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Active management actions for the conservation of the endangered Mediterranean island flora: the CARE-MEDIFLORA project

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Abstract
The Mediterranean Basin is one of the world's most biodiverse regions and it roughly counts 30,000 different plant *taxa*, of which approximately 50% are endemic *taxa* to the region. Thus, this area has been recognized among the world's 34 biodiversity hotspots. Furthermore, the rate of endemism of the big Mediterranean islands is higher than that usually recorded in the neighbouring mainland areas. Plants are vulnerable to many threats mainly represented by physical factors, such as climate change, extreme weather events, recurrent fires, agriculture, as well as by biological factors, such as invasive species and pests. All these factors are particularly worrying in island ecosystems where urban sprawl and human activities may represent a major source of threat hampering the preservation of important habitats and plant species, especially when circumscribed to small areas. In addition, less than 10% of these areas is protected (*e.g.* nature reserves, regional or national parks, *etc.*) and, likely most worrying, their management is not always based on the specific scientifically based plant needs. Given these circumstances, many plant species of the Mediterranean area are facing the risk of a severe decline and require urgent protection measures. While *in-situ* conservation is the fundamental approach to biodiversity conservation, *ex-situ* conservation is an alternative and effective way to prevent immediate extinction. The CARE-MEDIFLORA project, an initiative of eigh institutions all having a long experience in plant conservation, will make a step forward by using *ex situ* collections to experiment with *in situ* active management actions and measures for some *taxa* within the period of three years of the project. The involved institutions will jointly work to address both short-term and long-term needs, including: (1) *in situ* conservation for some of the most endangered plant species of the Mediterranean islands through active management actions (*e.g.* reintroduction, reinforcement, fencing, *etc.*), in collaboration with the most relevant local authorities to ensure the sustainability of the results; (2) *ex situ* conservation of the most endangered plant species of the Mediterranean islands through the collection and seed banking of accessions that will be representative of the overall diversity of the selected *taxa*; (3) establishing a network connecting scientific institutions from the Mediterranean islands in order to ensure the circulation of information, knowledge and project results sustainability. In addition, great efforts will be devoted to the training of conservation plant specialists, in order to increase collaboration among institutions dealing with *in situ* and *ex situ* conservation and to increase awareness about the vulnerability of the native flora through the involvement of local stakeholders and environment-related agencies.

Key words: alien species eradication, *ex situ* conservation, fence erection, *in situ* conservation, Mediterranean islands, plant translocations, seed banking, threatened Mediterranean flora.

Introduction

The Mediterranean Basin is an important center of plant diversity since, in only 1.6% of the Earth's surface, it hosts almost 10% of the world's plants; for this reason, it has been identified as one of the 34 global biodiversity hotspots (Mittermeier *et al*., 2005). The extremely high rate of regional endemism is likely the most striking feature of the Mediterranean flora, with approximately 60% of all native *taxa* being Mediterranean endemics, half of which corresponding to narrow endemic species (Thompson, 2005). This outstanding biodiversity is chiefly due to the unique paleogeographical, geological, and climatic history of the Mediterranean (*e.g.* Nieto Feliner, 2014). Actually, it lies at the intersection of the Eurasian and African landmasses, and is characterized by an noteworthy geomorphological and pedological variability. Furthermore, the Mediterranean sea shows some other peculiar conditions, being a semi-enclosed basin surrounded by a complex orography, which strongly affects the local climate and causes relevant interac-

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tions and feed-backs among ocean-atmosphere-land processes; all these factors, together with other characteristics of the sea (*e.g.* high water temperature and salinity, very limited tides, waves and meteorological phenomena) make the Mediterranean climatology really peculiar, also for its relevant annual and seasonal variability.

Plant diversity is, however, not evenly distributed. Actually, in areas featured by a high biodiversity, as the insular mountain ranges, the endemic-plant richness largely depends on environmental conditions and it was possible to identify hierarchically arranged hotspots within hotspots (Cañadas *et al*., 2014). In fact, within the Mediterranean Basin, 12 main meso-hotspots, accounting for roughly 44% of the endemic flora, have been recognized (Médail & Quézel, 1997, 1999); among these, all the large Mediterranean islands (*i.e.* Sicily, Sardinia, Cyprus, Corsica and Crete) and Balearic Archipelago play a relevant role, reaching more than 40% of endemism.

Mediterranean islands are defined as continental and oceanic islands, respectively, based on their different geological history. The first ones are the result of the fragmentation of continental plates (Rosenbaum *et al*., 2002), while the second ones have originated as a consequence of a volcanic activity (Guillou *et al*., 2004). Also for this reason, they are floristically rather diverse being, at least partly, the result of different processes occurred during their evolution. Despite their isolation and the crucial role played by the Mediterranean islands as climatic *refugia* (Medail & Diadema, 2009; Gentili *et al*., 2015), some similarities are still shared with the floras of the surrounding mainland areas.

Nowadays, the Mediterranean plant diversity is severely threatened both by natural and anthropogenic factors, and it deserves particular attention from a conservation viewpoint; this phenomenon in particularly relevant in the insular context. The Mediterranean basin was the cradle of some of the greatest civilizations with the foundation of many human settlements across the whole hotspot for more than four millennia, while the subsequent soil over-exploitation and the conversion of much of the pristine vegetation to agricultural lands went together (Tucker & Evans, 1997; Vogiatzakis *et al*., 2016); the population of the Mediterranean basin has recently exceeded 300 million and it is still increasing, especially in the North African countries.

The Mediterranean islands encompass a wide range of habitats within a small and restricted range. Among these, coastlines are particularly connotative of insular systems. They comprise a variety of valuable and fragile habitats such as sandy or rocky shores, dunes, cliffs, lagoons, salt marshes, estuaries and deltas. Those habitats are particularly prone to several severe threats for the conservation of biodiversity. Moreover, Mediterranean islands are featured by important and exclusive mountain habitats with a remarkable flora which might be severely affected as for example by global warming. As one may expect, the geomorphological features of the Mediterranean usually limit the chance for plants to overcome the acting threatening factors by migrating upwards or sideways in neighbouring areas. For this reason, insular ecosystems are considered more fragile than continental ones, while the uncertainty regarding the conservation of valuable native flora is much more exacerbated in insular habitats than in their mainland counterparts.

The preservation of biodiversity, a well-established priority in the global environmental policies, is a key component of the UN 2030 Agenda for Sustainable Development and is a global commitment under the Strategic Plan for Biodiversity 2020, as well as under the EU Biodiversity Strategy to 2020 (*i.e.* Target 6). Nowadays, biological diversity faces several threats and the loss of biodiversity is constantly increasing (Pimm *et al*., 1995; Butchart *et al*., 2010; Ceballos *et al*., 2015). Actually, several international conventions set ambitious targets to reduce biodiversity loss. The Global Strategy for Plant Conservation (GSPC), adopted by the Convention on Biological Diversity in 2002 and updated in 2010, provides the overall framework for plant conservation at global and national level. Plant conservation has been embedded within target 5 of the Global Strategy for Plant Conservation (GSPC) (2008), that was updated at the Conference of the Parties to the Convention on Biological Diversity (CBD, 2010) to "*At least 75 per cent of the most important areas for plant diversity of each ecological region protected, with effective management in place for conserving plants and their genetic diversity*" together with target 7 that concerns *in situ* protection of threatened plant species "*At least 75 per cent of known threatened plant species conserved in situ*" and target 8 being related to *ex situ* conservation "*At least 75 per cent of threatened plant species in ex situ collections, preferably in the country of origin, and at least 20 per cent available for recovery and restoration programs*".

However, despite the efforts made, the loss of biodiversity is constantly increasing worldwide mainly by the continuous and growing human-related impacts (*i.e.* pollution, global warming, industrialization, urbanization and consequent "waste of land"). In fact, despite the adoption of several shared directives aiming at the protection of plant species and areas featured by a remarkable biodiversity, such instruments do not seem to be as effective as needed and expected.

A similar general trend is observed at European level. In Europe, the Habitat Directive (HD) and the Natura 2000 network with more than 27,000 sites covering about 18% of the terrestrial surface of the EU (European Commission, 2015), represent the core strategy of nature conservation in the EU countries and the most important tool aiming at halting, or at least significantly reducing, biodiversity loss (*e.g.* Balmford *et al*., 2005; Maiorano *et al*., 2007; Pullin *et al*., 2009). Habitat Directive promotes the conservation of biodiversity by maintaining, or restoring, natural habitats and species in a favourable conservation status by means of cogent protection policies (European Commission, 1992). However, the last European Reports of HD reveals negative conservation status for a fairly good number of plant species protected by the Directive (EEA, 2015). At the same time, a high percentage of "unknown" conservation status was reported for 13 States (>20% in Portugal, Italy, Spain, Denmark and UK), highlighting the urgency of promoting in-depth researches on species listed in the Habitat Directive at continental level (Fenu *et al*., 2017).

In recent years, great efforts have been made to take concrete conservation actions and, in particular, a great development covered the structures dealing with *ex situ* conservation. *Ex situ* strategies (*i.e.* conservation of species outside their natural habitats) represent alternative ways to preserve plant diversity. Germplasm conservation, including seed banking, pollen/tissue storage and vegetative cloning, allows to preserve most of the genetic material in a small space. Several germplasm banks are particularly interested in preserving the flora of the Mediterranean islands such as BG-SAR in Sardinia (Fenu *et al*., 2015), BGS-CAT in Sicily, MPCU of MAICh in Crete, or BGVIB in Sóller, Mallorca (Spain). Despite several objective constraints (*e.g.* plants that produce few viable seeds, plants growing in peculiar habitats or unorthodox seeds, *etc.*), main purpose of these structures is to ensure any possible effort for the long-term conservation of the highest number of plant *taxa*. Optimistically, *ex situ* conservation could reach significant levels in the forthcoming years (at least in some territories worldwide) and with accessions representative of the natural variability. However, the main question still remains: how these accessions will be used for future conservation activities?

Conversely, despite the strategic importance of the *in situ* measures highlighted by all most important international conventions (*e.g.* Target 7 of the GSPC for 2020), their full application remain far from being widely achieved. *In situ* strategies (*i.e.* conservation of species in their natural habitats) is considered the most appropriate way of conserving biodiversity and the preservation of the areas where natural populations of species exist is an underlying condition for their proper and effective conservation. Thus, according to Article 8 of the GSPC, *in situ* conservation is generally considered the primary approach for species conservation as it ensures that species are maintained in their natural environments, allowing evolutionary processes to continue, while *ex situ* conservation plays a complementary role to *in situ* conservation, providing a "safety back-up" and an insurance policy against extinction in the wild. In this context, plant translocation is a relatively recent development and a potentially important tool for reducing the extinction risk of threatened species and improving their conservation status. Translocation, or the controlled placement of plant material into a natural or managed area (*e.g.* Godefroid *et al*., 2011; Abeli *et al*., 2016; Volis, 2016), includes population reinforcement, reintroduction and introduction aiming at enhancing population viability, for instance by increasing population size and/or genetic diversity. Given that, any translocation ideally requires a thorough understanding of the biology of the species involved (*e.g.* life form, reproductive biology, symbiotic relationships, *etc.*), a well-arranged translocation plan should take into account: the selection of the planting area(s), the origin of the genetic material, the type of propagative material (seeds or cuttings), planting methods, and lastly the monitoring actions to be undertaken (IUCN-SSC, 2013, Godefroid *et al*., 2010). Though some examples are available worldwide, very few translocations have been carried out in the Mediterranean territories compared to the true need of reducing the extinction risk for many plant species, most of which narrow endemics (*e.g.* Cogoni *et al*., 2013; Rita & Cursach, 2013, Piazza *et al*., 2011).

The importance of translocations, aiming to contribute to the recovery of a given threatened species, is particularly relevant when it is part of an integrated *ex situ* and *in situ* conservation approach. In particular, the tight connection between *in situ* and *ex situ* conservation strategies is the emerging tool in the conservation of plant diversity (*e.g.* Cogoni *et al*., 2013; Volis, 2016). However, several constraints may hamper the implementation of these conservation actions, such as the high economic and time costs, the availability of optimal sites, the difficulties (or impossibility) of implementing these actions on private areas, and the high uncertainty of success chiefly connected to natural stochastic events (*e.g.* Godefroid *et al*., 2011; Fenu *et al*., 2015; Volis, 2016). Considering these limitations, it is often necessary and useful to identify other active management measures, such as fencing (to prevent grazing and to protect the most critical life-cycle stage for the population survival), removing/eradicating alien invasive plants or controlling pest plants.

Study area

The Mediterranean Basin, with about 10,000 islands and islets and 244 of which are inhabited, encompasses one of the largest "archipelagos" in the world (Pons *et al*., 2013). Some eastern Mediterranean countries, such as Croatia and Greece (Nikolic *et al*., 2008; Kougioumoutzis *et al*., 2016), include a remarkable number of these islands; however, the largest Mediterranean islands (Sicily and Sardinia), as well as around 1100 islets, are located in the western side (Pons *et al*., 2013). For historical and geographical reasons, but also due to the particular biotic interactions among species, Mediterranean insular conditions determine specific plant diversity and assemblages (Pons *et al*., 2013). Accordingly, the rate of plant endemism reaches very high levels in the Mediterranean islands, generally comprising between 10-12% of the total vascular flora (*e.g.* Pons *et al*., 2013; Fenu *et al*., 2014). In particular, plant endemism rate is considerably higher in mountain ranges and in satellite uninhabited islets, where endemics represent about 35-40% of the vascular flora (*e.g.* Brullo *et al*., 2005a, 2005b; Guarino *et al*., 2005; Trigas *et al*. 2013; Kougioumoutzis *et al*., 2016; Fois *et al*., 2016).

The largest Mediterranean islands are six and can be divided into Tyrrhenian (*i.e.* Baleares, Corsica, Sardinia and Sicily) and the East Mediterranean (*i.e.* Crete and Cyprus). The Tyrrhenian islands belong to the Protoligurian massif, the Hercynian formation – corresponding more or less to the actual Balearic Islands, Corsica, Sardinia and Sicily – that underwent fragmentation during the Oligo-Miocene (Rosenbaum *et al*., 2002). The Balearic Islands form an archipelago of five major islands and about 100 small islets, covering a surface of 4,992 km^2. Only the main island (Mallorca) is characterized by the presence of true mountain ranges, *i.e.* Serra de Llevant and Serra de Tramuntana whose highest peak is the Puig Major (1,445 m a.s.l.); the Balearic flora displays 1551 *taxa* of which 140 narrow endemics (Sáez *et al*., 2013). Corsica, covering a surface of 8,748 km², is mostly mountainous with several peaks above 2,500 m, of which the highest is the Monte Cinto (2,710 m a.s.l.). The peculiarity of Corsica is his alpine zone; furthermore, the great altitudinal range generates its endemic plants richness. The Corsican flora amounts to 2,798 *taxa*, of which 302 are endemic (13.49%), including 132 exclusive *taxa*, 78 Corso-Sardinian *taxa*, 19 *taxa* which belong to the Italian-Tyrrhenian superprovince, and 7 *taxa* can be found in both Corsica and the Balearic Islands, while other endemics belongs also to other adjacent areas (Jeanmonod & Gamisans, 2013).

Sardinia, placed at the center of the Thyrrenian sea, covers a surface of 24,089 km² and is the second largest island in the whole basin after Sicily. The high mountain of Sardinia is represented by the Gennargentu massif whose highest peak is Punta la Marmora 1,834 m a.s.l. Sardinian flora, after the latest floristic researches, counts more than 3,000 *taxa*, of which 347 are endemic (*e.g.* narrow endemics, Sardinian endemics, Corso-Sardinian endemics, Corso-Sardinian-Balearic endemics) with 45.8% (183 *taxa*) being exclusive endemics (Fenu *et al*., 2014).

Sicily is the largest Mediterranean island with an area of 25,711 km^2 and, being placed in the center of the Mediterranean basin, it acted, and still acts, as a crossroad for plant westward and eastward migrations. Its highest peak is represented by Mt. Etna (currently 3,340 m a.s.l.), the highest active volcano of Europe. As concerns its floristic richness, the vascular flora is currently estimated to consist of about 3,200 *taxa* (Giardina *et al*., 2007; Raimondo *et al*., 2010) with about 370 narrow endemics (*i.e.* exclusively occurring in Sicily).

The East Mediterranean group includes Crete and Cyprus; Crete is the fifth largest island in the Mediterranean Basin and is located in the southernmost part of Greece. It has a total area of 8,700 km^2 including 200 satellite small islands and islets around it. The island is generally characterized as mountainous and the proximity of the high mountains to the sea is characterized by large deep gorges, accommodating unique habitats. According to the latest update reports (Dimopoulos *et al*. 2013, 2016; Strid 2016), the flora of Crete comprises about 2,100 native *taxa* with ca. 11% of them being endemic to the island (228 *taxa*). The floristic region of Crete - Karpathos is the most important center of endemism in Greece and it is characterized by the highest rates of vascular plant endemism and range-restrictedness (Georghiou & Delipetrou 2010; Dimopoulos *et al*., 2016).

Cyprus is the third largest island in the Mediterranean with an area of 9,251 km^2. The island is divided into three main geomorphological zones, the Troodos Range, the Pentadaktylos Range and the Mesaoria plain. The geology and geomorphology of the island, the climatic conditions, its location between the three continents (Europe, Africa and Asia), along with more than 10,000 years of history and civilization, yielded a flora of great diversity and richness (Tsintides *et al*., 2007). The flora of Cyprus comprises 1,640 indigenous *taxa* (species and subspecies). The endemic flora of Cyprus includes 142 endemic *taxa* which consists account for 8.66% of the native flora of the island (Hand *et al*., 2011).

The CARE-MEDIFLORA approach

Due to the overall situation, in which extraordinary rates of endemism are associated with an exceptional degree of environmental and human-related threats, some not secondary features are shared by the Mediterranean insular territories. Such similarities and differences represent a great opportunity to join and harmonize methods and methodologies focused on endangered plant conservation in such a peculiar and unique natural laboratories. With this vision and under this light, no project aiming to develop knowledge and methodologies in plant conservation islands has been developed and implemented so far.

The project CARE-MEDIFLORA, 80% funded by the MAVA Foundation, is an initiative led by institutions of six Mediterranean islands and the IUCN/SSC Mediterranean Plant Specialist Group (more details at http://www.care-mediflora.eu/), that have long experience in plant conservation activities. The protection of threatened flora towards the targets of GSPC (Global Strategy for Plant Conservation) constitutes the main focus of the project partners (institutions and Gene Banks from six Mediterranean islands) which, among others, have already successfully collaborated in a previous project named "*Ensuring the survival of endangered plants in the Mediterranean*" (Gil *et al*., 2013).

The approach agreed by all partners is mainly based on using *ex situ* activities as a tool to improve *in situ* conservation of threatened plant species, *i.e.* by using genetic material (seeds) and know-how from previous *ex situ* actions (*e.g.* seed collections, germination experiments, living plant collections, *etc.*) for implementing studies and field works aiming at a true *in situ* conservation of the species.

The project strategy combines different methodologies for prioritizing endangered plant species occurring in each Mediterranean island (six partner island). In this light, the project aims at tackling the issue of conservation urgency towards endangered plant species of the Mediterranean through an innovative multi-level approach that encompasses *in situ* and *ex situ* methodologies. Actually, the CARE-MEDIFLORA project is arranged into four main objectives: (1) elaboration of conservation priorities and selection of target species in each island; (2) *in situ* conservation actions; (3) *ex situ* conservation actions and, lastly, (4) networking and communication activities.

1. Elaboration of conservation priorities (Comparison and harmonization of the criteria for establishing the conservation priorities) and selection of target species in the different islands.

In a preliminary stage the partners will cooperate in order to select the species that will be targeted during the project, using common criteria to prioritize their conservation actions. This phase has been identified as a crucial starting point in order to develop knowledge and common methodologies among islands. As a consequence of this shared approach, four different main criteria were established and followed:

Threat degree: it refers to the inclusion of a plant species in a threat category of global IUCN Red List (IUCN, 2012a); additionally also the plants listed in the national or regional (IUCN, 2012b) catalogues was been considered (*e.g.* Delage & Hugot, 2015). In the framework of the CARE-MEDIFLORA project, it was agreed that the plant species should be at least "threatened" (thus corresponding to the CR, EN and VU categories); additionally, also DD plant species could be included as a precautionary principle.

Regional Responsibility: it indicates the highest relevance given to those species whose distribution is circumscribed to a specific area and represents the first order of priority at local level (Martin *et al*., 2010; Bacchetta *et al*., 2012; Gauthier *et al*., 2010; Fenu *et al*., 2015). Actually, given the aforesaid peculiarities of the Mediterranean area, plant conservation priority settings at finer-scales should be preferred due to biogeographic and cultural diversity and regional threats. Accordingly, a special priority will be given to the endemic plant species and plants deserving a conservation interest for a given island (*e.g.* peripheral and isolated plant populations, PIPPs, *etc.*).

Policy plant species: it refers to those species listed in the annexes of Habitat Directive (Annexes II, IV and V). The conservation of plant species of community interest in a favourable conservation status by means of cogent protection policies is mandatory for all EU member states (*e.g.* Fenu *et al*., 2017). In addition, each partner may consider those plants listed in other specific national or regional regulations: for example in Crete about 80 *taxa* are protected by Greek Presidential Decree 67/81 "On the protection of native flora and wild fauna and the determination of coordination procedures and control of research on these" or the Balearic List of Threatened species (Sáez & Rosselló, 2001; CAIB, 2005).

Finally, *wetlands and plants* eco-physiologically linked to such peculiar habitats have a particular interest for conservationists. This is particularly true for those species unable to migrate to other sites which, in a context of climate change or climatic instability, could act as *refugia*l stands.

Main result of this preliminary phase will be a checklist including the whole pool of species selected by each island. Furthermore, always considering these four criteria, each partner will decide which are the plant populations needing urgent *in situ* conservation measures (such as translocation, alien species eradication, fencing, *etc.*) and in which populations seed collection could be performed for germplasm conservation. For the selected plants/populations, each partner will plan its own *in situ* and *ex situ* activities. Of course, changes to the targeted species list will be always possible, respecting the four criteria, during the project thus making the list flexible, open and continuously upgradable (*i.e.* dynamic list).

2.* In situ *conservation actions

It includes all the *in situ* measures aiming at improving the conservation status of the selected species/populations. The optimal action will consist in the plant translocations (including reintroduction and/or reinforcement), but also complementary active management measures (as passive defence measures which may consist in fencing the area where the threatened species/populations occur, eradicating or controlling pest plants, or restoring the natural vegetation within or around the area, thus reconnecting isolated remnants) will be adopted.

In order to define whether the translocation of the target species is possible and feasible, it will be necessary to perform a preliminary survey chiefly based on historical data, current distribution range of the species, distance from the nearest natural population(s) and availability of the potential growing sites. In addition, researches on the life cycle, reproductive biology, population biology and ecological requirements of the particular species or plant group are needed and crucial for having a reliable *in situ* action (Falk *et al*., 1996; Valee *et al*., 2004; Menges, 2008; IUCN/SSC, 2013; Cogoni *et al*., 2013; Fenu *et al*., 2016; Volis, 2016); a translocation plan will be created for each target species taking into account the guidelines of IUCN/SSC (2013). Where relevant, in cases of target species selected for *in situ* actions and already sampled and stored in the partners' seed banks during previous projects, such as the above mentioned "*Ensuring the survival of endangered plants in the Mediterranean islands*", propagative material (mainly seeds) may be obtained from these collections. A similar approach will be adopted in order to plan the passive or other management actions. In addition, all partners are committed for the periodical monitoring of all *in situ* activities, as well as for the maintenance of the protections (*e.g.* fences) in order to verify if and to which degree the initial objectives have been accomplished. Finally, in order to make the *in situ* activities more effective, they will be implemented in collaboration with the local authorities, and consequently regional authorities and local stakeholders will be actively involved in the monitoring process.

3.* Ex situ *conservation actions

Ex situ measures, such seed collection, curation and storage for germplasm conservation, are a relevant part of the project. Germplasm collection and curation will be carried out considering the national and international regulations and standards (such as those ones developed by the international networks of Genmeda, Ensconet, *etc.*). The germplasm will be collected following criteria aiming at maximizing the representativeness of the genetic diversity of the populations in each island (Bacchetta *et al*., 2006). To achieve this goal, collections of the same *taxon* will be carried out in more than one location and, for those *taxa* occurring in two or more islands, they will be sampled considering their multiple occurrence.

As a precautionary measure, aiming at ensuring the conservation of the collected seed material, accessions will be duplicated in the seed banks of other project's partners or, if necessary and appropriate, in other public institutions.

Moreover, data concerning the germination ecophysiology of the collected germplasm will be obtained through seed germination tests. The species to be tested will be selected on the basis of their availability, particularly in terms of number of seeds per accession. Therefore, germination tests will be carried out only for those species whose distribution allow the collection of adequate quantity of seeds to be used both for *ex situ* conservation and seed germination tests. All info concerning the collection of accessions and germinations outcomes will be published in the project's website, as well as in the database of the Mediterranean network Genmeda.

In addition to the long term seed conservation, each institution will guarantee seeds availability for future recovery or restoration programmes and, at the same time, seed collection will be partly dedicated to an "active collection" to be used for producing plants.

In cases of extremely endangered perennial plants, a collection of cuttings could be useful for having an *ex situ* "copy" of the wild population. Therefore, such "living duplicates" will be cultivated in the partners' botanical gardens, and they will enable their use in recovery plans but also for disseminating the project targets and results.

In the framework of this activity, joint field trips will be carried out by the members of the partner institutions involved in the project during the whole collecting seasons. Seed sampling will be performed by the personnel of the partner institutions in collaborations with regional authorities and local stakeholders.

4. Networking and communication activities

Networking among the project partners is considered as a priority: local institutions/authorities in each island will be in regular contact with related international initiatives/projects at Mediterranean level, aiming at exchanging experiences so as to improve collaboration and effectiveness on plant conservation, as well as building a wider and more sustainable network of Mediterranean Plant Conservation Centres. All island partners of this project have already successfully collaborated in a previous MAVA funded project, while project partners from four out of the six islands had also collaborated in past Interreg projects and are already members of the network `Genmeda (Network of Mediterranean Plant Conservation Centres) that funded in 2010, counts so far in total 13 members from 7 different countries. Special actions will be devoted for the enlargement of the members of this network from both Northern and Southern Mediterranean countries and for the improvement of its functioning: this will enable to share the knowledge with botanical gardens, seed banks (and other conservationists) from other parts of the Mediterranean, especially from Northern African and Near East countries.

The autonomy of each partner for the activities in their island will be respected. Sharing knowledge with the staff of local authorities will be provided by project partners, aiming at the long-term continuation of *in situ* plant monitoring, as well as for the maintenance needs of infrastructure provided by the project. Furthermore, there will be the possibility for the partners' members to visit each other institutions during the annual project meeting, so as to share know-how and problems solutions. In this framework, the elaboration of further common lines of research between two or more partners will be strongly encouraged.

Communication in its various forms will be considered one major point and a project communication team will be established; then each partner will present in detail the project in the social networks and in its own website, taking care to constantly update the dedicated web page(s) whenever there will be significant news or key outcomes, by a project information leaflet in all languages of the partners, technical reports and scientific papers.

In addition, non-electronic communication will have a prominent importance: each partner will organize some local event to disseminate the aims of the project and the key issues related to the theme of native flora conservation. These events will be open to both local people and private stakeholders and actors, as well as to anyone who might have an interest in the topics. A final international workshop involving all the partners will be held at the end of the project. This event will be aimed at presenting the results of the project and at intensifying the collaboration between the Mediterranean partners, as well as laying the foundations to draw up new cooperation among institutions involved in flora conservation. The participation of the partners in scientific meetings with posters and oral communications will be greatly supported, while other kinds of communication will see the creation of a project leaflet.

Expected results and project benefits

Given the current situation of the native vascular flora and its conservation status, there is a serious need for changing the management of the natural habitats in the whole Mediterranean basin. This project will concretely contribute to alleviate the lack of dedicated conservation management plans by providing effective measures both for *in situ* and *ex situ* protection. In particular, at the end of the project the following goals will be achieved: (a) a list of plants needing urgent *in situ* and *ex situ* conservation measures based on scientific criteria; this list could be useful also for future conservation programs both at local and national level; (b) 60 *in situ* conservation actions (10 per island) addressing at least 30 different threatened plant *taxa* (at least 5 per island); (c) a total of 600 accessions for *ex situ* actions related to at least 120 target *taxa* (at least 100 accessions for min. 20 *taxa* per island).

Furthermore, the project will strength the existing network of Mediterranean institutions involved in native plant conservation, including both *in situ* and *ex situ* plant conservation specialists. In addition, the project will provide exchange opportunities for the partners staff.

On the one hand, this project promote a management strategy for following similar directions in different territories in the framework of the commitments deriving from the international conventions (such as the Convention on Biological Diversity), the common European and the Euro-Mediterranean Partnership policies, and so on. Actually, cross-border cooperation projects appear as one of the most effective tool contributing to the joint development of an indispensable management plan. In this light, this kind of cooperative project display strong points, such as exchange of experiences, good practices implementation, collaboration on the setting up of common methodologies and, not less relevant, the adaptation of the tools to the specific peculiarities of each territory.

Concluding remarks

As far as we know, the CARE-MEDIFLORA project represents the first attempt to develop a common approach and methodology for plant conservation in the Mediterranean insular context, where a high level of endemicity is associated with a remarkable degree of environmental and human influences. In fact, there are very few successful projects of translocation of threatened plant species in the Mediterranean area aiming to promote the long term conservation of threatened plant species in their natural habitats. In this sense, CARE-MEDIFLORA also constitutes a unique opportunity to unify and coordinate methods and methodologies on endangered plant conservation in such a peculiar natural laboratories. The experimental conservation actions, particularly the plant translocations, may act as a model for other threatened species occurring in the Mediterranean islands and in the whole Mediterranean area. In fact, the project actions can be replicated in the partners countries (at a larger scale), as well as in other Mediterranean countries with similar environmental conditions.

In addition, further outcomes may emerge from the project that will be useful for conservation policies both at local and national level, particularly for contributing to the national reporting to the relevant Multilateral Environmental Agreements (MEAs, such as CBD and GSPC). In fact, this project is focused on the conservation of priority plants selected according to the regional responsibility criterion and those included in the main international regulations (*e.g.* Habitat Directive) attaining also to the GSPC and European Plant guidelines. Additionally, these priority lists may support at local level the identification of the Important Plant Areas (IPAs) and the Key Biodiversity Areas (KBAs) in the Mediterranean islands. The results that will be achieved through the CARE-MEDIFLORA project may contribute to reach the targets of the EU Biodiversity Strategy to 2020 (*i.e.* Target 6) and several Aichi Targets (*e.g.* 11, 12 and 19); in particular, the implementation of the *in situ* conservation measures can significantly contribute to the achievement of the Aichi Target 12 that, although these actions are the best way to conserve natural plant populations, very little has been done in the Mediterranean area compared to what is necessary to prevent the risk of extinction of many plant species.

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