Raising Rarity: creating meaningful and sustainable conservation outcomes through community-based outreach

Megan J. Hirst[1], **John Arnott**[2] **& Russell A. Larke**[3]

Abstract

A priority in plant conservation science is the identification of species at risk of extinction, allowing for conservation efforts to be focused on those that are most critically endangered to prevent their loss. A 2023 revision of threatened plants in Victoria found that 1,557 species remain under direct threat of extinction, despite conservation work being undertaken across the state to safeguard both individual species and plant communities. Although conservation efforts are fundamental to the protection of our flora, the persistently high number of threatened species illustrates a need to reimagine the way in which we approach conservation. Central to this is a need to engage more people across a broader cross-section of the community so that they can contribute to initiatives that effectively reduce the number of species at risk.

Raising Rarity is a community-based outreach programme run by Royal Botanic Gardens Victoria (RBGV). It is designed to actively engage distinct sectors of the Victorian community in local plant conservation. The programme acknowledges that although the expertise provided by RBGV in areas that include conservation horticulture, seed ecology, population genetics, outreach and education is critical to plant conservation efforts, the engagement and involvement of the broader community is fundamental to creating sustainable plant conservation solutions. Raising Rarity achieves this by working with volunteers, school groups, regional botanic gardens, local councils and members of the nursery industry to grow and display rare and threatened Victorian plants in accessible horticultural settings. The initiative aims to increase public knowledge, awareness and hands-on involvement in plant conservation.

There are four key components to the Raising Rarity programme: (1) school outreach; (2) local government outreach; (3) botanic gardens outreach in an initiative called Care for the Rare; and (4) commercialisation of an RBGV rare plant collection. This article provides an overview of each of these components and outlines future objectives for the Raising Rarity programme.

[1] Megan J. Hirst is a Seed Ecologist at Royal Botanic Gardens Victoria, Australia, and a Post-Doctoral Fellow at Deakin University, Melbourne, Australia.
Address: Royal Botanic Gardens Victoria, Melbourne 3004, Victoria, Australia.
Email: Megan.Hirst@rbg.vic.gov.au
[2] John Arnott is Manager Horticulture at Cranbourne Gardens, Royal Botanic Gardens Victoria, Australia.
Address: as above.
[3] Russell A. Larke is Conservation Horticulturist at Cranbourne Gardens, Royal Botanic Gardens Victoria, Australia.
Address: as above.

DOI 10.24823/Sibbaldia.2023.2000

Introduction

A priority in plant conservation science is to identify species at risk of extinction and then to focus conservation efforts on the most critically endangered to prevent further loss. These include species restricted to ecosystems that are severely threatened by habitat loss and fragmentation, competition from exotic species and the devastating effects of extreme climatic events. Critical on-ground support in habitats where at-risk plants naturally occur (*in situ*) is paramount; however, there is also a need to safeguard populations using *ex situ* strategies like seed banking and managed living collections to mitigate risks. Although safeguarding the survival of rare plants is vital work, such work has not historically involved a broad spectrum of society. Despite significant conservation efforts across Australia, the decline of threatened plant species continues. A lack of public awareness and engagement in plant conservation and associated actions have been identified as critical factors contributing to this continued decline (Broadhurst & Coates, 2017).

***'Species extinction and the extinction of experience are explicitly linked'* (BGCI, 2022)**

The rise of extinction denial (Lees *et al*., 2020), science scepticism (Rutjens *et al*., 2021) and science denial (Rosenau, 2012) undermines our ability to effectively conserve species. Targeted and collaborative efforts are required to address the issues caused by these damaging trends and associated misinformation. Moreover, plant blindness and the general societal decline in botanical knowledge are very real concerns that challenge successful plant conservation outcomes (Balding & Williams, 2016; Stroud *et al*., 2022). The less people know about plants and the all-important role that they play in sustaining life on Earth, the less they are likely to act for their conservation. However, botanic gardens such as Royal Botanic Gardens Victoria (RBGV) are well placed to tackle this problem by utilising accumulated and diverse expertise to create positive change through education and outreach programmes that effectively engage the community (Westwood *et al*., 2020). The benefits of increased community engagement, enhanced botanical knowledge and awareness, and plant appreciation, as well as participation in nature activities, will have a positive impact on plant conservation and will promote positive change (Richardson *et al*., 2020).

What is 'rarity'?

There are differing concepts of what constitutes 'rare'. From an ecological perspective, 'rarity' can be used to describe species with limited distributions (extent of occupancy) and/or low abundance (area of occupancy) (see Gaston, 2003). Rarity is used here as an umbrella term that covers any threatened plant species classified into one of the recognised threat categories (i.e. conservation status) based on the species' risk of extinction, for example Extinct, Critically Endangered, Endangered or Vulnerable. Species are categorised according to defined criteria such as population size and trajectory, known threats, area of occupancy and extent of occurrence within that area, in accordance with guidelines published by the IUCN (IUCN, 2012). The Australian government legislation for describing and protecting threatened species at federal level is the Environment Protection and Biodiversity Conservation Act 1999 (hereafter EPBC Act), while the Flora and

DOI 10.24823/Sibbaldia.2023.2000

Fauna Guarantee Act 1988 (hereafter FFG Act) is legislated by the Victorian government. Currently, 1,419 Australian plant species are listed as threatened at national level under the EPBC Act and over a third (1,557) of all plants in Victoria are listed under the FFG Act at state level.

Understanding why a species occurs where it does and how that might impact its rarity is a matter of fascination for botanists and ecologists alike, but now there is an urgency attached to acquiring such knowledge. We are experiencing a global biodiversity crisis, so identifying the mechanisms that underlie rarity (or commonness) is of practical importance for the management of endangered and declining species, as well as species whose ranges are expanding. How will species cope in a warming world? Will a species once widely distributed and abundant necessarily be better positioned than an allied species that is narrow and rare? Earlier research (Hirst, 2017) explored the idea of species rarity by examining horticultural potential as a method for plant conservation. The growth, flowering and survival information gained by Hirst (2017) was used to activate conservation strategies at a local outreach/education level. This led to the development of the Raising Rarity project in 2018, funded by a two-year grant from the Australian Flora Foundation and with additional support during the initial phase from the Friends of the Royal Botanic Gardens Melbourne. Recently, the project has gained support from the Foundation of Australia's Most Endangered Species and the Alpine Garden Society-Victorian Group.

The Raising Rarity project

Since 2018, the Raising Rarity project has continued to build upon the work of RBGV plant science and conservation horticulture, using this knowledge to expand *ex situ* living collections of Victoria's threatened flora. The project utilises a collaborative approach representing the diversity of RBGV expertise in conservation horticulture, seed ecology, population genetics, outreach and education. In addition, the RBGV team work alongside volunteers, communities, local councils and school groups to grow rare and threatened Victorian plants in order to raise awareness and involve whole communities in plant conservation initiatives. Selected species are then displayed and trialled in accessible horticultural settings (Fig. 1).

Raising Rarity species selection and horticultural potential

All plants selected for the Raising Rarity project must be listed as threatened Victorian taxa (Table 1). For the programme to succeed, an understanding of the methods and attributes that make a good garden plant (i.e. ease of propagation, pest and disease resistance, vigour and flowering period) is required when selecting plants for their suitability in cultivation.

Propagation

For each target species, a reliable propagation method is established. This has typically been achieved primarily through the germination of seed. As the project has developed, however, we have incorporated asexual propagation techniques to accommodate species with limited seed availability (for example for some *Grevillea* species) in order to maintain individual genotypes and bolster plant numbers (Table 2). The project undertakes conventional seed testing to investigate the viability of each species by using cut tests, X-ray imaging and germination testing. A combination

DOI 10.24823/Sibbaldia.2023.2000

Fig. 1 A living collection: the yellow-flowered *Xerochrysum palustre* (swamp everlasting) at the Raising Rarity outdoor research plots within the Australian Garden, Cranbourne, RBGV. Continuing loss of habitat due to altered hydrology, weed invasion, land conversion and reduced rainfall is likely to lead to further decline of this species. Photo: RBGV.

of nursery glasshouse conditions and laboratory incubators are used to test germination. For species in which dormancy or a low germination response is expected, pre-treatments such as scarification or the use of plant growth regulators such as gibberellic acid are incorporated. Furthermore, multiple vegetative propagation techniques (division, layering, cuttings) are trialled, sometimes using a rooting hormone gel with active ingredient 3.0 g/L indole butyric acid for semi-hardwood cuttings, and then assessed (Table 2). For example, in the rare Victorian endemic *Lobelia gelida* (snow pratia), the germination response was low (Table 2) and seed availability was limited, so we capitalised on the species' ability to root at the node and tested stem-layering techniques to initiate adventitious root formation. These were readily formed, allowing us to separate the stems into segments to grow on (Fig. 2).

Plant trials

After successful propagation, plants are transferred to containers in the RBGV Cranbourne nursery and eventually planted into the Research Garden at RBGV Cranbourne for evaluation in a garden setting. Throughout the trial period, seedling growth, phenological stages (vegetative, bud formation, flowering, seeding), and pest and disease occurrence are monitored and recorded. This is valuable information on how to propagate and grow these species. It is then used to assess the horticultural potential of each species, many of which have never been grown before.

DOI 10.24823/Sibbaldia.2023.2000

Table 1 Species selected for the Raising Rarity programme, their conservation status and whether they are subject to the EPBC Act or the FFG Act.

Target species information			
Species	**Family**	**Conservation status**	**Description**
Wittsteina vacciniaceae	Alseuosmiaceae	Vulnerable FFG Act	Victorian endemic, rainforest margins, sheltered subalpine woodland
Argyrotegium nitidulum	Asteraceae	Vulnerable EPBC Act	Localised alpine endemic on Bogong High Plains, Victoria
Brachyscome chrysoglossa	Asteraceae	Endangered FFG Act	Commonly on clay soils subject to inundation
Brachyscome tadgellii	Asteraceae	Endangered FFG Act	Localised alpine endemic, moist habitats
Craspedia aurantia var. *jamesi*	Asteraceae	Endangered FFG Act	Alpine and subalpine heath, locally common
Craspedia canens	Asteraceae	Critically Endangered FFG Act	Restricted to small grassland areas, in wet depressions
Leptorhynchos orientalis	Asteraceae	Endangered FFG Act	Open grassland community
Leucochrysum albicans subsp. *tricolor*	Asteraceae	Endangered EPBC Act, Endangered FFG Act	Exceedingly rare in Victoria, dry shaly soils
Leucochrysum alpinum	Asteraceae	Endangered FFG Act	Alpine summits, shallow soils
Olearia frostii	Asteraceae	Vulnerable FFG Act	Victorian alpine endemic, grassland and open heath, locally common
Podolepis laciniata	Asteraceae	Endangered FFG Act	Alpine habitat, grassy habitat near treeline
Rutidosis leptorhynchoides	Asteraceae	Endangered EPBC Act, Endangered FFG Act	Confined to basalt grassland
Xerochrysum palustre	Asteraceae	Vulnerable EPBC Act, Critically Endangered FFG Act	Rare due to habitat depletion, lowland swamp habitats
Ballantinia antipoda	Brassicaceae	Endangered EPBC Act, Critically Endangered FFG Act	Short-lived Victorian endemic, germinates in winter in moss mats
Drabastrum alpestre	Brassicaceae	Critically Endangered FFG Act	Only known from two populations in Victoria, dry rocky habitat
Wahlenbergia densifolia	Campanulaceae	Endangered FFG Act	Rare in Victoria, confined to water-retentive basaltic soils
Lobelia gelida	Campanulaceae	Vulnerable EPBC Act, Endangered FFG Act	Victorian endemic, known from a few populations on Mt Buffalo
Glycine latrobeana	Fabaceae	Vulnerable EPBC Act, Vulnerable FFG Act	Widespread but of sporadic occurrence and rarely encountered
Grevillea callichlaena	Proteaceae	Critically Endangered FFG Act	Victorian alpine endemic, known from two populations, grows among boulders in snow gum woodland
Grevillea dimorpha	Proteaceae	Endangered FFG Act	Victorian endemic, restricted to Grampians, sandy soils on sandstone
Grevillea monslacana	Proteaceae	Critically Endangered FFG Act	Victorian endemic, in montane wet sclerophyll forest and subalpine open woodland
Grevillea parvula	Proteaceae	Endangered FFG Act	Often in riparian sites, broad altitudinal range
Grevillea polychroma	Proteaceae	Endangered FFG Act	Victorian endemic, riparian sites, open woodland to tall open forest
Grevillea victoriae subsp. *victoriae*	Proteaceae	Endangered FFG Act	Victorian endemic, subalpine and alpine areas in snow gum woodland, boulders often present
Ranunculus victoriensis	Ranunculaceae	Endangered FFG Act	Victorian alpine endemic, damp grassland and open heath
Stylidium armeria subsp. *pilosifolium*	Stylidiaceae	Critically Endangered FFG Act	Victorian endemic, restricted to dry shaly soils

DOI 10.24823/Sibbaldia.2023.2000

Table 2 Species selected for the Raising Rarity programme with viability tests, germination response and notes, and asexual propagation methods implemented. All information is used to assess and build *ex situ* living collections.

Target species		Species viability testing and propagation methods			
Species	**Family**	**Seed viability (%)**	**Germination (%)**	**Germination notes**	**Vegetative propagation**
Wittsteina vacciniaceae	Alseuosmiaceae	100 (initial cut test & x-ray)	86 (n = 200 seed)	Viable seed remained post germination (post cut test), GA3 responsive	Stem cuttings in plugs with rooting hormone gel
Argyrotegium nitidulum	Asteraceae	100 (initial cut test)	76 (n = 200 seed)	Viable seed remained post germination (post cut test)	Separation of small clumps
Brachyscome chrysoglossa	Asteraceae	50 (initial cut test)	20 (n = 180 seed)	Poor-quality seed collection, seed germinates without pre-treatment	Separation of small clumps
Brachyscome tadgellii	Asteraceae	90 (initial cut test & x-ray)	60 (n = 200 seed)	Viable seed remained post germination (post cut test)	Separation of small clumps
Craspedia aurantia var. *jamesi*	Asteraceae	100 (initial cut test & x-ray)	100 (n = 200 seed)	Fresh seed germinated readily	Separation of small clumps
Craspedia canens	Asteraceae	100 (initial cut test & x-ray)	90 (n = 200 seed)	~ 10% unfilled seed at conclusion (post cut test), review x-ray images	Separation of small clumps
Leptorhynchos orientalis	Asteraceae	90 (initial cut test & x-ray)	80 (n = 200 seed)	~ 20% unfilled seed at conclusion (post cut test), review x-ray images	N/A (annual)
Leucochrysum albicans subsp. *tricolor*	Asteraceae	100 (initial cut test & x-ray)	88 (n = 157 seed)	~ 10% unfilled seed at conclusion (post cut test) review x-ray images	N/A (treat like an annual)
Leucochrysum alpinum	Asteraceae	100 (initial cut test & x-ray)	100 (n = 200 seed)	Fresh seed germinated readily	N/A
Olearia frostii	Asteraceae	90 (initial cut test & x-ray)	60 (n = 200 seed)	Seed appeared to deteriorate on agar plate, review method	Stem cuttings
Podolepis laciniata	Asteraceae	100 (initial cut test & x-ray)	92 (n = 200 seed)	~ 10% unfilled seed at conclusion of test	Separation of small clumps
Rutidosis leptorhynchoides	Asteraceae	100 (initial cut test & x-ray)	82 (n = 200 seed)	~ 10% unfilled seed at conclusion of test	Stem cuttings
Xerochrysum palustre	Asteraceae	100 (initial cut test & x-ray)	100 (n = 200 seed)	Fresh seed germinated readily	Division, stem cuttings
Ballantinia antipoda	Brassicaceae	100 (initial cut test)	80 (n = 180 seed)	GA3 responsive	N/A (ephemeral)
Drabastrum alpestre	Brassicaceae	100 (initial cut test)	92 (n = 191 seed)	~ 10% unfilled seed at conclusion (post cut test)	Small rhizome sections
Wahlenbergia densifolia	Campanulaceae	100 (initial cut test)	90 (n = 200 seed)	~ 10% unfilled seed at conclusion (post cut test)	Small rhizome sections
Lobelia gelida	Campanulaceae	100 (initial cut test)	20 (n = 187 seed)	GA3 responsive, dormancy issue	Stem layering
Glycine latrobeana	Fabaceae	100 (initial cut test)	30 (n = 200 seed)	Mould issues with scarification of hard seed coat (post cut test), review method	N/A (non-stoloniferous)
Grevillea callichlaena	Proteaceae	N/A (small tests < n = 5 seed undertaken)	N/A	Seed appeared to deteriorate on agar plate under standard conditions	Tip cutting
Grevillea dimorpha	Proteaceae	N/A (seed unavailable)	N/A	N/A	Tip cutting
Grevillea monslacana	Proteaceae	N/A (seed unavailable)	N/A	N/A	Tip cutting
Grevillea parvula	Proteaceae	N/A (small tests undertaken)	N/A	Seed appeared to deteriorate on agar plate in standard conditions	Tip cutting
Grevillea polychroma	Proteaceae	N/A (seed unavailable)	N/A	N/A	Tip cutting
Grevillea victoriae subsp. *victoriae*	Proteaceae	N/A (small tests < n = 5 seed undertaken)	N/A	Seed appeared to deteriorate on agar plate in standard conditions	Tip cutting
Ranunculus victoriensis	Ranunculaceae	100 (initial cut test & x-ray)	78 (n = 200 seed)	Scarification of seed coat, viable seed remained post germination test	N/A
Stylidium armeria subsp. *pilosifolium*	Stylidiaceae	100 (initial cut test & x-ray)	75 (n = 163 seed)	GA3 responsive, viable seed remained post germination test	Separation of small clumps

Fig. 2 Asexual propagation: new growth on the stem cuttings of *Lobelia gelida* (left). The stem is secured with pins and placed in warm, humid conditions until root initiation is evident (centre). Individual segments are removed and potted up to grow on in 40–70 mm containers in nursery conditions (right). Photo: M. Zweck.

Seed harvesting

After flowering, seeds are collected from these *ex situ* populations and stored in the Victorian Conservation Seedbank (VCS) at RBGV. Seeds harvested from outreach programmes are databased, viability tested and stored at −20 °C as a separate *ex situ* collection (with unique accession numbers). Genotyped individuals are maintained through vegetative (clonal) propagation.

Notes on plant selection and genetic diversity

Although we can select for attractive features in breeding programmes, the genetic diversity of the species in the Raising Rarity programme is always maintained to ensure that genetically and geographically representative material persists. This diversity must be preserved to support future programmes of population reinforcement and translocations if they should be required.

In addition, when selecting plant material for use in our school outreach programmes, the preference is to use *ex situ* material collected from the closest wild population (if feasible, based on population size) to each school site (Fig. 3).

When growing on material from seeds as part of maintaining an *ex situ* collection, there are some considerations that must be recognised; changing the growing environment of a plant, as happens in any *ex situ* living collection, can have consequences, including the selection of genotypes more favoured to garden conditions that differ significantly from those found in nature. This can result in the collection of individuals from *ex situ* populations where important adaptations, such as drought tolerance, may be diminished or lost (Ensslin & Godefroid, 2019). A future objective of the project is to use population genetics to assess *ex situ* population characteristics before undertaking any *in situ* work (e.g. translocations) using the collected seed, in order to ensure adequate genetic diversity is maintained in both settings.

Raising Rarity outreach programmes

Raising Rarity is a community-based outreach programme designed to actively engage

DOI 10.24823/Sibbaldia.2023.2000

Fig. 3 Examples of two endangered Raising Rarity trial species: *Podolepis linearifolia* (basalt podolepis) (left) and *Grevillea dimorpha* (flame grevillea) (right). Photos: R. Larke (left) and K. Qu (right).

distinct sectors of the Victorian community in Victorian plant conservation.

The Raising Rarity programme currently involves four key components:

1. School outreach programme
2. Local government outreach programme
3. Botanic gardens outreach programme (Care for the Rare)
4. Commercialisation of an RBGV plant collection

1. School outreach programme

The Raising Rarity school outreach programme engages school students directly in the conservation of threatened Victorian species. Students learn to cultivate, monitor growth, record flowering time and collect seed for safeguarding at the VCS and to establish additional *ex situ* populations for selected species. The data collected provide insight into how the species performs in cultivation. Two separate pilot programmes are under way, with Penleigh Essendon Grammar growing *Xerochrysum palustre* (swamp everlasting) and Rosedale Primary School growing *Craspedia canens* (grey billy-buttons). A key objective of the programme is to ensure that schools are growing threatened species from their local areas. As the project develops in 2024, plant distribution agreements will be negotiated between RBGV and each school because of the different needs of the student cohort and the plant material to be grown and monitored.

2. Local government outreach programme

The local government outreach programme was established in partnership with the City of Melbourne (CoM) to facilitate local government involvement in the conservation of Victorian threatened species. The CoM

DOI 10.24823/Sibbaldia.2023.2000

project included the development of a Threatened Species Living Collections Plan to guide the selection, acquisition, maintenance, documentation, interpretation and display of threatened plant species in city green spaces for the purposes of plant conservation (Larke *et al.*, 2023). Incorporated into the plan was a Threatened Species Assessment Tool which was developed to rate 200 threatened Victorian plant species using criteria such as horticultural requirements (ease of propagation and cultivation) and conservation requirements (such as conservation status, provenance and whether living collections are critical because sufficient seed is not or cannot be collected and stored). Moreover, priority was also given to species that provided additional benefits to the CoM. An example of a benefit would be suitability for green infrastructure projects within the city on green roofs and rain gardens.

The project was officially launched on 11 May 2023 at the Urban Nature: Urban Myth? Symposium for urban practitioners, hosted by the CoM. The plan is publicly available on the CoM's Cities with Nature website.[4]

Opportunities have been identified beyond the city with multiple Local Government Areas (LGAs) in Victoria expressing interest in developing threatened species plans to become actively involved in the conservation of Victorian species. Conversations at the symposium highlighted the aspirations of many land managers who seek to be involved in plant conservation but often lack the knowledge and support required to establish and deliver these programmes. RBGV is currently working on a business model to help LGAs develop these programmes across Victoria. Support is planned that will include assistance with the development of threatened species plans and associated documentation, specialist advice on species selection and provision of plant material to support the implementation of these projects.

3. Botanic gardens outreach project (Care for the Rare)

Care for the Rare is an RBGV and Botanic Gardens of Australia and New Zealand (BGANZ) initiative to support regional botanic gardens in Victoria. The aim is to build capacity to enable regional botanic gardens to actively participate in *ex situ* plant conservation and to establish a multi-site conservation collection of rare and threatened Victorian species.

In 2018, a survey of regional botanic gardens in Victoria indicated that very few gardens across the state were involved in plant conservation activities or had identified plant conservation as an attainable goal. Many gardens self-perceived a 'lack of skills and resources' necessary to manage rare and threatened species in their collections. Garden staff and volunteers specifically cited their major impediments as 'difficulties in accessing plant material and information about their cultural requirements'. Interestingly, landscape character and the 'constraints' of heritage landscapes were also referred to as potential impediments to developing conservation collections of indigenous plants.

An expression of interest was circulated to all Victorian botanic gardens within the BGANZ network, resulting in a positive response from 24 gardens, representing approximately 70 per cent of botanic gardens within Victoria. It was not possible to establish conservation collections in all 24 gardens; however, with support from the Helen Macpherson Smith

[4] https://api.citieswithnature.org/storage/uploads/2222/Threatened_Plant_Living_Collection_Plan_10May2023.pdf

DOI 10.24823/Sibbaldia.2023.2000

Case study – *Xerochrysum palustre* and Penleigh Essendon Grammar School

Xerochrysum palustre (swamp everlasting) is a daisy species that naturally occurs in lowland swamps and seasonal wetlands. It is a Critically Endangered (FFG-listed) species in Victoria and is a good example of one at risk of extinction owing to habitat loss and changing hydrology associated with land use change such as urbanisation. Once widespread throughout the state, the species is now restricted to fragmented populations whose numbers are dwindling, with most populations including fewer than 250 individuals (Carter & Walsh, 2011). To support the conservation of the swamp everlasting, RBGV undertook an integrated programme that included surveys, seed collection, population genetics analysis, seed research including germination response to different temperatures using a thermogradient plate (Sunner *et al*., 2020) and the establishment of *ex situ* living collections. This research resulted in the acquisition of both high-quality seed collections and representative living collections; however, increasing overall numbers in both remains a priority.

The school outreach programme was identified as a viable method to assist with increasing seed collections and expanding living collections of the swamp everlasting. As part of a pilot programme, Penleigh Essendon Grammar School became the first school to care for its own living collection of this critically endangered

Fig. 4 Swamp everlasting goes to school: Penleigh Essendon Grammar School and the Raising Rarity team setting up a living collection, with students responsible for cultivating and monitoring on campus. Photo: K. Qu.

DOI 10.24823/Sibbaldia.2023.2000

species. Students attended a workshop at RBGV Cranbourne in August 2022 to discover how to identify the species and to learn about current and future threats, and the value of *ex situ* collections to support species conservation efforts.

RBGV's Raising Rarity team travelled to Penleigh Essendon Grammar School a month later, joining senior students of Environmental Studies at their outdoor school research plots (Fig. 4). Here, the students set up their plots, established a grid system, labelled each plant, tested the soil moisture and pH levels, and planted out tubestock of the plants they had propagated earlier. Over the next few months, the students were responsible for monitoring their plots and recording the phenology (flowering stages) of each plant until seed production. Such data collection provides important biological information that directly contributes to increasing our understanding of how to cultivate species and how long a species requires to set seed in a range of settings. The project's goal is for students to collect seed for safeguarding at the RBGV VCS. In February 2023, after school resumed, students brought their seed collections to RBGV (Fig. 5). They then had the opportunity to set up x-ray imaging and germination tests as per current best practice (Hirst *et al*., 2021), as well as touring the facilities.

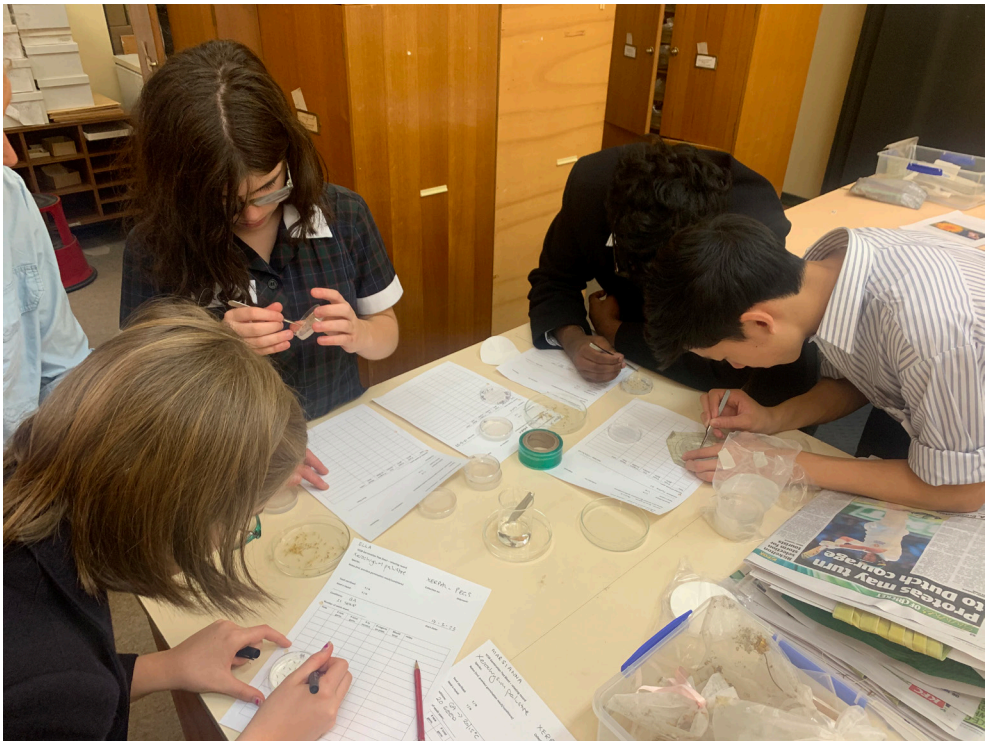

Fig. 5 Swamp everlasting goes to the Herbarium at RBGV: Penleigh Essendon Grammar School students and the Raising Rarity team setting up germination plates to test viability. Photo: A. Scott.

DOI 10.24823/Sibbaldia.2023.2000

Trust (HMS), the RBGV implemented a pilot programme to establish conservation collections at six gardens across Victoria: Australian Botanic Gardens Shepparton (Greater Shepparton Shire), Ballarat Botanical Gardens (City of Ballarat), Colac Botanical Gardens (Colac Otway Shire), Dandenong Ranges Botanic Gardens (Parks Victoria), Sale Botanic Gardens (Wellington Shire) and Wilson Botanic Park (City of Casey). This led to the development of Conservation Collection Plans which articulate the broad approach, aims and objectives for the development of a conservation collection for each botanic garden, including detailed species lists and a planting schedule. Funding from the HMS Trust enabled RBGV to employ a dedicated plant propagator to source, propagate and produce the living plant stocks identified in each Conservation Collection Plan, and for these plants to be delivered to each participating garden (Fig. 6). The Care for the Rare pilot programme has been a resounding success and we look forward to exploring opportunities to extend and develop the project into additional regional Botanic Gardens. For further information on Care for the Rare, see Case Study 11.2 in Shade *et al.* (2021).

4. Commercialisation project

This project aims to increase public knowledge and awareness of rare plants and plant communities throughout Victoria. The project uses an innovative approach to save rare and threatened flora by assessing the horticultural potential of rare species, introducing these species into cultivation, and providing an opportunity for domestic gardeners to grow these plants and to contribute to the ongoing conservation of these species. A research-focused approach will be taken throughout the project, from documentation and optimisation of

Fig. 6 Cranbourne Gardens staff dispatching Care for the Rare stock to the Australian Botanic Garden Shepperton. Photo: J. Arnott.

DOI 10.24823/Sibbaldia.2023.2000

propagation methods using seed and cutting material, through to assessment of plant growth and performance, both in containers and in the ground. At present, approximately 25 rare and threatened Victorian plants are being trialled in the nursery and in the outdoor research beds at RBGV Cranbourne.

Delivery of commercialisation will require a multi-disciplinary team to develop a strategic direction for the project which will include financial modelling, contract negotiations, brand establishment, marketing strategy, trademarking, plant selection and production, contracting propagators/growers and the exploration of avenues to market (retail and/or wholesale). It is estimated that the first RBGV selection will be released in 3–4 years.

Future priorities for the development of the Raising Rarity programme include continued discussion with the RBGV Reconciliation Action Plan working group to develop our partnership goals with First Nations People and the development of an evaluation framework in partnership with social researchers to measure the impact of the Raising Rarity projects.

Conclusion

Helping rare plants and taking the necessary steps required to safeguard their survival is a vital role, and one that everyone can become involved in by caring and advocating for their local native flora. Historically, conservation efforts by earlier practitioners, though crucial to the ongoing protection of our threatened plant species, have not been sufficiently successful to arrest their continuing decline. Therefore, we need to rethink the way we deliver and support conservation projects. Looking for new and innovative ways to engage people in community-based conservation projects will go a long way to curing plant blindness and creating meaningful and sustainable conservation outcomes. Let us imagine a future in which every home garden, every school, every council and every botanic garden across the state of Victoria – and further abroad – can all meaningfully contribute to the cultivation of rare and threatened plant species, thereby ensuring their survival (Fig. 7).

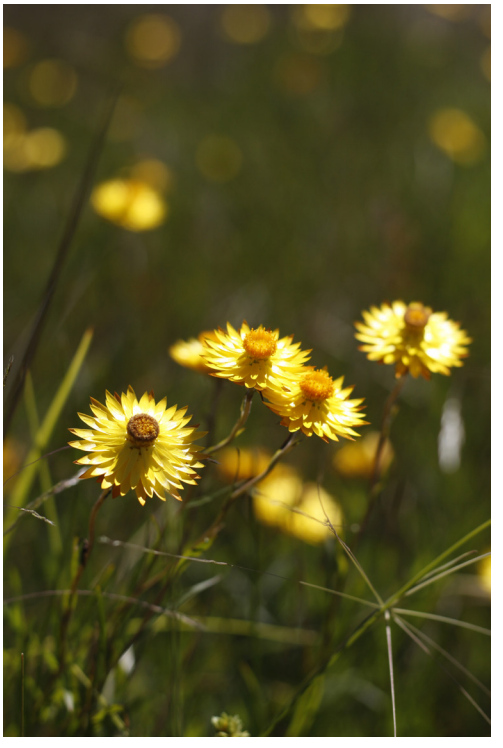

Fig. 7 Swamp everlasting at home: close-up of *Xerochrysum palustre*, flowering *in situ* in early summer. Photo: N. Centrofanti.

Acknowledgements

We thank our RBGV colleagues for their ongoing support and enthusiasm in collaborating on this project. Teamwork at its best. Ben Liu, Matthew Henderson, Caitlin Gray, Marie Velthoven, Sebastian Beck, Scott Levy, Maja Zweck, Mandy Thomson and Jason Caruso, for all their energy and enthusiasm from sourcing, growing, propagating, and teaching and touring. Special thanks to

DOI 10.24823/Sibbaldia.2023.2000

Alastair Robinson, Neville Walsh, Rodger Elliot, Andre Messina and Chris Russell for their most helpful plant and technical expertise. We thank urban ecologist Lee Harrison of City of Melbourne, and the staff and amazing students involved in our two pilot school programmes (Penleigh Essendon Grammar School and Rosedale Primary School, Victoria). We would also like to thank the following organisations for their generous support: the Foundation of Australia's Most Endangered Species, the Alpine Garden Society Victorian Group and the Australian Flora Foundation.

References

BALDING, M. & WILLIAMS, K.J. (2016). Plant blindness and the implications for plant conservation. *Conservation Biology*, 30(6): 1192–1199. doi: https://doi.org/10.1111/cobi.12738

BOTANIC GARDENS CONSERVATION INTERNATIONAL (2022). 7th Global Botanic Garden Congress Conclusions. Available online: https://www.bgci.org/wp/wp-content/uploads/2022/10/7GBGC-Final-Conclusions-2.pdf (accessed August 2023).

BROADHURST, L. & COATES, D. (2017). Plant conservation in Australia: current directions and future challenges. *Plant Diversity*, 39(6): 348–356.

CARTER, O. & WALSH, N. (2011). National recovery plan for the swamp everlasting *Xerochrysum palustre*. Department of Sustainability and Environment, Melbourne. Available online: http://www.environment.gov.au/biodiversity/threatened/recovery-plans/national-recovery-plan-swamp-everlasting-xerochrysum-palustre (accessed August 2023).

ENSSLIN, A. & GODEFROID, S. (2019). How the cultivation of wild plants in botanic gardens can change their genetic and phenotypic status and what this means for their conservation value. *Sibbaldia*, 17: 51–70. doi: https://doi.org/10.24823/Sibbaldia.2019.267

GASTON, K.J. (2003). *The Structure and Dynamics of Geographic Ranges*. Oxford University Press, Oxford.

HIRST, M.J. (2017). Exploring adaptation in a key Australian genus *Brachyscome* through experimentation. PhD thesis, School of BioSciences, Faculty of Science, University of Melbourne.

HIRST, M.J., COMMANDER, L.E., EMERY, N., GUJA, L.K., LIYANAGE, G., MERRITT, D.J., NORTON, S.L., STEVENS, A., TURNER, S.R. & WOOD, J.A. (2021). Seed germination and dormancy. In: MARTYN YENSON, A.J., OFFORD, C.A., MEAGHER, P.F., AULD, T.D., BUSH, D., COATES, D.J., COMMANDER, L.E., GUJA, L.K., NORTON, S.L., MAKINSON, R.O., STANLEY, R., WALSH, N. *ET AL.* (eds), *Plant Germplasm Conservation in Australia: Strategies and Guidelines for Developing, Managing and Utilising Ex Situ Collections*, 3rd edn. Australian Network for Plant Conservation, Canberra, pp. 187–239.

INTERNATIONAL UNION FOR CONSERVATION OF NATURE (2012). *IUCN Red List Categories and Criteria Version 3.1*, 2nd edn. IUCN, Gland and Cambridge.

LARKE, R., HIRST. M., WILLIAMS, N.S.G. & ARNOTT, J. (2023). *City of Melbourne Threatened Plant Living Collection Plan*. Report for the City of Melbourne.

LEES, A.C., ATTWOOD, S., BARLOW, J. & PHALAN, B. (2020). Biodiversity scientists must fight the creeping rise of extinction denial. *Nature Ecology and Evolution*, 4: 1440–1443. doi: https://doi.org/10.1038/s41559-020-01285-z

RICHARDSON, M., PASSMORE, H.-A., BARBETT, L., LUMBER, R., THOMAS, R. & HUNT, A. (2020). The green care code: how nature connectedness and simple activities help explain pro-nature conservation behaviours. *People Nature*, 2: 821–839. doi: https://doi.org/10.1002/pan3.10117

ROSENAU, J. (2012). Science denial: a guide for scientists. *Trends in Microbiology*, 20(12): 567–569.

RUTJENS, B.T., VAN DER LINDEN, S. & VAN DER LEE, R. (2021). Science scepticism in times of COVID-19. *Group Processes & Intergroup Relations*, 24(2): 276–283.

SHADE, A., O'DONNELL, K., PERRINS, L., STANLEY, R., TAYLOR, D., TURNER, S.T. & VILER, V. (2021). Living plant collections. In: MARTYN YENSON, A.J., OFFORD, C.A., MEAGHER, P.F., AULD, T.D., BUSH, D., COATES, D.J., COMMANDER, L.E., GUJA, L.K., NORTON, S.L., MAKINSON, R.O., STANLEY, R., WALSH, N. *ET AL.* (eds), *Plant Germplasm Conservation in Australia: Strategies and*

Guidelines for Developing, Managing and Utilising Ex Situ Collections, 3rd edn. Australian Network for Plant Conservation, Canberra, pp. 347–348.

STROUD, S., FENNELL, M., MITCHLEY, J., LYDON, S., PEACOCK, J. & BACON, K.L. (2022). The botanical education extinction and the fall of plant awareness. *Ecology and Evolution*, 12: e9019. doi: https://doi.org/10.1002/ece3.9019

SUNNER, N., HIRST, M.J., VENN, S. & WILLIAMS, N.S.G. (2020). Exploring seed ecology and habitat of the vulnerable swamp everlasting – *Xerochrysum palustre*. *Australasian Plant Conservation*, 29(3): 3–6.

WESTWOOD, M., CAVENDER, N., MEYER, A. & SMITH, P. (2020). Botanic garden solutions to the plant extinction crisis. *Plants People Planet*, 3: 22–32.

DOI 10.24823/Sibbaldia.2023.2000