeared, people are asking us what we are doing there etc. Additionally, we obtained this information during talks with locals, mayors or form questionnaires.

In contrary, for specialists were more important presentation on conferences, organization of discussions and publishing of scientific papers. Both categories were interested in TV shots. Surprisingly, we observed very low interest in Linked-in profile. This was probably caused by the fact that the majority of scientists started to use ResearchGate. We thus added information about the project to particular members of the team. Evaluation of direct impact is not possible, nevertheless, we observed high interest in international internships from students from different countries, who found the information about projects at conferences or COST meetings. Additionally, the thesis dealing with Minuartia is currently also running out of the project team.

Policy impact

The project deals with the species protected on national as well as EU level. It thus fulfils the programs focusing on enhancement of biodiversity. The EU added value is based on the implementation of Directives 92/43/EEC, (i) activities aimed at improving of the conservation status of species of EU interest since it focuses on priority European species **Minuartia smejkalii*. Further, it fulfils aims of A Priorized Action Framework (PAF) (F1,thematic priority 2) since it establishes new management plan for Hadce u Hrnčíř SCI and updated Methodology of Care based on management realization and its evaluation and The priority C (Article 12) by suppression of species illegal collecting and working with the most important stakeholders. Project leads to implementation of MAWP, mainly strategy area SA1.7 Biodiversity, ecosystems, agriculture and forests as they deal with evaluation of **M.smejkalii* conservation status, predicting their future behaviour and lead to halting loss of biodiversity and the degradation of ecosystem services.

The project thus required the permissions form The Law on Conservation of Nature and Landscape (Regulation Nb. 114/1992 Code) and from the Forest law (Regulations no. 289/1995 Code), which were successfully obtained. Concerning Rescue planting in private gardens, we solved the legislative protection of F2 generation, ownership of species (the conflict between the Civil Law and The Law on Conservation of Nature and Landscape). These issues were discussed with the lawyer of NCA and final solution incorporated to the methodic Rescue planting in private gardens. Additionally, the Rescue planting in private gardens led to an increase of regional identity and public awareness.

Further, the project evaluated the data about climatic change from projects focusing on climate change and included the model of global change to the modelling of species population dynamic. The populations on the most open sites were considered for the long time as the most perspective. Nevertheless, the evaluation of the life cycle showed that there may be a huge problem with the survival of seedlings when the climate will be warmer and dryer. On the basis of these results we adapted the methodology of care about *M.smejkali*i and suggested new approaches such as plant translocation, creation of mosaic in the forest or keeping of more

shaded parts on the steep sites with south exposition. These changes will be incorporated to the new Management plan for Hadce u Želivky NNM (2022-2032).

The networking with other projects led to the establishment of large COST action, which creates a network of 49 organizations from 32 countries and deals with the rare species and their protection.

6.4 Analysis of benefits

In this section please discuss the project's progress focusing on the results achieved. Justify any anticipated significant deviations from the targets set initially, and comment on targets already met or exceeded. In the case of the Final report, where relevant, refer to the final actual values of the Key Project-level Indicators(KPIs).:

1. Environmental benefits

a) Direct / quantitative environmental benefits:

The project had a direct impact on improving the conservation status of *Minuatia smejkalii*, species of priority interest, in two European important areas with a total area of 46.73 ha. Since the total area of species is limited by the occurrence of serpentine, it is not possible to enhance it. In contrary, the population size of rare species bound to this specific substrate increased. Concerning population size of *Minuartia smejkalii*, it is evaluated on two levels: populations in-situ and ex-situ. Prior to the project start, population size in nature was 434 individuals, ex-situ population was not established. The target population size in nature was 589 individuals and 600 individuals in the ex-situ population. Population size in nature was 1015 individuals (without transplanted plants) in 2021. The project thus reached the planned population size. Additionally, 3307 individuals were transplanted to the natural localities to enhance population size or to reintroduce the species. The ex-situ populations were established in Visitor Centre and in private gardens by transplantation of 3148 individuals. Populations are flowering and reproducing. The estimated population size in ex-situ cultures is totally appr. 5000 individuals.

Concerning policy implication on NATURA 2000, we enforced the permission from Forest law and Water law needed for forest grazing, implemented new knowledge and approach (forest pasture, plant translocation) to the methodology of care about plant species, management plans and Forest management plan and find the solution how to involved local people to the Rescue planting in private gardens.

b) Qualitative environmental benefits

Evaluation of **species trend** is done every 6 years. The last evaluation was done in 2019, the next will be thus in 2025. According to data evaluation, the majority of the population got stable, and the number of individuals rapidly increased. Nevertheless populations on steep slopes with south exposure are decreasing (mainly DK2 and DK5) and one is very small (DK5 - 12 individuals). We, however, suppose that the population will be evaluated as U1. Total area of the species occurrence is still very small. Therefore we suggested in After LIFE reintroduction of species to other suitable areas outside of the SCI area.

Concerning **habitat quality**, intensive management interventions lead to its improvement. Total area of habitat did not change since it is given by the occurrence of serpentine, nevertheless we created a lot of patches suitable for serpentine species including *M. smejkalii* (*M. smejkalii* disperses to one of these patches). Nevertheless, management interventions

(mainly grazing and mowing) have to continue in the following years to keep the habitat in conditions suitable for serpentine species.

The majority of threats were suppressed by project implementation. The **high competition** was suppressed mainly by mowing, grazing and manual removal of humus layer. The sowing of *Rhinanthus* was not successful. A**ccumulation of the humus layer and changes in soil chemistry** were suppressed by removal of the humus layer. At the beginning of the project, the humus layer was removed only superficially and the non-target vegetation developed again. We thus decided to remove the humus layer more intensively to the serpentine background. The serpentine vegetation was recovered after 4-5 years. **Suppression of negative effects of forest management** was done only partly. Since the modelling of the critical phase of life cycle showed that the plant survival on the steepy slopes with south exposure is negatively affected by climate change, we decided to abandon tree cutting in such places. **Reduction of intensive grazing** by fencing of the most grazed rocks was partly successful. The protection prior to large animals led to an increase in flowering and seed production not only *M. smejkalii*, but also other serpentine species. Nevertheless, we observed persistent grazing of tufts of M.smejkalii by mice. **Vandalism** was successfully suppressed by building a barrier in combination with landscaping of the area. The Rescue planting in private gardens in combination with enhancement of public awareness led to disappearance of digging of plants in nature.

The only one threat which was not suppressed is **climate change**. Climate change has a strong impact on survival of individuals of *M. smejkalii* and serpentine vegetation on the steepy slopes with south exposition (mainly DK2, DK4 and DK5 populations). This threat is not possible to eliminate, nevertheless, we implemented (or suggested) some adaptive actions to help the species to survive for the future. The first action was to abandon tree cutting on these sites and support natural regeneration of forest (all populations). To support the DK2 population we created 4 new patches on the more shaded parts and transplanted there M. smejkalii. In contrary, we were not able to transfer plants in the DK5 population to the more shaded parts. This activity was thus suggested in After LIFE and in the management plan. Concerning the DK4 population, it is still stable. Nevertheless, it will be regularly monitored and special attention will be given to the plant's survival.

On the basis of further evaluation of plant life cycle and impact of management interventions, we suggested appropriate management for particular sites, which consider future climate changes.. Management interventions implemented in the LIFE project were very intensive (e.g. removal of humus layer by digger) and led to regeneration of natural processes on these sites. Therefore the **management interventions after the project end** will have lower intensity. The only action, which will be done every year will be mowing and grazing. The grazing by large animals is more suitable than mowing since it leads to creation of small patches of bare soil and thus improves the establishment of serpentine species, nevertheless it is not possible to apply it on the whole area. Therefore a combination of mowing and grazing will be implemented twice per year. The removal of expansive grasses and mosses (manually or by digger) will be done appr. every 10 years, depending on climatic conditions. Removal of non target juvenile trees (*Picea, Frangula alnu*s) will be done appr. every 3 years, mainly in CP and Hadce u Hrnčíř. Nevertheless in the case of creation of open gaps, the mowing or grazing must immediately follow tree cutting to suppress development of *Calamagrostis epigejos*. In contrary, the restoration of Pine forest on the steepy slopes with south exposure should be supported. All actions are explained in After LIFE and will be ensured by the Management plan. Additional actions continuing after the project end will be monitoring of population

dynamic natural, reintroduced as well as ex-situ populations. The monitoring will be done in cooperation with the NCA.

2. Economic benefits

The economic benefits were connected mainly with out-sourcing of particular actions (e.g. graphical and printing services, genetic analysis, evaluation of ecosystem services, transport of soil and cages, websites programming and maintenance…), using services of local providers of accommodation and order of equipment or consumables. Concerning services (digger and other machines, catering), we prefered regional producers, and thus supported local economics. Other economic benefits were connected with enhancement of soft tourism near both SCI areas due to organization of actions or by geocaching. Increasing presence of tourists can raise business opportunities for guest houses, restaurants and other local entrepreneurs. Detailed economic benefit was evaluated in action D5 - Evaluation in socio-economic impact.

The project brought with it the involvement of a few employees in IBOT: main project investigator 1.0 FTE, project assistant – financial manager 0.3 FTE, senior researcher 0.1 FTE and other researcher 0.45 FTE and approx. 1.25 FTE for technicians. IBOT also employed 41 student helpers and offered the possibility of cooperation on different phases of the project for 5 bachelor students, 2 master's students, 6 postdocs and 4 internship students (one student from France, one from Mexico).

ČSOP Vlašim included the following employees in the project: ČSOP project leader 0.4 FTE, project assistant 0.3 FTE, field workers and technicians approx. 3 FTE and temporary educator 0.6 FTE

Moreover, one part-time position (approx. 0.1 FTE) for project coordinator was created by the Ministry of the Environment.

The total number of full time equivalent (FTE) jobs created is approx. 7.5 FTE (The exact number cannot be determined because the FTEs fluctuated over time).

3. Social benefits

The most important social benefit was the action Rescue planting in private gardens, which is focused on the involvement of local gardeners in species protection. Gardening is very popular mostly among pensioners, who face the risk of marginalization. The project offered a new opportunity for this group to raise its social status and network with other similar people through sharing of the results. Awareness raising in the local community showed the negative impacts of vandalism on the population of this species and related natural and socioeconomic values in the region. Vandalism became thus a non-tolerated behaviour. Second important social benefit was creation of interactive items and running of educational programmes in the Visitor Centre of Želivka SCI Vodní dům and other activities connected with education of children and general public.

Other social benefits were aimed at nature conservationists since we demonstrate the new approaches in conservation.

Social benefit is described in action D5 - Evaluation in socio-economic impact in detail.

4. Replicability, transferability,

The replicability and transferability of the project is based on enhancement of awareness as well as active dissemination of the results. The project shows that the most important opportunity for transfer and replication of results could be based on two aspects: the Rescue planting in private gardens and management interventions on specific substrate. The most

important target audience are conservationists and state organs of nature protection. Therefore we decided to take part in more actions (conferences, meetings, seminars), where we discuss these results. Rescue planting in private gardens is slowly spreading into the awareness of conservationists due to its presentation on the meetings of botanists or conservationists. The methodology was prepared to be easily applicable for many protected species. It contains two parts: a general description of Rescue planting in private gardens and a plan for particular species. This approach is cheaper than cultivation in a botanical garden, since it needs investment only at the beginning and the care about plants is based on voluntary contracts. Additionally, it naturally and easily spreads information about species and thus increases public awareness. The gardens could be used also for education of children at schools.

Information about Rescue planting in private gardens is spread on the meetings of COST action, especially in working groups 2 (ex-situ conservation) and 4 (working with the public). We thus consider that the replicability potential of this action is very high, but it will be policy dependent since the laws about nature conservation are different in each country.

The management interventions are the second important actions for replication to other serpentine sites or for transfer to other extreme sites (e.g. rocky grasses, abandoned quarries, sand pits). Especially removal of the humus layer by digger to the bedrock is an unusual approach, which was already transferred to the restoration of the sludge pond of goldmine Roudný. Similarly, forest grazing in Pine forest is a relatively new approach, which could be transferred to other sites or habitats. The management of serpentine sites was already transferred to Bernartice query, where our experience with the recovery of serpentine vegetation on sites after removal of humus layer was used for change in Recultivation plant - from bringing topsoil and artificial afforestation to natural succession. Additionally, our experience was used for the establishment of perialpidic pine forest in the already abandoned part of the query. Specifically, the serpentine vegetation was created from seed bank (as in the private garden) and the rest of the plants will be pregrown in serpentine soil and transplanted to the areas. This action is financed by a private company - Bernartice query. The second replication is currently running in the areas outside Hadce u Želivky NNM, where the serpentine sites will be managed and 3 new population of *Minuartia smejkalii* established from the ex-situ cultures (action is supported by Norwegian founds). This activity is running with cooperation with the University of Oslo. The results will be thus easily disseminated to Norway. Similar actions are planned in the area of Hadce u Hrnčíř NM and Borecká skalka NM.

5. Best Practice lessons

Management interventions such as mowing, forest thinning or removal of humus layer are based on standard approaches. Nevertheless, their application is usually based on the current habitat quality. In our LIFE project, we, however, included in the planning of these interventions evaluation of plant life cycle, identification of its critical phases and model of climate change. On the basis of these data we rearranged the interventions planned in the proposal to be effective also in the future. Specifically, we abandoned tree cutting on the steepy slopes with south exposure to keep the area partly shaded and decided to create new patches with Minuartia in more shaded parts. Additionally, we decided to thin the forest only slightly since creation of open gaps leads to quick spreading of *Calamagrostis epigejos*. Forest thinning must be thus immediately followed by grazing or mowing. Concerning removal of the humus layer by digger, it was done at the beginning only superficially not to destroy surrounding trees,

but the non-target vegetation developed again. We thus updated the methodology and removed the humus layer more intensively to the serpentine background.
Concerning enhancement of population size, we used standard approaches of sowing and transplantation of juvenile plants. Surprisingly, the sowing was unsuccessful even though the seeds had high germination ability. This finding shows that even if the approach is common, it cannot be automatically considered as suitable for similar rare species and should be tested prior usage. Additionally, we added plant translocation to the standard care about the species.

6. Innovation and demonstration value:

The demonstrative aspect of the project was the Rescue planting in private gardens. The primary motivation of transfer of this Swiss approach to the Czech condition was reduction of vandalism and plant collection in nature. During the implementation of this action we found that it was a great opportunity for creation of a network of ex-situ populations, which are on one side in local climatic conditions, but on the other site, they slightly differ in environmental conditions. Therefore they are ideal for keeping maximal genetic diversity. The Rescue planting in the private garden was successful - we established 20 gardens, plants are flowering and reproducing. Preserved genetic diversity was comparable with natural populations. Since this approach was new in the Czech Republic and dealt with the protected species, we solved some legislative issues. The first question was connected with the protection of the second generation of the plants. Since these plants were not protected by the law, it was necessary to prohibit the trade or their donation in the convention with the gardeners. Second question was about ownership of plants since there was discordance between civil law (the owner of the garden is normally also the owner of the plant) and Law on Conservation of Nature and Landscape (owner of the plant is the holder of permission, in this case different from the owner of the garden). Finally, we prepared with the lawyer of NCA conventions, where the care about plants is specified and actions such as trade or donation prohibited. Since this contract is voluntary, it is supposed to be respected. Additionally, the NCA decided that it will be the holder of the permission and this permission will be transferable to the regional coordinator and gardeners via signed convention. This information as well as conditions were incorporated to the final methodology of Rescue planting in private gardens.

7. Policy implications

The most important national legislative barrier is connected with forest grazing, which needs permission from Forest law and Water law. Since the Water law cannot allow such action, we found the alternative solution with the Regional office Středočeský kraj. Such permission is a novelty in the Czech legislative and can be used as a pilot for the management of other sites in the Czech Republic. Additionally, we implemented new knowledge and approach (forest pasture, plant translocation) to the methodology of care about plant species, management plans and Forest management plan. Management plan and Forest management plans are crucial documents for care about the area since they specify management interventions and forestry for the next 10 years..

The most important contribution to legislative is the Rescue planting in private gardens, which is a new approach for species conservation. We thus have to solve many questions connected with the correct interpretation of laws. Concerning EU level, we found that each country has different approaches, in particular laws dealing with protection of rare species (seed collection in nature, species planting, reintroduction). Therefore this must be considered in the

conventions when the Rescue planting in the private garden will be transferred to foreign conditions.

7 Key Project-level Indicators

KPI database contains three specific contexts: Rescue of *Minuartia smejkalii* in situ and Rescue of *Minuartia smejkalii* ex-situ and Dissemination of information on *M. smejkalii*. KPI database was updated according to real obtained values.

Humans influenced by the project include people involved in the Rescue planting in private gardens (ex-situ context). We supposed that totally 10 gardeners will be involved, but we found that it is necessary to create rocks separately for each SCI area. Final number of influenced people is thus 20. We added a new indicator - students absolving the educational programs, totally 455 people.

Ecosystem

The total area of the ecosystem did not change, nevertheless the ecosystem conditions increased to moderate since it needs other interventions and the trend shows some improvements.

Habitat

Total area of habitat did not change since it is bounded to serpentine bedrock. The only change was for habitat 8220-Siliceous rocky slopes with chasmophytic vegetation, where the area increased by removal of humus layer and vegetation from the rocks. The habitat conditions were improved from U2 to stable for 8220-Siliceous rocky slopes with chasmophytic vegetation and to U1 for G3.44-Spring heath Scots pine forest and G3.4211-Central European Scots pine forests.

Habitat trends are stable for 8220-Siliceous rocky slopes with chasmophytic vegetation and G3.44-Spring heath Scots pine forest. In contrast, it is still declining for G3.4211-Central European Scots pine forests because of high mortality of pines in the CP caused by decrease of level of groundwater.

Wildlife species

Prior to the project start, population size in nature was 434 individuals, ex-situ population was not established. The target population size in nature was 589 individuals and 600 individuals in the ex-situ population. Population size in nature was 1015 individuals (without transplanted plants) in 2021. The project thus reached the planned population size. Currently, the population size is increasing and we expect its stabilization. Evaluation of species trend is done every 6 years. The last evaluation was done in 2019, the next will be thus in 2025. We, however, suppose that the population will be evaluated as U1 since its natural area is very low and the species is threatened by climate changes.

Additionally, 3307 individuals were transplanted to the natural localities to enhance population size or to reintroduce the species.

The ex-situ populations were established in Visitor Centre and in private gardens by transplantation of 3148 individuals. Populations are flowering and reproducing. The estimated population size in ex-situ cultures is totally appr. 5000 individuals in area 430m2.

Information and awareness

Website: the domain www.kuricka.cz has 2762 unique visitors so far and www.sandwort.eu has 236 unique visitors so far, which is more than we planned (400 visits at the end and 1100 after 5 years). In contrary, the visits to English websites were lower than expected.

Concerning social networks, the *facebook.com/kuricka*, total daily reach of the site activities reached 8092 users until 2018. Nevertheless, due to change of the advertisement and analytics system of Facebook (Facebook Ads -> Facebook Business), currently available data are only from January 2019. Total daily reach of the site activities reached thus only 4 275 users. Number of followers increased to 189. We were not able to evaluate the visits in Link-in Profile since the statistics are available only for one year. The profile was visited by only 3 visitors last year, which is lower than it was expected.

Other tools

Concerning other tools, we exceeded the expected number of print media (expected 2, finally 14) as well as publications/reports (expected 4, finally 12). Additionally we prepared 5 TV or radio broadcasts, which was not originally planned. The information about the project, Minuartia or serpentine was displayed totally on 31 panels or posters. The number is higher than expected since we added the information table to the gardens with Minuartia. Number of organized events is slightly lower than it was planned - we were able to organize 17 events, while 18 were planned. This was caused by COVID-19.

Capacity building

Networking: we planned to be in contact with 30 professionals, which was already reached due to organization of excursions, visits of projects, attendance on seminars or by preparation of other projects. We contacted appr. hundreds of people.

Professional training: During the project student internship were open as bachelor thesis (5 participants - 3 finished, 2 cancelled), master thesis (2 participants – 1 finished, 1 will finish in 2022), postdoc internship (6 participants), practices (4 participants) and internship for high school students (12 participants). Planned attendance was 5.

Jobs: the final FTE for Dissemination of information is 0.9, for Rescue of M. smejkalii in-situ 4.4 and for Rescue ex-situ 2.2. Finally, the total project FTE values reached 7.5. The employment of temporary student helpers is not included in this number.

8 Comments on the financial report

8.1 Summary of Costs Incurred

PROJECT COSTS INCURRED				
	Cost category	Budget according to the grant agreement in €*	Costs incurred within the reporting period in €	%**
1.	Personnel	493 186	526 702	107%
2.	Travel and subsistence	38 268	35 480	93%
3.	External assistance	89 111	53 012	59%
4.	Durables goods: total non-depreciated cost	12 972	33 524	258%
	- Infrastructure sub-tot.	4 169	4 706	113%
	- Equipment sub-tot.	8 803	28 818	327%
	- Prototype sub-tot.	0	0	0
5.	Consumables	17 900	11 246	63%
6.	Other costs	36 711	26 620	73%
7.	Overheads	**47 792**	**48 099**	100%
	TOTAL	**735 940**	**734 683**	99,8%

Overview of the cost incurred:

The financial report captures the costs, respectively expenditures incurred since the beginning of the project implementation by 30th June 2021. Almost 100 % of the total project budget was spent.

The highest item of total costs is the budget capture **Personnel costs**, it represents 72% of all costs**.** It means expenditures of staffing of project work incl. management.

There worked six permanent members of the project team with various percentages of their working time allocated to the project in the Institute of Botany (main project investigator, project assistant – financial manager, senior researcher, researcher and one or two technicians – from 10/2018 two part-time technicians at the same time). Student helpers were involved by physical work in the locations of the occurrence of Minuartia smejkalii (their main roles were: care about plants, counting of seeds, preparation of samples and sorting of biomass). One person changed her status during the project – she (Miss K.Hrušková) started as student helper and after some time she became the part-time employee (technician) of the IBOT involved in this project.

In ZO ČSOP Vlašim there were thirteen permanent members involved in the project (ČSOP project leader, 3 project assistants – project manager and animal facility manager, educator, 4 field technicians and 5 field workers).

The Ministry of Environment had one representative. The representative of the ministry acted as a consultant, resp. advisor in the project.

For IBOT - total annual personnel costs are calculated as the sum of annual gross salary (detail from accounting) + annual obligatory social (24,8%) and health insurance deductions (9%) + Cultural and Social Needs Fund (2%, compulsory for public research institutions – Czech Ministry Finance Decree No114/2002). Total number of hours worked per year is 1720 (or % for part-time) for those without the timesheets or the sum of actual worked hours per year from timesheets. In IBOT accounting there are personnel costs related to the project that are calculated as the percentage specified in salary contract (% of time dedicated to the project) from the basic pay + percentage from project-related part of the salary + corresponding share of these deductions: obligatory social and health insurance and cultural and social needs fund.

There are similar rules for ČSOP - Monthly project cost is calculated as a project share of monthly salary + project share of monthly obligatory social insurance deductions + project share of monthly obligatory health insurance deductions. Project share of monthly pension insurance and share of obligatory insurance of employees were calculated in personnel costs as well in 2017 and 2021, in other years they were not included to ensure we fit in the budget. The share of the project costs on total monthly and personnel costs is determined either by a labour contract annex or by a share of productive hours on total productive hours according to time sheets. Annual salary is calculated as the sum of monthly salaries. Annual obligatory health and social insurance deductions are calculated as the sum of monthly deductions of the employee.

The project advisor from the MŽP was employed specifically for this project, so the annual personnel costs were calculated as the sum of monthly salaries and the relevant share of compulsory levies. The timesheets were maintained from the start of the MŽP participation in 2018.

Totally, the personnel costs were approx. 7% higher than budgeted. The main reasons to explain this difference are the extension of the project by six months and the fact that the fieldwork was more difficult and demanding than expected - the seeds had to be collected every year in order to obtain a sufficient number of seedlings for planting. As a result, the plantings were divided into several years. Similarly, the evaluation was laborious, especially the sorting of biomass, counting seed production, etc. That's why we had to find more helpers than budgeted.

The last part of this document is a table with budgeted person-days and the estimated percentage of spent person-days divided according to the type of the action. We can see that the highest increase in comparison with the budget was in the Action D (+73%) - mainly due to the project prolongation, which allowed to include vegetation season 2021 and by the

increasing number of individuals in nature as well as ex-situ population for measurement. A big increase can also be observed in the Action C (more than +47% person-days) - the main reason for this was the replacement of external grazing services by the self-help and implementation of grazing and mowing in 2021. The higher number of person-days in the Action A (+35%) was caused by the need of more helpers for fieldwork esp.collection of seeds. There were also more negotiations with gardeners and higher demands on the construction and preparation of rock gardens for rescue planting than originally assumed. The lower number of person-days in the Action E (-27%) appeared thanks to the involvement of trainees and the interruption of the activities by the Covid-19 pandemy.

The second highest item of the eligible costs is the capture **External Assistance** that represents 7% of total costs. The expenditures in this category were spent for the services that could not be realised by beneficiaries themselves.

The IBOT reports mainly costs for sequencing, transport of soil, rocks and cages and assessment of ecosystem services and socio-economic impact of the LIFE project in this capture.

ZO ČSOP Vlašim included e.g. these costs to this capture: transport of rocks and substrate, website programming and maintenance, substrate removal, rent of excavator, design and print of interactive elements etc.

The total costs of External Assistance were lower than expected because of more reasons. The forest pasture was not carried out externally as budgeted because of the need of special permissions to enter the protected zone of the water source and finally, it was done by ČSOP employees themselves. Moreover, due to the Covid-19 situation the final conference was held on-line and that is why the costs were different from the budget.

The other part of the costs was spent on **travelling** (5% of total costs) to the destinations where rescue operations and project meetings were taking place. We can name these localities: surroundings of the dam Švihov (Želivka), Bernartice, Vlašim, Benešov, Kamberk, Borovsko, Hrnčíře, Kácov, region Podblanicko, Kobylí etc. Foreign business trips were made to Brussels (Kick off project meeting), Helsinki (presentation of the project), National park Majella in Italy (networking), Münster (conference) and Zurich (consultations and networking). Additional travels were to the different seminars, where the project was presented.

The category Travel costs for IBOT included costs for various tickets, accommodation, use of company cars (or private cars registered for the business purpose in internal IBOT system) and per diems. The public means of transport were used in case it was effective. Due to complicated accessibility of localities with Minuartia smejkalii and the necessity to take various materials and tools to the terrain there was the use of private cars often more appropriate that the usage of public means of transport.

The existing car park of IBOT was used and only real maintenance costs were reported. In some cases, IBOT employees use their own cars. In that case, they receive a reimbursement

settled by the Czech law (Regulations No. 385/2015, 463/2016, 333/2018, 358/2019 589/2020 Code). Travel costs are calculated by following formula: distance (km) * (price for using a car per km + price for fuel consumption per km) + subsistence allowance per working day. Cost of fuel is established by a Ministry of Finance regulation (updated every year) or documented by a receipt. Subsistence allowance cost is regulated by the Czech law according to the length of the travel and also updated every year.

You can see the rates for the reimbursement for the use of a private car in this table:

Government regulations:

Year	Wear and tear cost per km	Fuel cost (benzine 95/oil) CZK per liter
2016	3,80	29,70 / 29,50
2017	3,90	29,50 / 28,60
2018	4,00	30,50 / 29,80
2019	4,10	33,10 / 33,60
2020	4,20	32,00 /31,80
2021	4,40	27,80 / 27,20

As an example we attach the example of calculation of this type of travel costs in **FR Annex 8k.**

Or IBOT employees can use a company car. The usage of the company car also includes the consumption of fuel and the wear and tear costs of the company car (it means how much the maintenance of the car costs per each km). These two types of costs are regularly calculated by the technical department of IBOT at the end of each month (they have a log book with mileage records for each use of the car) and sent to the accountant who charges these costs to individual projects numbers. The calculation is based on the average consumption of fuel of an individual company car and the rate of wear and tear per km (it is determined by internal regulations).

As an example we attach the example of calculation of this type of travel costs in **FR Annex 8l.**

Travel costs of ČSOP Vlašim can be divided into two categories: overnight travel, related to kick-off meeting and networking and domestic travel related to all other activities. For the first category, full cost of tickets, accommodation and per diems is included in the project with specific information on the travels.

For the second category, ČSOP Vlašim is using its own vehicle fleet for domestic travels. The cars are used for various purposes. Based on an EASME letter of 12/03/2019 Ares(2019)1699999, the mileage costs are calculated by dividing all actual costs generated by the vehicle, which are the fuel, insurance and maintenance costs, by the total count of kilometres driven. The resultant kilometre-rate shall be multiplied by the number of kilometres travelled within the project. In line with the EASME letter of 26/06/2019 Ares(2019)4063655, the mileage and costs ratios for years 2017 – 2019 are calculated together, not on a yearly basis.

Resulting amounts of travel costs are reported in the financial reporting form and underlying accounting documents are accounted for and earmarked as accounting code 405 cest (cest = travel in Czech) in the accounting system of ČSOP Vlašim. Kilometers travelled by the vehicles are logged in travel log books of each vehicle.

Overall travel costs were 5% lower than budgeted – mainly because of Covid-19 pandemic restrictions and necessity to prefer on-line communication.

The capture **Equipment** created 4% of total costs. The IBOT purchased the camera with accessories and notebook as planned. One extra item was added – the navigation, its costs in the budget were shifted from the Other direct cost category.

ČSOP Vlašim reported higher costs than expected because of buying a car – Dacia Duster – this purchase was accepted within the duration of the project and the costs were shifted from the External Assistance category. The main reason for its purchase was the need to get to the forest pasture areas. Among other equipment costs we can mention e.g. camera, notebook, photo traps, chainsaw, electric fence or accumulator from this capture in ČSOP report. The camera was used during the project for documentation of all actions. Photos were used for publications, preparation of information panels etc. Notebook was the main shelter for record keeping, preparation of reports, web, social media, presentation on seminars etc.

Every item of the equipment category was used exclusively for work on the project LIFE for Minuartia and its usage will continue on the After Life actions and for nature conservation activities.

There is an only item in **Infrastructure** capture (0,6% of total costs) and it is the tourist information point building as budgeted.

The **Consumables** represent 1,5% of total costs and its list includes such items as nails, wires, markers, boxes, silica gel or special batteries. They were used for marking plants in the field and for their transportation to the target sites.The highest items of this category are microclimatic stations, which consumption was higher than we originally budgeted (this change was accepted within the duration of the project). Totally, the expenditures in this category were lower than in the budget because of the change of the methodology of genetic analysis that were finally ordered externally, the methodology of the collection of seeds changed also and some of budgeted items were not needed.

The category **Other direct cost** represents 3,6% of total costs. We can find such items as posters, promotional items, use of areas, equipment and analysis in IBOT (internal invoices), publications and translations in this capture in the IBOT financial report. The item Professional fee "Greifensee" is related to the training of a project team in Rescue planting in the private garden in the company Topos-Marty and it was not originally planned.

ČSOP Vlašim reported only refreshment costs for project meetings in the other direct costs category. The final expenditures in this category were lower than budgeted too because the

planned conference was not held and many meetings took place virtually and lower refreshments cost were needed.

When calculating **Overheads** costs we respected the rule of 7% flat-rate of eligible costs.

In general, the budget was used appropriately and nearly 100% was spent.

There were changes in the amount of the budget distributed among beneficiaries. The biggest change was that the Ministry of Environment (MŽP) did not claim all its allocated budget. Final claim of 9,302 EUR is just 45% of the originally budgeted sum of 20,679 EUR. We would like to mention that the MŽP budget was 2.8 % of the total project budget.

Main reason was the late start of practical work of MŽP on the project. From the beginning MŽP could not contract Project Assistant / Advisor for the position envisaged by the Grant Agreement. The lack of available experts with fitting and sufficient experience, situation of practically full employment in the Czech Republic and limited attractiveness of this partial position were main reasons for this unfortunate situation. At the end of 2017 MŽP reorganised its department and the post of Project Assistant / Advisor was filled as of 01. 01. 2018 i.e. 18 months after the start date. The late start meant not only saving in fees for the vacant period mentioned above but it had further consequences. IBOT and CSOP had to do some tasks originally assigned to MŽP, mainly a substantial part of monitoring (F.2). Monitoring was not, for practical reasons, transferred to MŽP on the basis of Project Manager decision. Allocation for the MŽP was consensually lowered (two times). MŽP claimed 80 % of the final lowered budget. The 20 % gap was caused by Covid-19 situation, mainly due to just the on-line final conference. For these logical reasons, part of budgeted personnel costs of the MŽP was transferred to the partners.

There were a few movements among budget categories, the most of them were mentioned in the text above. To sum it up, the biggest changes were the increase in the Personnel Costs by the shift from External Assistance and Other Direct costs captures in ČSOP (pasture implemented by self-help) and from Travel and Consumables costs in IBOT (higher pers.costs due to the prolongation of the duration of the project and higher need of helpers in terrain) and the increase in the Equipment costs category by the shift from the External Assistance category (a car and other necessary items). The most remarkable reductions in comparison with the original budget were in the captures: External Assistance (no external grazing services used), Consumables (a change of methodology of genetic analysis - done externally, some of budgeted items were not needed) and Other direct costs (final conference was held on-line, a planned paid promotion was replaced by the leaflets and direct promotion in Vodní dům).

Allocation of costs per action:

Action Number	Action Name	Breakdown of costs for Actions in € - BUDGET	Breakdown of costs for Actions in € - REALITY
A1	Administrative issues	14 725,00	7 213,76
A2	Revitalization of habitats of endemic priority species *M.smejkalii	31 443,00	31 262,74
A3	Enhancement of population size of endemic priority species *M.smejkalii	11 375,00	23 751,95
A4	Ex-situ conservation and reintroduction of endemic priority species *M. smejkalii	72 008,00	44 535,23
A5	Rescue planting of *Minuartia smejkalii in private gardens	16 157,00	26 327,30
C1	Revitalization of habitats of priority endemic species *M.smejkalii	170 608,00	208 496,28
C2	Enhancement of population size of endemic priority species *M.smejkalii	2 694,00	3 569,81
C3	Ex-situ conservation and reintroduction of the endemic priority species *M. smejkalii	10 527,00	7 996,65
C4	Rescue planting of *Minuartia smejkalii in private gardens	10 395,00	21 529,88
D1	Revitalization of habitats of endemic priority species *M. smejkalii	20 595,00	29 342,23
D2	Enhancement of population size of endemic priority species *M. smejkalii	5 785,00	9 141,24
D3	Ex-situ conservation and reintroduction of endemic priority species *M. smejkalii	25 800,00	27 435,26
D4	Rescue planting of *Minuartia smejkalii in private gardens	11 407,00	13 202,58
D5	Evaluation of ecosystem services	4 430,00	4 145,54
D6	Evaluation of socio-economic impact of the project	4 430,00	4 086,79
E1	Enhancement of public awareness	63 854,00	48 529,51
E2	Active dissemination of project results	77 094,00	40 484,14
F1	Project management	116 406,00	120 987,35
F2	Project monitoring	13 535,00	10 730,17
F3	After-LIFE Plan	4 880,00	3 815,86
OVERHEADS		47 792,00	48 099,16
TOTAL		**735 940,00**	**734 683,43**

The standard FINANCIAL STATEMENTs of the INDIVIDUAL Beneficiaries are attached for IBOT (**FR Annex 8a**), the MŽP (**FR Annex 8b**) and for ČSOP (**FR Annex 8c**).

An overall view of the project's management is given in to the CONSOLIDATED FINANCIAL STATEMENT (**FR Annex 8d**)**.** This statement summarizes the total costs and receipts of the project for the period from 7th July 2016 to 30th June 2021 and is attached to the Report.

Subscribed copies of pdf versions are also attached (IBOT - **FR Annex 8e**, MŽP - **FR Annex 8f**, ČSOP - **FR Annex 8**g, Consolidated - **FR Annex 8h**).

We enclose two signed Beneficiary's Certificates for NATURE and BIODIVERSITY Projects (IBOT - **FR Annex 8i**, ČSOP - **FR Annex 8j**).

8.2 Accounting system

On a general level, all partners shall follow principles of Act on Budgetary Rules No. 218/2000 Coll. and its associated Decrees. There is, of course, an operational standard double-entry bookkeeping system.

The Departments of Budget or Economics manage all book entries. This is the standard procedure for all Beneficiaries. All the documents, on the basis of which the costs are charged, are archived in accordance with the terms of the project and the beneficiary's internal rules.

All internal accounting is kept in CZK (in accordance with the Accounting Act No. 563/1991 Coll.) – conversion to EUR is made only for formal Life Financial Report ("FINANCIAL STATEMENT of the INDIVIDUAL Beneficiary"). The daily rate conversion method is used.

Each project partner (i.e. Beneficiary) uses specific identification code for the purpose of separately recording costs in his accountancy system.

- Institute of Botany of the CAS — LIFE for Minuartia = Project No. 200901EU
- Ministry of Environment — LIFE for Minuartia = Project No. PDD470001
- ZO ČSOP Vlašim — LIFE for Minuartia = Project No. 405

The accounting system in Czech Republic is standardized by the Ministry of Finance in the form of accounting standards. The system is based on the unequivocal determination of the types of cost items so that it is immediately recognizable what type of expenditure is involved. Cumulatively, synthetic accounts are used, analytical evidence can be used to specify cost items. The costs are listed by default as the first sign 5, the proceeds are charged with the sign 6. Special accounts are used to record the acquisition of fixed assets with depreciation.
Each partner is responsible for the costs he/she charged as eligible project costs. In accordance with Financial control Act No. 320/2001, Coll., is obliged to undertake preliminary, continuous and follow-up control. Prior to the creation of an accounting case, the Operation Commander, Budget Administrator and Chief Accountant are involved in the process. The Operation Commander is responsible for substantive accuracy, the Budget Administrator approves the financial criteria and the Chief Accountant is responsible for the correctness of the accountancy. Each of these three people confirms the correctness with his/her signature.
There was the electronic document approval system called IBIS in 2019 in IBOT implemented. So since 2019 all documents have been approved in e-way (the same three checks) and the whole flow has become easily controllable and clear.
In ČSOP there is no electronic system of approving documents. Every document is signed first by the head of the center, then by the chairman and only then it is booked by the accountant. Signatures are made physically.The similar procedure takes place at the MŽP.
Costs are attributed to the project through an internal code that provides separate accounting (above mentioned). The contractor is asked to provide the registration number on the document (invoice). However, if this is not technically feasible for him, then the document is addressed only to the consumer. For this purpose a project designed stamp is used.

There has also been an attendance monitoring system in IBIS in IBOT since 2019. The superior employee/manager can monitor the attendance of subordinate colleagues on a daily basis and every month the manager has to approve the attendance of his subordinates in the system - this is a necessary step for the economic department, it is needed for the salary calculation.
Before 2019 there were Internal Time and Performed Work Statements, they were checked and signed by the superior employees on a regular basis. Brief description of daily work is given in the personnel file as well a part of the work assignment that is allocated to the project. Since 07/2019 there has been an obligation for most of the employees of the project to use timesheets. They are regularly (on a daily basis) updated by the employee, usually in xls format and after the month ends it is printed and approved and signed by the superior manager. Total number of hours worked per year is 1720 (or % for part-time) for those without the timesheets or the sum of actual worked hours per year from timesheets.

The timesheets of the project advisor from MŽP were filled out from the start of his participation on the project and were regularly checked and signed by his superior manager on a monthly basis.

8.3 Partnership arrangements

The partnership is based on a contractual relationship. The Partner Agreement between IBOT and the MŽP was based on the signature of Decision about provision of subsidy of MŽP and was signed on 15th September 2017 and the Partner Agreement between IBOT and ČSOP Vlašim dated on 31st August. Rights and obligations as a condition of financial transfers are enshrined in above mentioned agreements. Partners agreed on quarterly reporting periods. Agreed deadlines were respected without delay. The coordinating beneficiary - IBOT - checked regularly submitted documents and resolved all possible ambiguities operatively with partners.

Based on Amendment No.2 of Grant Agreement which entered into force 28.1.2021, amendments to the Partnership Agreement with both partners concerning the extension of the project duration until 30.6.2021 were also concluded (attachments **FR Annex F1d** and **FR Annex F1e**).

Each partner filled out the Financial statement separately. The consolidated cost statement was prepared at the end by the coordinating beneficiary.

First and second pre-payments were distributed to our partners exactly according to the contract. The payment of the balance to individual beneficiaries will be reimbursed according to the total amount of eligible costs incurred and accepted.

8.4 Certificate on the financial statement

Irrelevant for our project, the total contribution is lower than EUR 750,000.

8.5 Estimation of person-days used per action

Action type	Budgeted person-days	Estimated % of person-days spent
All projects when applicable Action A: Preparatory actions	931	135%
NAT and CLIMA projects Action B: Purchase/lease of land and/or compensation payment for payment rights	0	0
ENV projects Action B: Implementation actions	0	0
GIE projects Action B: Core actions	0	0
NAT projects Action C – Concrete conservation actions	1472	147%
CLIMA projects Action C: Implementation actions	0	0
ENV and GIE projects Action C: Monitoring of the impact of the project action	0	0

NAT and CLIMA projects Action D: Monitoring and impact assessment	484	173%
ENV and GIE projects Action D: Public awareness/communication and dissemination of results	0	0
NAT and CLIMA projects Action E: Communication and Dissemination of results	856	73%
ENV and GIE projects Action E: Project management	0	0
NAT and CLIMA projects Action F: Project management (and progress)	1148	101%
TOTAL	4891	124%