



Use of native plants for ornamental purposes to conserve plant biodiversity: Case of study of Majella National Park

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ABSTRACT

The Majella National Park in Italy, through its ex situ plant conservation facilities (seed bank, botanical gardens and nurseries) plays an important role in preventing biodiversity loss, especially those rare and endemic species. Among the various conservation strategies, the Park developed a useful way to increase ex situ collections through a nursery chain and selling/giving indigenous species to the local people and community also for ornamental purposes. To date, more than 500 individuals of indigenous species are given every year.

This spread of native plants contributes to the diffusion of the rare and endemic species in the protected area and its surroundings enhancing their survival chances.

1. Introduction

Endemic taxa are key elements to establish national conservation priorities and to guide conservation strategies, as their persistence depends entirely on national policy. In general, the higher the number of taxa endemic to a country, the greater the responsibility of that country in preserving global biodiversity (Brundu et al., 2017). Using the categories of the IUCN Red List to all Italian endemic vascular plants (1340 taxa) Orsenigo et al. (2018); Orsenigo et al. (2020) assessed their current risk of extinction. The results revealed that six taxa are already extinct in Italy and that 22.4 % (300 taxa) are threatened with extinction. From the data of the third Italian assessment regarding the conservation status of plants listed in the (Directive 92/43/EEC), the EU checklist showed a critical situation with only 34 % classified with a “favourable” Conservation Status (Fenu et al., 2017).

For the conservation of endemic and non-endemic species, preservation facilities such as botanic gardens are important to preserve plant diversity ex situ and can prevent extinction through integrated conservation action (Abeli et al., 2020; Mounce, Smith, & Brockington, 2017).

However, the establishment of ex situ collections with a high conservation value requires a sound understanding of the evolutionary processes that may reduce the suitability of these collections for future reintroductions. Particularly, risks such as fitness decline of cultivated plants over time, trait shifts and loss of adaptation to the original habitat due to changes in selection regimes have rarely been addressed so

far. Genetic drift can lead to fitness decline in ex situ cultivated plants, but these drift effects strongly depend on the conditions and cultivation history in the ex situ facility (Ensslin, Tschöpe, Burkart, & Joshi, 2015). From the evolutionary point of view, the materials stored in the seed banks are representative only of the moment in which they were collected, while the environmental factors impose evolutionary changes in the existing plant populations (Lowe, Gillies, Wilson, & Dawson, 2000). Nevertheless ex situ conservation of plants can be used to avoid complete extinction of very rare species (Dalrymple & Abeli, 2019). Volis and Blecher (2010) clearly identified the main roles of ex situ collections in conservation: creating a backup of genetic material if in situ conservation actions fail; preserving a significant portion of the genetic diversity of a species; and propagating species for restoration. Botanical gardens, seed banks and nurseries can be very effective in achieving these goals. Furthermore, a lot of these structures perform research activities to enhance the effectiveness of the conservation actions made.

2. Majella National Park

In Italy, the Majella National Park (MNP) is an important node of the Natura 2000 network as it is a Special Protection Areas (SPA) by 74,000 ha and includes within it a 4 Special Areas of Conservation (SAC) (Fig. 1).

The Park's flora stands out for its high numbers: 2286 specific and subspecific taxa' (Conti, Ciaschetti, Di Martino, & Bartolucci, 2019), among which 201 endemic taxa to Italy including 15 exclusive

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Fig. 1. "Michele Tenore" Botanical Garden.

endemics such as *Pinguicula fiorii* Tammaro & Pace, *Soldanella minima* Hoppe subsp. *samnitica* Cristof. & Pignatti, *Ranunculus multidentis* Dunkel, *Crepis magellensis* F.Conti & Uzunov, *Centaurea tenoreana* Willk., *Aquilegia magellensis* F.Conti & Soldano etc. More than 200 taxa are included in Italian Red List and Habitat Directive. The undisturbed environment of the Park is highlighted also by the presence of only 110 alien plant species, 55 of which naturalized and 16 invasive. In addition, there are more than 30 natural and semi-natural habitats in the Park territory listed according to Directive (EEC) 92/43.

The diversity of environments that characterizes the Park territory, together with the presence of a cultural background that still gives much importance to traditional habits, has allowed the conservation of an agricultural biodiversity that has completely disappeared in other places. It consists of a heritage of over 60 local varieties and landraces created by a long and balanced coevolution between man and his natural environment.

The Majella National Park in addition to protecting its territory with in situ actions and rules, has several structures suitable for the ex situ conservation of the plant heritage. In particular, it manages two botanical gardens (currently the only ones in Central Apennines managed by protected areas), a nursery and a seed bank.

As well as conserving species and their genetic heritage in suitable environments and their undoubted role in increasing public awareness about the importance of preserving biodiversity, such structures also play an important role in favoring scientific research on wild species and their possible use in reconstruction and restoration of degraded ecosystems.

One of the conservation objectives of the Park is to conserve endemic and rare species, those of particular phytogeographic interest, together with threatened traditional agricultural varieties.

The conservation work made by the seed bank and the nursery of the Park focuses on the most endangered species. They currently preserve more than 150 cultivars and wild species, many of the latter featuring on IUCN lists and/or protected by international conventions (Cites, Bern, etc.), the European Community "Habitat" Directive 43/92, Regional Law no. 45/1979 for the protection of Flora in Abruzzo and Regional Red Lists of Italian Plants. Over the years, many species have

been studied in their germination ecology, morphometry of seeds, seed dispersal, etc. (Di Cecco et al., 2017; Di Cecco, Di Musciano, D'Archivio, Frattaroli, & Di Martino, 2019; Di Martino et al., 2014; Frattaroli et al., 2013).

The Park's structures also play an important role for the restocking and creation of new populations of very rare plant species, activities that are known to be important in order to avoid the risk of extinction in nature (Abeli & Dixon, 2016).

3. Nursery

Although a uncommon practice in traditional nurseries, the reproduction of native plant species is of fundamental importance in a protected area. The introduction of non-native plant species from other geographical areas can threaten local biodiversity as these plants may act as invasive species colonising natural environments, hybridising with native populations so jeopardising their genetic integrity, act as vectors for parasites and even in some cases represent a risk for human health (Galasso et al., 2018; Pyšek et al., 2004; Richardson & Pyšek, 2006).

On the other hand, natural selection over thousands of years has produced native species well adapted to, and in harmony with, their environment. So, wild plants are also successfully used in sustainable landscaping and xeriscaping for their beauty, functionality in maintaining environmental stability in terms of resource preservation, low water consumption, reduced demand for pesticides and other chemical inputs, suitability in preserving valuable wildlife habitats as well as reduced maintenance and labor costs.

As well as to reinforce natural populations and to maintain the collections in the two botanical gardens, the plants grown in the nursery of the Park are used to the cultivation of medicinal herbs and traditional fruit trees on farms and smallholdings, to encourage the use of local species or ecotypes to restore and improve degraded environments (Fig. 2).

Among the species cultivated in the nursery, about 100 are those identified to be sold or given for ornamental purposes. Those plants are given for free to schools, public administrations and other institutions



Fig. 2. a) Plants for sale at the botanical gardens of the Park, b) detail on some rare species.

and private farms and smallholdings of the area that subscribe conservation projects of the Park. The plants are sold to visitors of the two botanical gardens at very low prices from EUR 1.50 to EUR 10.00 depending on the species, size and size of the pot. The species most in demand are the most flashy, but even the rare species have a good demand from visitors. In this respect, the structure of the nursery is entered in the Official Register of Producers and authorized under Legislative Decree 214/2005. The reproduced plants are also exhibited in flower and other botanical collection shows. The Park made an agreement with a private nursery to increase the number of reproduced

plants.

To date, more than 450 pots of indigenous plants are sold/given every year (Table 1).

In the nursery activity, reproduction by seed is preferred in order to ensure the genetic diversity and avoid genetic drift of the cultivated plants. The propagules are picked up from wild population avoiding their impoverishment following the rules edited by (ENSCONET, 2009). In order to avoid the genetic drift of the ex situ collection, the propagules are collected at almost every year in several localities.

Table 1

List of species cultivated and offered for sale at the Park's botanical gardens.

<i>Acer opalus</i> subsp. <i>obtusatum</i>	<i>Lychnis coronaria</i>
<i>Acer pseudoplatanus</i>	<i>Malus sylvestris</i>
<i>Achillea nobilis</i>	<i>Melissa officinalis</i>
<i>Allium schoenoprasum</i>	<i>Nepeta nuda</i>
<i>Althea officinalis</i>	<i>Origanum vulgare</i>
<i>Aquilegia magellensis</i>	<i>Phlomis fruticosa</i>
<i>Aquilegia dumeticola</i>	<i>Pinus mugo</i>
<i>Atadinus alpinus</i>	<i>Prunus avium</i>
<i>Aubrieta columnae</i>	<i>Prunus mahaleb</i>
<i>Betula pendula</i>	<i>Prunus spinosa</i>
<i>Buxus sempervirens</i>	<i>Pyracantha coccinea</i>
<i>Campanula spicata</i>	<i>Pyrus pyraster</i>
<i>Centaurea tenoreana</i>	<i>Pyrus cordata</i>
<i>Centaurea ambigua</i> ssp. pl.	<i>Quercus cerris</i>
<i>Centranthus ruber</i>	<i>Quercus pubescens</i>
<i>Cerastium tomentosum</i>	<i>Rhamnus cathartica</i>
<i>Chamaecytisus spinescens</i>	<i>Ribes multiflorum</i>
<i>Cornus mas</i>	<i>Ribes uva crispata</i>
<i>Cornus sanguinea</i>	<i>Rosa canina</i>
<i>Corylus avellana</i>	<i>Rosmarinus officinalis</i>
<i>Crataegus monogyna</i>	<i>Rubus idaeus</i>
<i>Dianthus hyssopifolius</i>	<i>Salix alpestrina</i>
<i>Dianthus ciliatus</i> s.l.	<i>Salix purpurea</i> s.l.
<i>Dianthus carthusianorum</i> s.l.	<i>Salix alba</i>
<i>Dianthus armeria</i>	<i>Salvia officinalis</i>
<i>Edrajanthus graminifolius</i>	<i>Salvia nemorosa</i>
<i>Emerus major</i>	<i>Sambucus nigra</i>
<i>Euonymus europaeus</i>	<i>Saponaria officinalis</i>
<i>Euonymus latifolius</i>	<i>Satureja montana</i>
<i>Fagus sylvatica</i>	<i>Saxifraga paniculata</i>
<i>Fragaria vesca</i>	<i>Saxifraga callosa</i>
<i>Fraxinus excelsior</i>	<i>Sempervivum arachnoideum</i>
<i>Genista tinctoria</i>	<i>Sempervivum tectorum</i>
<i>Gentiana dinarica</i>	<i>Silene paradoxa</i>
<i>Geranium sanguineum</i>	<i>Sorbus aria</i>
<i>Geranium macrorrhizum</i>	<i>Sorbus domestica</i>
<i>Helicrisum italicum</i>	<i>Sorbus torminalis</i>
<i>Hyssopus officinalis</i>	<i>Sparganium erectum</i>
<i>Ilex aquifolium</i>	<i>Spartium junceum</i>
<i>Iris marsica</i>	<i>Tanacetum corymbosum</i> subsp. <i>achilleae</i>
<i>Juniperus communis</i>	<i>Tanacetum parthenium</i>
<i>Juniperus communis</i> var. <i>saxatilis</i>	<i>Taxus baccata</i>
<i>Juniperus sabina</i>	<i>Thymus vulgaris</i>
<i>Laburnum anagyroides</i>	<i>Typha angustifolia</i>
<i>Lavandula angustifolia</i>	<i>Valeriana officinalis</i>
<i>Ligustrum vulgare</i>	<i>Viburnum lantana</i>
<i>Lonicera caprifolium</i>	<i>Viburnum opulus</i>

4. Conclusion

The diffusion of reproduced plants in the territory by selling/giving to cultivate them in the gardens reduces the risk linked to the cultivation (collection on the field is avoided). Furthermore, as regard the contribution of wild plants to improved flower trade, aspects to be considered include: i) conservation and sustainable use of wild species; ii) identification of wild species useful as sources of new ornamentals; iii) germplasm conservation; and iv) the role of research institutions and nurseries in the innovation process (De Pascale & Romano, 2017). However, it should be noted that all species reproduced and offered for sale are not covered by CITES Annexes.

The development of an ex situ cultivation for sale wild plants can be considered as a solution to develop efficient propagation protocols overcoming the "Challenging propagation" indicated by Abeli et al. (2020). The strengths of cultivation in the nursery and sale wild plants are both the develop of propagation structures and the opportunity to obtain a large number of individuals. Moreover, the ex situ collections of wild ornamental plants, as well as being sold, they provide the opportunity to be used for translocation and reinforcement of wild populations, guaranteeing the plant genetic diversity (Fig. 3).

To conclude, although the study on the effects of the cultivation and sale / donation of native species for ornamental purposes is still in its



Fig. 3. Plants grown in park nurseries (*Saxifraga callosa* Sm.).

infancy, this procedure can lead to increasing awareness on the part of people and improve the possibility of survival of rare and threatened species. Another advantage concerning the sale of rare species is the reduction of indiscriminate harvesting by collectors, considering that the collection is an important threat for the IUCN (Gentili, 2008).

Declaration of Competing Interest

The authors declare no competing interest.

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