

Report on the outcomes of a Virtual Mobility¹

Action number: CA18201

Grantee name: Mariana Oliveira e Castro

Virtual Mobility Details

Title: Modelling current and future suitable areas of European threatened plant species

Start and end date: 28/02/2023 to 30/05/2023

Description of the work carried out during the VM

Description of the virtual collaboration and activities carried out during the VM, with focus on the work carried out by the grantee. Any deviations from the initial working plan shall also be described in this section.

(max. 500 words)

The main goal of this VM Grant was to model the suitable environmental habitat of selected threatened European plants, predicting their survival under future climate change projections.

I proposed to model the suitable niches of 8-10 European threatened plant species, however the number of studied species increased to 25 (based on European or Country level assessments). This change to the original goals of this VMG significantly expands the goals of the grant and is linked with another running project, also included in ConservePlants actions, where the reproductive performance of the same species is currently being evaluated.

List of threatened species studied:

- *Allium nigrum* – LC;
- *Anarrhinum longipedicellatum* R.Fern. – NT;
- *Armeria sampaioi* (Bernis) Nieto Fel. – VU;
- *Campanula alata* Desf. – VU (PT);
- *Centaurea exarata* Coss. – VU (PT);
- *Dactylorhiza elata* (Poir.) Soó – LC;
- *Dactylorhiza maculata* (L.) Soó – LC;
- *Dianthus cintranus* subsp. *barbatus* R.Fern. & Franco – VU (PT);
- *Echium boissieri* Steud. – VU (PT);
- *Erysimum lagascae* Rivas Godat & Bellot – VU (PT);

¹ This report is submitted by the grantee to the Action MC for approval and for claiming payment of the awarded grant. The Grant Awarding Coordinator coordinates the evaluation of this report on behalf of the Action MC and instructs the GH for payment of the Grant.

- *Lamium coutinhoi* J. G. Garcia – NT (PT);
- *Leuzea longifolia* Hoffmanns. & Link – EN;
- *Lysimachia ephemerum* – LC;
- *Lysimachia vulgaris* – LC;
- *Narcissus bulbocodium* – LC;
- *Omphalodes kuzinskyanae* Wilk. – VU;
- *Ononis hackelii* Lange. – NT;
- *Ranunculus henriquesii* Freyn – VU (PT);
- *Saxifraga cintrana* Kuzinsky ex Willk. – DD;
- *Scilla ramburei* Boiss. – DD;
- *Scrophularia grandiflora* DC. - LC;
- *Senecio doricum* subsp. *Iusitanicus* Cout. – VU;
- *Stachys palustris* – CR (PT);
- *Verbascum litigiosum* Samp. – VU;
- *Viola langeana* Valentine – LC (PT).

In detail, to model the environmental niches, environmental data was downloaded from Worldclim, namely 19 environmental variables and elevation at the present and at four future climatic projections (two models of the Coupled Model Intercomparison Project phase 6 at two scenarios in 2041-2060). Variables were download at two resolutions (30 arc-seconds or 2.5 minutes according with species distribution). Species occurrence information available in GBIF were downloaded and filter to extract geographic information of species presences and absences. Additionally, country level information of presences (namely, Flora-On platform) was also added. Duplicated and closer reports were deleted to ensure only one occurrence per pixel. Modelling was performed in R software using MaxEnt through biomod2 package, while environmental and presence-absence data was prepared using dismo, ecospat and raster packages, also in R software. Environmental niche suitability of each species was observed in QGIS software and maps were built in the same platform. The proportion of stable niche (suitable niche common to present and future niche projections, in grey), niche lost (suitable niche present in present projection only, in orange) and niche gain (suitable niche present in future projection only, in green) were calculated in QGIS (example in Figure 1).

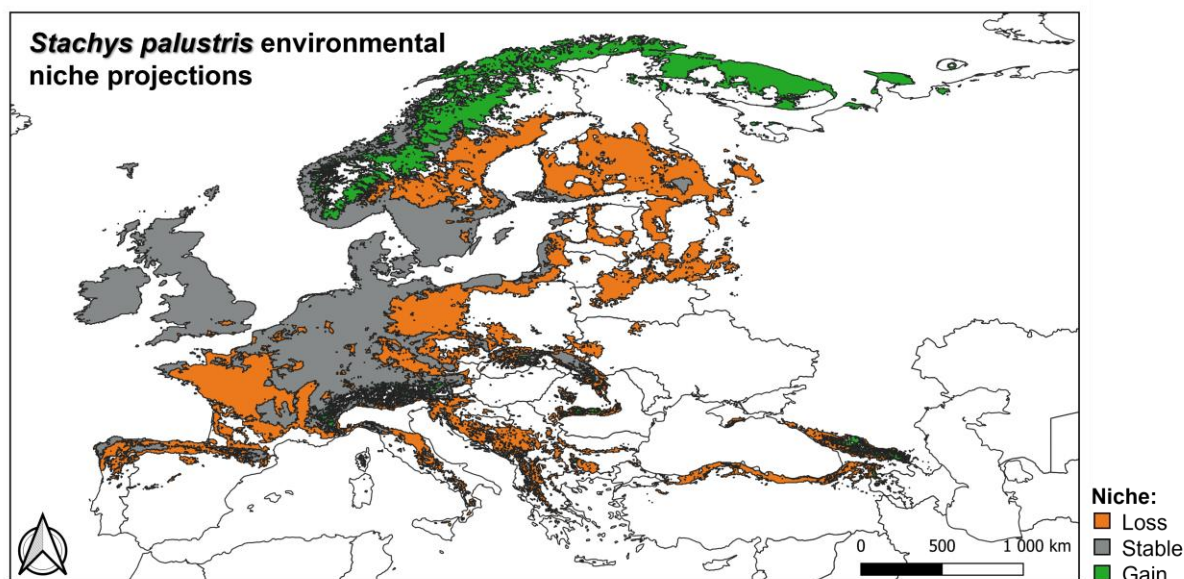


Figure 1: *Stachys palustris* environmental niche projections. Comparison of present and future climatic niche projection HadGEM3-GC31-LL model under ssp585.

A document is being prepared to be submit to a scientific journal and the results will be presented in the annual meeting of the WG1 to be held in Coimbra, 28th to 31st August, 2023.

Description of the VM main achievements and planned follow-up activities

Description and assessment of whether the VM achieved its planned goals and expected outcomes, including specific contribution to Action objective and deliverables, or publications resulting from the VM. Agreed plans for future follow-up collaborations shall also be described in this section.

(max. 500 words)

Monetary resources available for the development of *in situ* conservation actions are limited, what makes mandatory a rigorous and well-developed conservation plan. One important factor to be considered is the projections of climatic changes scenarios, as they directly impact and (re)define species distributions, either decreasing or displacing the suitable available area. This is especially relevant for *in situ* conservation of threatened plants as long-term conservation plans need to identify the most suitable conservation areas and conservation actions accounting with climate change. With the development of niche modelling tools, it became possible to project current and future species distribution. With in this Virtual Mobility Grand, I provide information about suitable conservations areas for European threatened plants species by producing distribution maps in the future under different scenarios of climatic changes for 25 threatened species.

This main goal was achieved for 25 European threatened plants species and their congeneric non-threatened species to provide additional information to evaluate a possible generalist conserve action for the plant's genus or a species-specific conserve plan. At the same time, the use of a short-time period (2041-2060) to project the suitable areas of the selected species allowed to establish a priority order in terms of conservations actions, e.g., plant species with high percentage of niche lost need to be following with more detail and justify a stronger immediate effort of conservation. As the number of species modelled increase, it will be also possible to assess the general response pattern of European threatened plant species to climatic change.

The results are currently being analysed in detail and general considerations are still preparation, being an ongoing work. The final report will be presented in the ConservePlants MC Meeting to be held in Coimbra in August 2023, as proposed in the application. Additionally, a manuscript is being prepared with all these results to be submitted to a high impact scientific journal, publishing not only the general consequences of climatic change in plant species niche suitability, but also provide information about specific species with different requirements. This will allow to achieve the main goal of this Virtual Mobility Grant: incorporation of European threatened plants species performance under future climate scenarios in future conservation plans. Finally, the results can also be translated and adapted to technical reports to be used by local stakeholders in conservation agencies for the development of targeted conservation actions.