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OPINION

Preventing species extinctions: A global conservation consortium for *Erica*

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Societal Impact Statement

Human-caused habitat destruction and transformation is resulting in a cascade of impacts to biological diversity, of which arguably the most fundamental is species extinctions. The Global Conservation Consortia (GCC) are a means to pool efforts and expertise across national boundaries and between disciplines in the attempt to prevent such losses in focal plant groups. GCC *Erica* coordinates an international response to extinction threats in one such group, the heaths, or heathers, of which hundreds of species are found only in South Africa's spectacularly diverse Cape Floristic Region.

Summary

Effectively combating the biodiversity crisis requires coordinated conservation efforts. Botanic Gardens Conservation International (BGCI) and numerous partners have established Global Conservation Consortia (GCC) to collaboratively develop and implement comprehensive conservation strategies for priority threatened plant groups. Through these networks, institutions with specialised collections and staff can leverage ongoing work to optimise impact for threatened plant species. The genus *Erica* poses a challenge similar in scale to that of the largest other GCC group, *Rhododendron*, but almost 700 of the around 800 known species of *Erica* are concentrated in a single biodiversity hotspot, the Cape Floristic Region (CFR) of South Africa. Many species are known to be threatened, suffering the immediate impacts of habitat destruction, invasive species, changes in natural fire regimes and climate change. Efforts to counter these threats face general challenges: disproportionate burden of in situ conservation falling on a minority of the community, limited knowledge of species-rich groups, shortfalls in assessing and monitoring threat, lack of resources for in situ and limitations of knowledge for ex situ conservation efforts and in communicating the value of biological diversity to a public who may never encounter it in the wild. GCC *Erica* brings together the world's *Erica* experts, conservationists and the botanical community, including botanic gardens, seed banks and organisations in Africa, Madagascar, Europe, the United States, Australia and beyond. We are collaboratively pooling our unique sets of skills and resources to address these challenges in working groups for conservation prioritisation, conservation in situ, horticulture, seed banking, systematic research and outreach.

KEYWORDS
biodiversity crisis, Botanic Gardens Conservation International, *Erica*, global conservation consortia, species extinctions

1 | INTRODUCTION

Biodiversity is in crisis, with over a million threatened species (Díaz et al., 2019) and ongoing decline of species and populations (Des Roches et al., 2021; Leigh et al., 2019; Mimura et al., 2017; Parmesan & Yohe, 2003; Thomas et al., 2004). To address this crisis, we must set out concrete steps that are sufficiently ambitious to make a real difference for the conservation of biodiversity and yet realistic in making best use of available resources (Díaz et al., 2020; Rounsevell et al., 2020; Williams et al., 2021). The Convention on Biological Diversity (Secretariat of the Convention on Biological Diversity, 2020) has set milestones including halting or reversing extinction rates and reducing the proportion of species under threat of extinction. Worldwide, the approximately 3000 botanic gardens and 60,000 associated botanical experts can make an important contribution to achieve these aims: They hold living collections representing 30% of known plant species (Mounce et al., 2017) and enable and engage in research, expanding the limits of our knowledge of plant diversity (Blackmore et al., 2011). They have the potential to act as a global plant conservation network, enabling the preservation of carefully prioritised, genetically diverse living collections, for future reintroduction in the wild (Pearce et al., 2020; Turner-Skoff et al., 2021; Westwood et al., 2021).

Plant conservation is already core business for many botanic gardens, but action needs to be coordinated to harness its full potential, pooling knowledge and limited resources to achieve carefully targeted goals. The aim of Botanic Gardens Conservation International's (BGCI's) Global Conservation Consortia (GCC) initiative is to 'mobilise a coordinated network of institutions and experts to collaboratively develop and implement comprehensive conservation strategies for priority threatened plant groups', with programmatic objectives covering network building, conservation prioritisation, in situ and ex situ conservation, research, capacity building, outreach and funding (Box 1; https://www.globalconservationconsortia.org/about-the-global-conservation-consortia/ accessed 12 January 2022).

Eight such consortia have been established to date, focussed on *Acer*, cycads, dipterocarps, *Magnolia*, *Nothofagus*, oak, *Rhododendron* and *Erica*. By focussing on specific taxonomic groups, institutions with specialised collections and staff can leverage ongoing efforts in curation and research to optimise impact for threatened plant species most in need of intervention.

Box 1 The programmatic objectives of the Global Conservation Consortia

- Foster new and existing network(s) of experts
- Identify species of greatest conservation concern and prioritise conservation action
- Ensure effective in situ species conservation
- Establish, expand and manage ex situ collections of high conservation value
- Foster applied research (e.g., conservation biology, ecology, horticulture, population genetics and taxonomy) to support species conservation
- Build capacity to empower and mobilise in-country partners in diversity centres and across species' ranges
- Increase public awareness and engagement with species conservation issues
- Collaboratively fundraise to scale-up conservation action.

2 | *ERICA*: A FLAGSHIP FOR THE CAPE FLORISTIC REGION

Species of *Erica* are archetypal elements of heathlands from northern Europe and the Mediterranean through the mountains of tropical Africa and Madagascar down to the southernmost point of the African continent. Almost 700 of the around 800 species of *Erica* are endemic to South Africa (Oliver & Forshaw, 2012), where they are concentrated in the Cape Floristic Region (CFR), representing the largest genus in the region (Linder, 2003) that alone accounts for around 7% of the entire CFR flora. They are often dominant in the vegetation, flowering profusely and providing a source of food for a range of animal visitors (Rebelo et al., 1985) and as an integral element of intact fynbos providing a key ecosystem service facilitating availability of scarce water resources in South Africa (van Wilgen & Wannenburgh, 2016). Further, human uses include cut flowers and confetti in South Africa and in horticulture particularly in Northern Europe (Nelson, 2012, p. 20; Nelson & Pirie, 2022).

Despite the abundance of the genus as a whole, of 944 *Erica* taxa currently included in the South African National Biodiversity

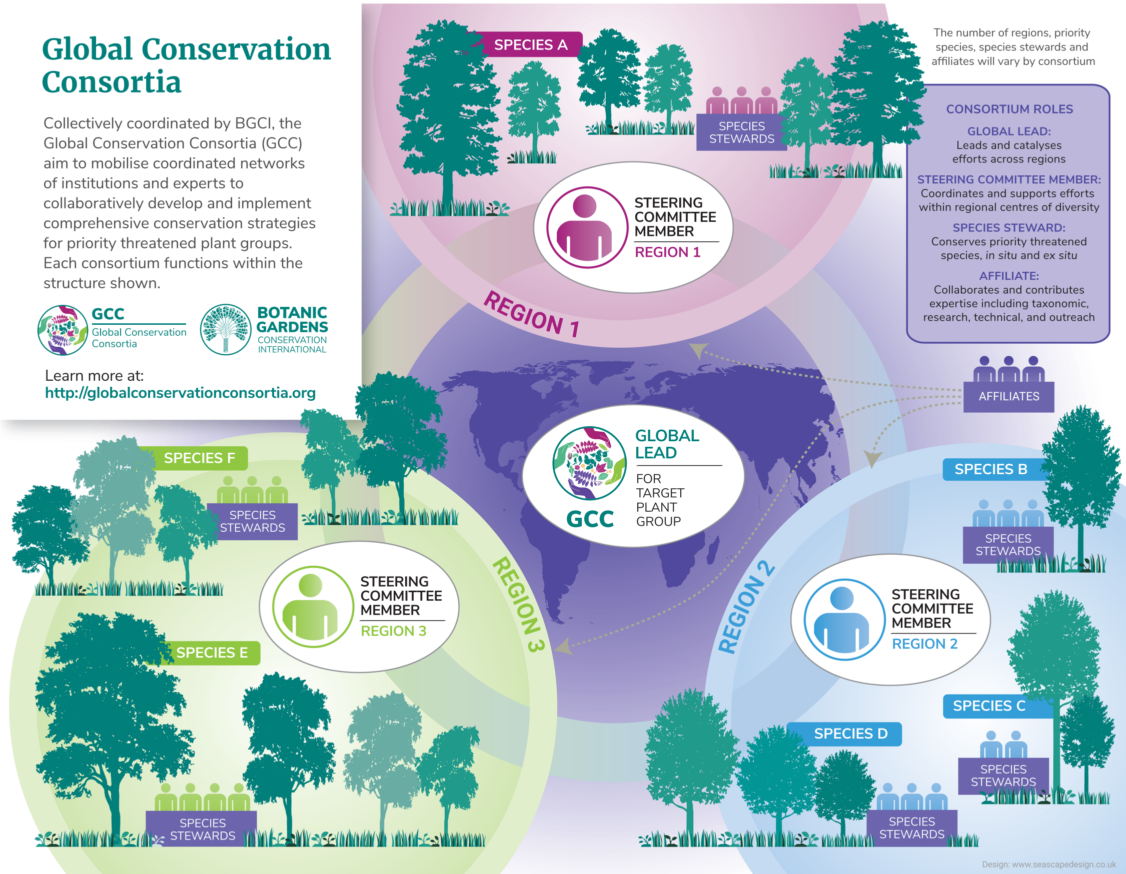

FIGURE 1 Structure and roles within Botanic Gardens Conservation International (BGCI)'s Global Conservation Consortia. Image: BGCI. Design: seascapedesign.co.uk

Institute (SANBI)'s Red List (Raimondo et al., 2009), 108 are classified as rare, a further 84 as vulnerable, 60 endangered and 46 critically endangered. Three are already extinct, a further three extinct in the wild.

3 | CHALLENGES FOR CONSERVATION OF *ERICA* SPECIES

Efforts for conservation of *Erica* species face challenges that may apply generally to diverse groups centred in biodiversity hotspots.

3.1 | Unbalanced distribution of biological diversity

Regional endemism, local regulations and local languages all speak for a need to organise conservation efforts locally. GCC are typically organised by grouping contributing partners under regional representatives of a steering committee, with the coordination of efforts for priority species undertaken by 'species steward' institutions, for activities both in the wild and in ex situ collections (Figure 1). However, many species-rich taxa are concentrated within regional biodiversity hotspots (Pearce et al., 2020; Turner-Skoff et al., 2021; Westwood et al., 2021), and single country endemics are more likely to be under threat (Lughadha et al., 2020). Given the uneven distribution of biological diversity, a minority of members of the international community could end up shouldering a disproportionate burden for preventing species extinctions, with less resources for in situ conservation and fewer local botanic gardens to cover a larger number of more threatened species.

3.2 | Limited knowledge of species-rich groups

Species-rich groups, particularly the largest genera, present a challenge both for research (Frodin, 2004) and by extension for effective conservation efforts. *Erica* is taxonomically complex with numerous species that are difficult to delimit or to identify. The relatively few Northern Hemisphere and tropical African high mountain species of *Erica* are well known (Beentje, 2006; Nelson, 2012; Ross, 1983) compared with the much greater numbers of South African and Madagascan species. Cape *Erica* has been the subject of long-term work by a number of specialists, particularly Harry Bolus (Guthrie & Bolus, 1909), Hans Dulfer (Dulfer, 1964), and most notably and recently E.G.H. Oliver, resulting in the description and revision of

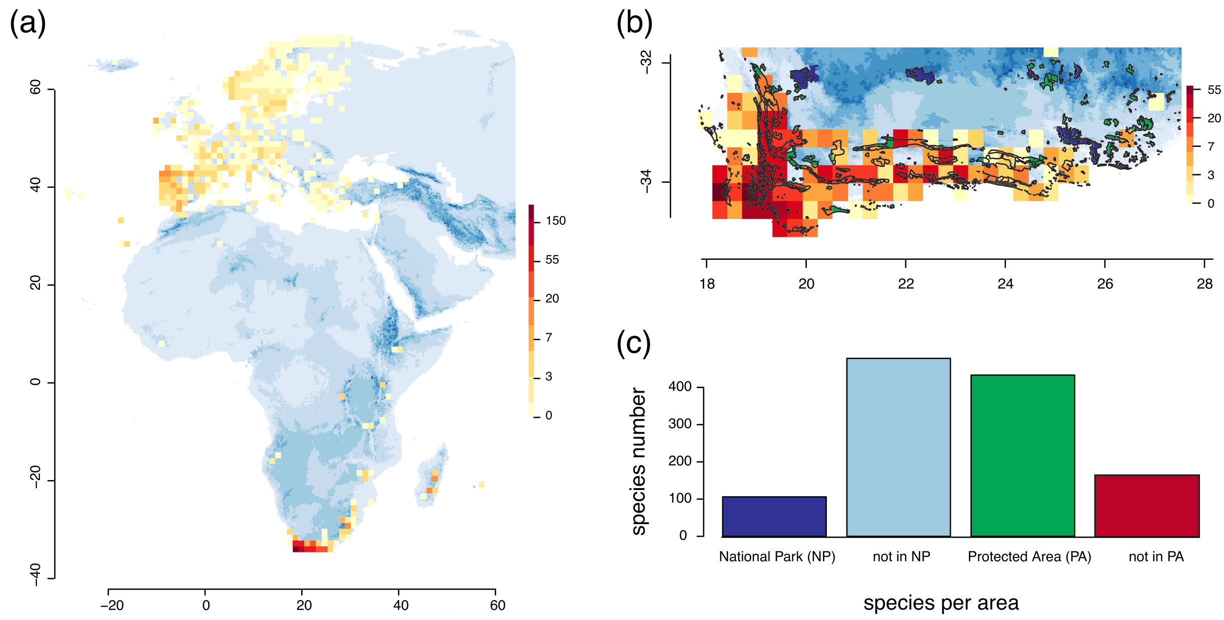

FIGURE 2 *Erica* distribution and species richness. Dataset from Pirie et al. (2019). Map projection (a and b) = geographic coordinate system, WGS84. (a) Number of taxa (ntax) = 646, number of observations (nobs) = 6818, grid size = 1.2 corresponds to approximately 1.2 × 0.2° = approximately 133 km, at equator. (b) ntax = 584, nobs = 2039, grid size = 0.3 corresponds to approximately 0.3 × 0.3° = approximately 33 km, at equator, yellow-red scale in numbers of species, white-blue map colour indicates elevation increasing with darker shade (without scale); protected areas data from the South African National Biodiversity Institute (South African National Parks, 2004; available at http://bgis.sanbi.org/SpatialDataset/Detail/649). (c) Numbers of species counted for National Parks (NP), other protected areas (PA) and not in protected areas [Correction added on 28 April, after first online publication: Figure 2B has been replaced to provide improved clarity.]

many species (e.g., Oliver, 2000; Oliver & Oliver, 2002), and a broad overview of the genus as a whole in the form of an electronic identification aid (Oliver & Forshaw, 2012). Madagascan diversity lacks such investment, and a modern and complete monograph of the genus as a whole is lacking. Work to address such knowledge gaps requires specialist researchers, training of which can be difficult to fund particularly over the longer timeframes required for expertise in such groups.

3.3 | Shortfalls in assessing and monitoring threat status

In South Africa, lowland species generally face increased pressure from ongoing habitat transformation. Alpine species are subject to declining extents of suitable conditions at higher elevations resulting from anthropogenically driven climate warming (La Sorte & Jetz, 2010). Many higher elevation species classified as 'Rare' in the most recent assessments (Raimondo et al., 2009) may be under threat due to the underestimated but still poorly quantified impact of introduced invasive species both inside and outside of declared protected areas (Zengeya et al., 2020). Summarising the distribution of species using openly available data (GBIF.org, 2017, curated in Pirie et al., 2019; Figure 2) for almost 600 Cape *Erica* species, we found that well over 100 species do not intersect with protected areas. Such data are limited, and generalisations by distribution can only apply in part to individual taxa that are impacted by local factors such as invasive species, inappropriate land management and human mediated disturbances of natural fire regimes (Skowno et al., 2021). Over a hundred South African *Erica* taxa are currently assessed as 'Data Deficient', with populations insufficiently known to be able to estimate the degree of threat to their survival. Madagascan *Erica* species remain entirely unassessed.

3.4 | Lack of resources for targeted data collection and in situ initiatives

To focus limited resources on optimal measures for the most critically threatened taxa, we need to find solutions for the above challenges and translate the best available data for diversity, threat status and representation in protected areas and ex situ collections into coordinated monitoring, collection and in situ conservation projects. Resources for such work are limited, and the direction of their deployment can be dictated by external factors. For example, increased levels of poaching of succulent plants in South Africa have resulted in an urgent need for work at critically affected sites and ex situ collections at the expense of routine effort in others. Current assessments of South African species follow different criteria to International Union for Conservation of Nature (IUCN), and most already exceed the 5-year period for reassessment (IUCN, 2012). Revisiting and reformatting hundreds of threat assessments represents an administrative burden that will inevitably be at the cost of other work.

3.5 | Knowledge gaps for cultivation and long-term viability of ex situ collections

Few gardens have specialist knowledge of optimal conditions for growing species of *Erica*, conditions differ considerably between gardens and interspecies variation in optimal growing conditions is also significant. Many gardens share collections data, for example, through BGCI's Plant Search (https://www.bgci.org/resources/bgci-databases/plantsearch/ accessed 2 February 2022), but there is not currently an easy way of summarising the overall coverage of species diversity in ex situ collections—including seed banks—for a given group. A thorough gap analysis of available material for species of critical conservation concern is needed to inform future collection priorities. This should include accession-level data for both seeds and cultivated plants if multiprovenance metacollections are to adequately represent species natural ranges (Griffith et al., 2019). For those species already represented in seed banks, we need to know how long seeds remain viable. Initial analyses suggest that seed from most *Erica* species maintain an acceptable level of viability (a measure of potential germinability) when stored at standard ex situ seed bank conditions of -20°C and between 3% and 6% moisture content. However, there appear to be some exceptions to this. We need to accelerate seed conservation research programmes to advance solutions for optimal long-term storage and germination and for ex situ collections and ensuring the supply of high-quality seed material for restoration efforts.

3.6 | Communicating the intrinsic value of plant species

Perhaps the greatest challenge to communicating the need to preserve biological diversity is when extinction of individual species—such as many threatened species of *Erica*—would have no obvious impact on human well-being. We need to find ways to demonstrate both the intrinsic value and largely hidden ecological roles as parts of complex food webs (including often specific pollinator interactions; Rebelo et al., 1985) to a public that may never encounter the species in the wild.

4 | GCC *ERICA* WORKING GROUPS

Here, we describe the approach that led to the establishment of the GCC *Erica* and consider how this and other consortia might address, in particular, the challenges associated with conservation in species-rich groups concentrated within biodiversity hotspots. We initiated six thematic working groups to coordinate distinct but interdependent fields of activities across in situ and ex situ conservation, research and outreach (Figure 3).

4.1 | Threat status and conservation prioritisation

Following similar efforts prior to the establishment of other GCC, for example, in oak (Beckman et al., 2019) and *Magnolia* (Cires et al., 2013), we are currently working on a gap analysis of ex situ collections from partner gardens across the BGCI network. Starting with a taxon-based approach and working with BGCI's PlantSearch database (https://tools.bgci.org/plant_search.php, accessed 2 February 2022), we aim to expand accession-level data to better reflect the representation of wild versus garden origin material and the coverage of intraspecific genetic diversity across the consortium's ‘metacollection’ (Griffith et al., 2019). To facilitate the integration of accession and threat status data from different sources, we have created a BRAHMS online database (http://brahmsonline.kew.org/gcce/Explore, accessed 2 February 2022) linking names and synonymy from the World Checklist of Vascular Plants (Govaerts et al., 2021), World Flora Online (Borsch et al., 2020), BODATSA (http://ipt.sanbi.org.za/iptsanbi/resource?r=brahms_online, accessed 2 February 2022) and taxonomic expertise (Oliver & Forshaw, 2012). This will help summarise the current state of knowledge and will allow us to organise and share taxon and accession-based data both within the consortium and with the wider research and conservation communities. Any improvement or modifications made to the taxonomy of the group during the development of this database and ongoing taxonomic research by the consortium will be fed back to relevant stakeholders (e.g., WCVP and WFO).

This first result: a priority list of taxa known to be most threatened and their representation in ex situ collections represents a crucial first step. Sites in situ that harbour priority species and are under immediate threat can be prioritised for rapid response to prevent extinction in the wild. Individual gardens can then prioritise auditing of accessions data and propagation of key taxa. From this baseline, collection and research efforts can be concentrated on the most critically threatened taxa, those that are underrepresented in ex situ collections, and those that are poorly known and likely to be threatened, for example, species assessed as Data Deficient for which distribution data indicate narrow distributions outside of protected areas.

4.2 | In situ conservation, collection and monitoring

Group members are already engaged in the monitoring of endangered species in general through various programmes such as the SANBI and the Botanical Society's citizen science initiative ‘Custodians of Rare and Endangered Wildflowers’ (CREW) programme in South Africa. These programmes are ideally positioned for providing data to the SANBI Threatened Species Unit for updating and improving conservation assessments for priority *Erica* species. We are also engaged in active and targeted seed collection coordinated by SANBI's Seed Conservation Programme.

Sharing knowledge and experience is key to develop the clear and achievable recovery plans for priority species that are needed to get

FIGURE 3 The working groups of GCC *Erica*. Top left: Anthony Hitchcock with reintroduced *Erica verticillata* (photo: Wendy Hitchcock). Top right: Alex Lansdowne at the Princess Vlei Forum in 2019 http://www.princessvlei.org/events--projects/today-we-are-planting-wolves (photo: Bridget Pitt). Centre left: *Erica* propagation at Belvedere Garden, Vienna (photo: MK/DR). Centre right: Millennium Seed Bank. Bottom left: TL: *Erica recurvata* (critically endangered), TR: *E. verticillata* (extinct in the wild) (photos: MDP); BL: *E. turgida* (extinct in the wild; photo: AL); BR: *E. baueri* (endangered; photo: RB-M). Bottom right: Seth Musker performs field work in the Western Cape sampling for a phylogenomics project on *Erica* species complexes (photo: MDP)

this type of work funded. The group can act in a coordinating and/or advisory role where financing for *Erica*-related projects is raised directly through the consortium or through, for example, BGCI (such as the Global Botanic Garden Fund or Anthony Hitchcock Fund). This will allow appropriate action for specific taxa, for example, monitoring only, or seed collection for long-term storage, through to more resource-intensive propagation and ex situ conservation, alien clearing and habitat restoration and reintroductions of severely reduced or extinct in the wild species.

The group faces enormous challenges. Targets to prevent extinctions and improve conservation status of threatened species are not being met (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services [IPBES], 2019). The cost of clearing invasive species is high. Potential restoration sites in South Africa are limited, with the most degraded sites disproportionately costly to restore (Holmes et al., 2020). So far, reintroductions have been restricted to extinct in the wild species around the city of Cape Town (Hitchcock & Rebelo, 2017). Realistic measures of success are going to depend on resources invested in specific projects.

4.3 | Plant care and propagation

Botanic gardens across the world hold collections of *Erica* species, some successfully conserving accessions over many years or even decades (Nelson & Pirie, 2022) and thereby preserving species such as *Erica verticillata* that had subsequently become extinct in the wild and was thought to be lost entirely (Hitchcock & Rebelo, 2017).

Through shared experience and agreements between gardens, we can ensure that material of critically endangered or extinct-in-the-wild species—and with it the risk of loss at individual sites—is spread across partners. The aim of ex situ collections is to facilitate reintroductions, but they also serve as poignant displays to inspire support for such actions across a wider international public.

By pooling the combined experience of horticulturalists across the network, we can share, develop and preserve protocols to secure *Erica* ex situ collections through vegetative and seed propagation. Together, we can address common challenges such as transitioning to peat-free compost for ericaceous plants and cultivating Mediterranean-climate species under glass at higher latitudes and opportunity of cultivating higher altitude species threatened by climate warming in conditions more suitable for their optimum care. We can accelerate the collection of data from ageing field and nursery experts to preserve their knowledge for future generations. Lessons learnt for *Erica* species will doubtless provide insight into the cultivation of other Cape fynbos plants in similar specialised habitats.

4.4 | Seed research, conservation and supply

Seed banking remains the most cost-effective solution to conserve and make available material for enhancing living collections and restoring degraded wild populations (Liu et al., 2020). We are working through the Millennium Seed Bank Partnership (MSBP), a global network of organisations working to secure, and make available, seed material from wild plant species. Across the MSBP, seeds are collected and conserved ex situ in seed banks in the country of origin and operating to recognised international standards (http://brahmsonline.kew.org/msbp/Training/Standards, accessed 2 February 2022). For most of these collections, a duplicate is stored at the Millennium Seed Bank (MSB) at the Royal Botanic Gardens, Kew in the UK. To date, *Erica* seed collections secured in seed banks across the MSBP (and those duplicated at the MSB) amount to 643 (425) individual collections covering 270 (262) taxa from 22 (18) countries. This includes 362 seed collections of 238 South African *Erica* taxa secured through the partnership between the MSB and SANBI.

The MSBP collections are an invaluable resource for conservation (Liu et al., 2020), opening the potential for further expansions of living ex situ collections and providing material to support the reintroduction of species and improve genetic diversity in situ. We will collaborate with propagation practitioners from key botanic gardens through the plant care and propagation working group to explore different means to maximise genetic diversity and prolong the viability across the metacollection (Griffith et al., 2019). This will include cross-working group collaboration to identify priority species that are difficult to propagate or unsuccessful at the germination test stage, or which are selected for reintroduction, for in-depth research into germination and the development of seed propagation protocols.

For example, as part of the ongoing 20-year collaboration between Kew's Millennium Seed Bank Programme and SANBI, five conservation seed collections of *E. verticillata* have been secured and duplicated at Kew's Millennium Seed Bank. To date, staff at the MSB have undertaken a total of 31 germination tests on these collections. One accession (Hitchcock, A 1045B; MSB279981) originally collected in 2003 has had nine individual germination tests carried out on it with results varying from 21% (considered a failed test) to 92% germination (TRP, unpublished data). These tests introduced different temperature and light regimes, inclusion of G3 hormones and smoke water treatments to improve the initial germination results. The development of these germination protocols goes some way to improve the success of in situ and nursery production from seed.

4.5 | Taxonomy and phylogenomics

In South Africa, we need to address taxonomic uncertainties that have implications for the determination of conservation status and downstream conservation actions. We also need to provide improved tools for identification, particularly of threatened species, which currently presents a barrier to obtaining collections and data. In Madagascar, fundamental taxonomic research (ideally supported by molecular methods) is sorely needed as a prerequisite for effective conservation efforts.

MacKay and Gardiner (2017) summarised threat status and ex situ collections across broader taxonomic groups of *Rhododendron* species to prioritise conservation efforts. From our current understanding of phylogenetic diversity within *Erica* (Pirie et al., 2016), we can identify both closely related species sharing recent common ancestors and older lineages representing longer stretches of independent evolutionary history. Given finite resources and numerous threatened species requiring urgent conservation action, we may wish to take such phylogenetic diversity into account when prioritising our efforts. We are currently preparing a species prioritisation list based on the Evolutionarily Distinct and Globally Endangered (EDGE) approach (Gumbs et al., 2021; Isaac et al., 2007), with the intent of integrating the conclusions of this work into those of the conservation prioritisation working group.

4.6 | Outreach

Harnessing public awareness and channelling it into successful in situ conservation projects requires local investment in time, resources and goodwill. Local activities of organisations such as SANBI, the Botanical Society of South Africa (BotSoc) and CREW are key players in these endeavours and are well positioned to influence the reconciliation of local priorities—such as water supply improvements and local employment through restoration programmes (van Wilgen & Wannenburgh, 2016)—with conservation priorities in partnership with state conservation entities, state landowning agencies such as municipalities and NGOs. However, gardens and interested public in relatively species-poor, high-latitude regions must also be motivated to direct significant resources into projects with high returns—in terms of conservation outcomes—in hotspots of biological diversity, even when those are far from home.

An important role of botanic gardens is to communicate botanical-related themes to the visiting public through displays of living plants, events and dissemination across media. For example, *Erica* will play an ambassadorial role in interpreting the influence of a changing climate on fynbos in a redesigned glasshouse in Amsterdam dedicated exclusively to species from the CFR. Access to the often highly engaged section of society interested in gardens gives us the opportunity to raise both awareness and funds for important projects, such as efforts to conserve threatened species. By working together, we can both share and improve our public outreach material, including through social media, and amplify messages—particularly accomplishments and calls for support—that individually might otherwise be lost in the noise of the daily media stream. Our partners' direct involvement in the BBC's 'Green Planet' documentary series showcases the potential reach of effective science communication, bringing the wonders of fynbos to millions of screens worldwide. The challenge will be to translate this and other forms of public outreach into investments that make a real difference.

5 | CONCLUSIONS AND CHALLENGES FOR THE FUTURE

There are numerous benefits to acting within a collaborative, multidisciplinary consortium, from greater synergy of diverse skills, improved efficiency and sharing of resources, greater impact and leverage, for example, for fundraising, and improved transfer of knowledge (Pearce et al., 2020). Through coordinated actions, we can identify knowledge gaps and the resources needed to fill them. For *Erica*, this includes an urgent need to identify the highest priority species for targeting in situ conservation efforts and where necessary for bringing into and distributing across ex situ collections. One example is *Erica bolusiae* var. *cyathiformis*, which is extinct in the wild and might have been lost entirely without action prompted by the establishment of GCC *Erica* (see http://pza.sanbi.org/erica-bolusiae-var-cyathiformis, accessed 2 February 2022).

The resources, knowledge and network accumulated for GCC *Erica* have direct relevance for the conservation of other threatened South African and wider Mediterranean-climate plant species. Threatened *Erica* can be treated as flagship species for areas of endemism in the Cape that include other narrowly distributed species and used to promote in situ conservation of entire threatened habitats with their co-dependent networks including, for example, pollinators, herbivores and their predators (Hitchcock & Rebelo, 2017). Sampling effort directed to such areas can similarly target other threatened species, and the common growing conditions needed for ex situ conservation allow for collections and displays of a range of species including those of other Mediterranean-climate regions.

In establishing GCC *Erica*, we argue for forming working groups across regional boundaries focussed on shared areas of expertise. Optimal strategies may involve a combination of regional and disciplinary groups. Ultimately, the success of this, and other conservation consortia, will be ensured through the efforts of partner botanical gardens, institutions and other interested parties. If you are interested in getting involved in any of the GCC, please visit the website https://www.globalconservationconsortia.org/ (accessed 4 February 2022) and get in touch.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Michael D. Pirie drafted the manuscript. Michael D. Pirie, Robbie Blackhall-Miles, Greg Bourke, Dan Crowley, Ismail Ebrahim, Félix Forest, Michael Knaack, Rupert Koopman, Alex Lansdowne, Nicolai M. Nürk, Jo Osborne, Timothy R. Pearce, Daniel Rohrauer, Martin Smit and Victoria Wilman are responsible for the collaborative discussion of approach and editing of the manuscript.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analysed in this study.

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