Review of the Custodians of Rare and Endangered Wildflowers (CREW) Programme: Final Report

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The opinions expressed in this report have been based on the information supplied to Resilience Environmental Advice (Pty) Ltd by SANBI. The review conducted in this report is provided in response to a specific request from SANBI to undertake such an evaluation subject to the contractual terms between Resilience Environmental Advice (Pty) Ltd by SANBI dated 23 May 2018.

The findings presented in this report are provided on an independent, objective, third-party basis and were determined through the agreed review process. Resilience Environmental Advice (Pty) Ltd reserves the right to its independent opinions presented in this report. Should SANBI wish to amend the findings, such amendments must be explicitly stated in subsequent versions of this report and Resilience Environmental Advice (Pty) Ltd advised thereof in writing.

These opinions do not necessarily apply to conditions that may arise after the date of this Report, inclusive of additional data or perspectives held by SANBI staff and other stakeholders.
Key findings and recommendations

SANBI commissioned this review of the CREW programme to evaluate its effectiveness and contribution towards the SANBI mandate. The key findings and recommendations are reflected below. A suite of additional findings and recommendations were made, including the identification of key lessons learnt, which are documented in the content of the review report.

Key findings:

- The programme is effectively aligned with relevant components of SANBI’s mandate. Strong alignment has been achieved with relevant core components of South Africa’s (National) Plant Conservation Strategy (NSPC), contributing to 9 of the 16 targets, and SANBI’s Corporate Strategic Plan 2015 - 2020.
- Clear alignment has been attained with the constitutional mandate, objects and associated core activities of the Botanical Society of South Africa (BotSoc). CREW is highly synergistic with BotSoc’s current and proposed future focus areas, including effective and practical BotSoc member participation in plant conservation.
- CREW activities and available resources have been strongly aligned with the programme’s objectives, although additional resources would facilitate broader programme reach.
- CREW has leveraged the collection of accurate, reliable and recent plant species data totalling 100,5701 records for 8,973 plants (44% of the flora), with data collected for 2,120 threatened and rare plants since 2003. Plant data has been collected across vast geographical regions of South Africa and a highly diverse array of families and genera. A high frequency of targeted collection, high level of spatial accuracy, and high degree of sampling efficiency has been achieved across a vast array of botanical families. A total of 2,382 visits were undertaken to 58 under-sampled areas between 2003 and 2018.
- CREW has also provided a total of 19,4372 additional new specimens to SANBI’s Biosystematics Division to support the accurate and effective identification of species. Via CREW, the Biosystematics Division of SANBI has been able to describe 30 new plant species, including those under formal description at present. To the programme’s knowledge, no other country in the world adopts such a targeted approach to citizen science data collection for threatened and rare plants. The programme has also supported the collection of seed for the Millennium Seed Bank (MSB) for a substantially greater number of species and geographic locations than if such collection had been undertaken solely via SANBI staff. A total of 138 species have been collected by volunteers since 2016. Of the 514 threatened species banked by MSB between 2005 and 2018, 35 (7%) of these were collected by the CREW citizen science network.
- CREW has leveraged the goodwill, expertise, time and financial resources of volunteer citizen scientists, which has enabled SANBI to acquire vastly more data than it would have had the programme been implemented using only SANBI staff. Over the course of the project 178,803 person hours had been donated to the programme through volunteer time3. Volunteer’s time equates to the equivalent of 98 person years. At the end of 2018, the programme involved 923 volunteers spread across South Africa’s threatened ecosystems. In light of the vast geographical extent of the country, the immense diversity of South Africa’s flora, and the depth of skills and experience needed to accurately identify species, which take an extensive period of time to acquire, the programme has delivered a very high return on investment.
- The development of interns via the CREW programme has, and continues to make, an important contribution to the up-skilling and involvement of previously disadvantaged individuals in the identification, assessment and monitoring of threatened plant species, including their progression into formal employment in the sector. The programme has and continues to make an ongoing, sustainable contribution to transformation in the biodiversity sector, with 36 previously disadvantaged individuals having been trained up via the programme. Seventy percent (70%) of these previously disadvantaged individuals have found

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1 SANBI’s Threatened Species Unit database.
2 SANBI’s Botanical Research and Herbarium Management System (BRAHMS).
3 Between 2003 and the end of 2018.
permanent or long-term employment or are currently engaged in further study within the Biodiversity Sector.

- The data collected via the programme supports the effective annual updating of the Red List of South African Plants and updating of the National Biodiversity Assessment (NBA); updating of SANParks management plans, ongoing adaptive management, and World Heritage Site and Natural Wonders of the World reporting; Provincial Systematic Biodiversity Plans; National and Provincial Protected Areas Expansion Strategies; National and Provincial Biodiversity Stewardship programmes and local stewardship initiatives; District, Metropolitan and Local Systematic Biodiversity Plans, including biodiversity sector and bioregional plans; Environmental Impact Assessment (EIA) and Water Use License Application (WULA) processes; Spatial Development Frameworks; Environmental Management Frameworks; Strategic Environmental Assessments; Land Reform planning processes; Land Use Management decision making, and management of private land (e.g. grazing and burning regimes), amongst others. The integration of volunteer collected plant data into government land use planning and decision-making is novel globally. Without ongoing collection of new plant data, national, provincial, parastatal, district and local municipal government planning and decision-making would largely exclude consideration of recent, accurate and comprehensive plant species data. In the absence of this data, inappropriate land use management activities would be approved that would lead to the loss of threatened species and their associated habitats.

- The CREW model has proven to be an effective vehicle for botanically-focussed citizen science in South Africa. However, risks to its current effectiveness and future effective scaling-up include the potential to be drawn into tasks that fall outside of SANBI's core mandate and the programme’s core purpose. Most notably, a risk exists of capacity building and demographic expansion efforts diminishing available human resources to address core SANBI mandates.

- Based on its botanical relevance, global applicability, depth of functionality, user-friendly interface and extensive international use, iNaturalist is currently the most appropriate online citizen science platform for application by CREW.

**Key recommendations:**

- CREW’s current approach of partnering with citizen scientists and the Botanical Society is of benefit to SANBI, as it is an optimal return on investment. The continuation of the programme will provide a greater number of previously disadvantaged individuals with meaningful training, increase demographic representivity in the sector, and facilitate growth in volunteer recruitment.

- However, additional time is required to yield the full long-term potential of the programme in terms of volunteer recruitment and training, demographic impact, and data collection. Major changes to the focus and structure of the programme are not recommended, to avoid a reduction in the current momentum, cohesiveness and impact of the programme. Any potential changes should be incremental and complementary.

- The CREW programme could be geared to achieve greater impact. Due to resource constraints, programme upscaling would be best achieved through partnerships with existing biodiversity and allied actors and a highly focussed, modular approach. Should CREW expansion be pursued, it should be underpinned by pilot projects with a broader suite of operational partners. Retaining the core programme partnership, whilst strengthening and expanding CREW’s network through existing local actors with local knowledge within nodes and/or pilot projects is recommended. This model would enable greater involvement of previously disadvantaged individuals, whilst maintaining core structural and operational requirements for ongoing effectiveness.

- The existing formal and informal partnerships and levels of collaboration should be further strengthened. CREW must continue to nurture the current relationship with BotSoc and the Mapula Trust. Opportunity to expand CREW’s impact through additional financial support from these two donors should be explored. Expansion through new partners should also be

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4 This finding is based on inputs during the interviews conducted with stakeholders from various conservation agencies, other organs of state, CREW partners, volunteers and SANBI staff.
pursued, but in a complementary manner to BotSoc and the Mapula Trust’s involvement and support. SANBI has consistently funded more than 50% of the programme costs since 2003. Additional financial support from BotSoc and the Mapula Trust should be pursued, to achieve a fully equitable (50/50) funding arrangement between SANBI and BotSoc.

- At present the operational budget for CREW supports key tasks, but an increase of 15 to 20 percent should be sought via internal and external sources to enable the nodes to support volunteer groups at a more optimal level for the current suite of activities. This in turn would facilitate higher levels of targeted data collection and volunteer involvement, particularly by previously disadvantaged individuals.

- The viability of establishing a new CREW node in Pondoland should be assessed, to address current spatial and temporal data gaps within this biodiversity hotspot, particularly through existing projects (e.g. uMzimvubu Catchment Partnership Programme).

- SANBI should optimise the outcomes of its relationship with the Department of Science and Technology’s National Recordal System project, which works to document indigenous knowledge of South Africans, by involving CREW to a greater extent. This could be achieved by CREW assisting with plant identifications, providing training on how to press plants, assisting the DST in obtaining provincial permits etc. Plant specimens collected as part of the National Recordal System project could be sent via the CREW nodes to SANBI’s biosystematics team for formal identification and storage in the Pretoria National Herbarium.

- CREW could play a crucial future role by collecting essential new data for the listing of future Key Biodiversity Areas (KBA) via collecting essential data such as the number of mature plants at a site locality. CREW could also play a greater role in monitoring the status of priority plant populations, which is currently undertaken on a very limited basis, but this needs to be informed by regular analyses of monitoring priorities.

- Continuity is key to achieving deep and meaningful change and CREW should continue building transformation objectives into its Annual Operational Plans. However, SANBI should develop an over-arching citizen science strategy which clearly outlines their approach to citizen science and how the CREW programme contributes to the array of citizen science initiatives implemented.

- CREW’s Annual Operations Plan should be linked to a monitoring and evaluation plan, to enable tracking of relevance, quality of design/results chain, effectiveness, impact, efficiency, sustainability and adaptive management. Such indicators must be directly linked to the core objectives of the CREW programme, South African’s Plant Conservation Strategy, SANBI’s mandate, and the reporting requirements of the SANBI Board to the Parliamentary Portfolio Committee with regard to relevant aspects of SANBI’s mandate.

- To support the monitoring and evaluation of the CREW programme and other species programmes, provincial systematic biodiversity plans, bioregional and biodiversity sector plans, and biodiversity management plans for species should be required to explicitly document the extent to which key species data has been incorporated into such plans. The monitoring component should also be designed to support adaptive management and flexibility within the programme.

- In light of its rigour and methodology that enables outcome optimisation, the *Open Standards for the Practice of Conservation* should be considered by SANBI as its primary methodology for biodiversity programme/project design, implementation, monitoring, evaluation and review.

- CREW should consider applying the *Open Standards for the Practice of Conservation* when undertaking their biannual review and planning processes, to further strengthen their approaches.

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5 This proposed increase does not relate to CREW staff salaries.

6 This could present opportunities to involve a greater number of unemployed youths in poverty nodes in the country. Various opportunities and challenges to the involvement of unemployed youth were identified during this review, which are documented below and require careful consideration.

7 KBAs are a new standard for identification of key sites for the persistence of globally important biodiversity. The first comprehensive network of KBA sites in South Africa will be identified in 2019. KBAs will be incorporated into South Africa’s Biodiversity Monitoring Framework and will require annual updating.
Acknowledgements

Resilience Environmental Advice would like to thank the South African National Biodiversity Institute and the Botanical Society of South Africa staff for their input and logistical support during the review. We wish to thank John Donaldson, Deshni Pillay, Domitilla Raimondo, Zaitoon Rabaney, Kristal Maze, Ismail Ebrahim, Suvarna Parbhoo, Lize von Staden, Vathiswa Zikishe and Livhuwani Nkuna in particular.

We also wish to express our sincere appreciation to the various government, academic and civil society stakeholders who graciously provided input and freely shared their insights regarding the programme. We wish to thank the Outramps volunteer group and their champion Di Turner for enabling us to join them on one of their fieldtrips.
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1 Introduction

Resilience Environmental Advice Pty Ltd (REA) was appointed by the South African National Biodiversity Institute (SANBI) to review the Custodians of Rare and Endangered Wildflowers (CREW) programme.

SANBI leads and coordinates research, as well as monitors and reports on the state of biodiversity in South Africa. The Institute is mandated to provide knowledge and information, planning and policy advice, and to pilot best-practice management models in partnership with stakeholders to support the sustainable use of the country’s biodiversity. Giving effect to this mandate, SANBI plays an important role in supporting the translation of science into policy. Further information on SANBI’s mandate, approach, structure and objectives is provided in Appendix A.

SANBI has a Biodiversity Assessment and Monitoring (BAM) Directorate mandated to monitor and report on the conservation status of South Africa’s indigenous plant and animal species. SANBI has a strong focus on citizen science and has developed and supported projects and virtual museum platforms to facilitate the submission of field monitoring records from the public. Through these various platforms SANBI channels the South African public’s interest and passion for biodiversity conservation into expanding SANBI’s monitoring capacity. BAM employs staff to co-ordinate the collection of information on species through long term programmes involving volunteers from the public, scientists, taxonomists and conservationists from partner institutions across the country. Citizen science platforms that have been or are actively supported include the South African Bird Atlas Project, the Virtual Museums, iNaturalist for South Africa, the Rural Citizen Science Birding Project and the Custodians of Rare and Endangered Wildflowers (CREW) programme.

SANBI completed an external review of the work of its Biodiversity Science and Policy Advice Branch in 2017. This review noted a number of positive aspects of the CREW programme and recommended additional collaborations between CREW and other areas of SANBI’s work. In addition, the programme has been in implementation for 15 years and thus SANBI deemed it necessary to evaluate CREW to determine if it is still effectively contributing towards the SANBI mandate. This review will form an important part of the CREW programme’s learning process.

2 Scope, approach and methodology

The specific objectives of the review were to:

1. Evaluate how well the CREW programme has achieved its objectives and determine how well the objectives of CREW are aligned with the needs of SANBI and the Botanical Society.

2. Determine what added value SANBI obtains from engagement with citizen scientists through the CREW programme versus if this work was done by employed SANBI staff.

3. Identify areas where CREW may be able to provide greater support for SANBI work.

4. Determine if the level of investment in CREW is appropriate, given both SANBI’s needs and the CREW programmes’ objectives.

5. Evaluate the Human Capacity Development component of the CREW programme, including its three elements:

   a. Training volunteers to gain plant identification skills.

   b. Training interns to gain a suit of conservation skills, including plant identification, project management, data collection and processing.
c. Exposing university students to work on threatened plant conservation and job opportunities within this sector.

6. Investigate the use of available technologies for monitoring species, suggesting ways in which the CREW programme could make better use of available technologies.

7. Analyse who has been involved in the CREW programme – and suggest ways to improve representation of South Africa’s different demographic groups in the programme.

The following approach and methodology were applied to undertake the review:

1. Inception Phase
   a. Confirmed scope of work, methodologies, consultations, timing and reporting.
   b. Developed an information/document needs list.
   c. Prepared a list of programme contact persons and key stakeholders.
   d. Prepared a concise inception report, including a detailed project schedule.

2. Desktop review
   a. Undertook a comprehensive desktop review of key CREW documentation to:
      i. Obtained a sound understanding of the programme objectives.
      ii. Formulated an initial assessment of how well aligned the objectives of CREW are with the needs of SANBI and the Botanical Society.
      iii. Formulated an initial determination of the value add SANBI gets from engagement with citizen scientists through the CREW programme versus if this work was done by employed SANBI staff.
      iv. Identified areas where CREW may be able to provide greater support for SANBI work.
      v. Evaluated the Human Capacity Development component of the CREW programme (training of volunteers, interns and exposure for students).
      vi. Analysed who is involved in the CREW programme and suggest ways to improve representation of South Africa’s different demographic groups in the programme.

3. Consultations
   a. Facilitated participatory consultation with relevant SANBI staff, partners, beneficiaries and consultants (where relevant) via in-person and video technology interviews (e.g. Skype/Zoom) to evaluate each of the aspects described above in Desktop Review (see Appendix B for the list of stakeholders interviewed).
   b. Qualitatively (and quantitatively where possible) documented alignment, value adds, human and financial resource capacity, major achievements and opportunities for improvement.
   c. Corroborated stakeholder inputs where possible.

4. Evaluation
   a. Independently and critically assessed programme alignment, value adds, human and financial resource capacity, major achievements and opportunities for improvement via rigorous questioning and evaluation methods, including the use of relevant indicators where available.
b. Determined if the level of investment in CREW was appropriate given both SANBI's needs and the CREW programmes' objectives.

c. Investigated the use of available technologies for monitoring species, suggesting ways in which the CREW programme can make better use of available technologies.

d. Comprehensively captured key lessons learnt, challenges, and opportunities for improvement.

e. Identified emerging lessons and associated recommendations that could be applied to the scaling up, scaling down or redesigning of the programme.

f. Made recommendations on programme design, approach, methods, technologies, actions, and resourcing to improve current effectiveness, strengthen outcomes and/or guide potential changes and strategic options.

3 Objectives and deliverables of the CREW programme

3.1 Overview

The CREW programme is jointly funded by SANBI and the Botanical Society of South Africa (BotSoc) (see Appendix C for BotSoc’s mandate and objectives). CREW promotes the participation of citizens to survey and monitor plant species of conservation concern in areas where these species are known to occur.

The CREW programme has the following specific objectives:

1. Develop a network of civil society volunteers across South Africa’s threatened ecosystems to survey and conserve plants of conservation concern.

2. Contribute to in situ conservation of threatened plants via supporting provincial stewardship programmes and inputting into land-use decision making processes.

3. Work with national botanical gardens across South Africa to conserve threatened plant species in ex situ collections and pilot reintroduction of threatened plants into threatened ecosystems.

4. Develop capacity in plant conservation through targeted training of citizen scientists, students from tertiary education institutions and early career scientists.

The CREW programme was initiated in 2003 in the Cape Floristic Region (CFR), but has been expanded and now also has a strong presence in both the summer and winter regions (Raimondo et al., 2013). The programme expanded to the KwaZulu-Natal province in 2006, Mpumalanga in 2007, Eastern Cape and Limpopo in 2013, and Gauteng in 2015 (SANBI, 2018a). The CFR node and KZN nodes are currently led by node managers. Node co-ordinators are currently in place for KZN, the Eastern Cape and Limpopo. A support officer provides assistance for the CFR.

The programme’s four nodes - Cape Floristic Region node, KwaZulu-Natal (KVZ) node, Eastern Cape node and the BotSoc funded Limpopo node - provide support to the citizen science groups by providing resources, training and identification courses, as well as linking the groups to their local conservation agencies. Threatened plant data collected by the CREW citizen science groups is analysed by SANBI Threatened Species Unit’s (TSU) Red List scientists using the International Union

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8 The Mpumalanga and Gauteng groups are supported by the KZN node
for Conservation of Nature’s (IUCN) Red List Categories and Criteria to assess the risk of extinction of South Africa’s plants. The Red List status of South Africa’s species is one of the key indicators regularly reported to government via the National Biodiversity Assessment and through provincial and national state of the environment reporting. A summary of the CREW programme operational process flow is provided in Appendix D.

In addition, the TSU co-ordinates and promotes the application of threatened species information in all spheres of biodiversity conservation – from national and international conservation legislation and policy, to conservation planning, protected area selection, protection of threatened habitats, and ex-situ breeding programmes within the SANBI National Botanical Gardens. All these focal areas of work are included in South Africa’s (National) Strategy for Plant Conservation that has been completed under South Africa’s responsibilities for implementing the Convention on Biological Diversity (see Appendix A).

These CREW nodes have supported citizen scientist groups by providing hands-on training, identification courses, financial and logistical resources, as well as networking and technical support liaison with plant specialists. A number of iNaturalist training courses have been provided and plant identification symposiums organised, these are practical sessions on specific genera, and often include instruction on plant pressing required for the genus in question.

The nodes are responsible to source priority species data from each group, whilst providing relevant information (locality, flowering time, identification sheets showing the species’ distinguishing features and images) for each species to the citizen science groups to guide their plant surveys.

The nodes and associated CREW groups work with the relevant provincial conservation agencies and support their biodiversity stewardship units in the surveying of sites for Red List and endemic plant species and the rapid determination of habitat condition. This information is an important input into national and provincial protected area expansion strategies and specific stewardship initiatives, as well as an array of other biodiversity and land use planning process and tools in the country (see Chapter 4.2).

The programme currently has 35 groups operating across South Africa, comprising of 923 dedicated citizen scientists, many of whom are members of the Botanical Society. Citizen scientists range from learners, to university students, to conservation interns and permanent staff, to retirees. The levels of expertise and experience of the citizen scientists vary greatly, with some being very new to science, whilst others having been actively involved in botanical surveys for more than a decade.

The geographical distribution of the various CREW citizen science groups is illustrated in Figure 3-1. This distribution is strongly aligned with areas of high endemism and plant diversity in South Africa.

Biannual planning sessions are held by CREW with all the programme nodes to identify and review progress made and to develop Annual Operations Plans to direct its future activities. Internal review of past actions and adaption of ongoing and proposed actions are undertaken as part of these planning sessions to ensure alignment and effectiveness. From the Annual Operations Plans, a fieldwork schedule for each node is developed for the year.
Figure 3-1: The localities of the CREW citizen science groups (SANBI, 2018a)

The number of sites surveyed by each of the CREW nodes are reflected in Figure 3-2

Figure 3-2: The number of sites surveyed by each of the CREW nodes (SANBI, 2018a)
4 Review findings

The review was undertaken by evaluating available documentation and interviews with key SANBI, BotSoc and CREW programme staff, CREW volunteers and other programme partners (see Appendix B for a list of the interviews undertaken). The evaluation included consideration of the following all aspects in the scope of this work outlined in section 2 above.

The following findings were made based on the desktop review and interview processes in relation to the evaluation objectives:

4.1 Achievement of objectives and alignment with SANBI and the BotSoc objectives

SANBI’s mandate, approach, structure and objectives is provided in Appendix A.

The CREW programme is effectively aligned with SANBI’s mandate in terms of:

- monitoring and report on the conservation status of threatened or protected plant species and listed ecosystems.
- acting as an advisory and consultative body on matters relating to biodiversity to organs of state and other biodiversity stakeholders.
- promoting the taxonomy of South Africa’s biodiversity.
- supporting the establishment, maintenance, protect and preservation of collections of plants in national botanical gardens and in herbaria.
- collecting, generating, processing, coordinating and disseminating information about biodiversity and establishing and maintaining databases in this regard.
- coordinating programmes to involve civil society in the conservation and sustainable use of indigenous biological resources and the rehabilitation of ecosystems.

In 2015, SANBI developed South Africa’s first (National) Strategy for Plant Conservation (NSPC) in response to the country’s commitments under the CBD, including South Africa’s endorsement of the Global Strategy for Plant Conservation (GSPC) and adoption of Decision X/17. The country strategy is aligned with the CBD-endorsed GSPC. The South African strategy was developed simultaneously with the review of South Africa’s National Biodiversity Strategy and Action Plan, and all activities in South Africa’s Strategy for Plant Conservation nest under activities within the National Biodiversity Strategy and Action Plan (Raimondo et al., 2015).

This strategy was developed under the leadership of SANBI, the focal point for the implementation of the Global Strategy for Plant Conservation nationally, with support from the Botanical Society of South Africa (BotSoc). The strategy includes 16 outcome-oriented targets, each of which, if effectively implemented, will support improved conservation of plants in South Africa.

Strong alignment has been achieved with relevant core components of South Africa’s Plant Conservation Strategy (SPC). Alignment of the programme with relevant aspects of the SPC resulted in CREW identifying a wide range of important plant conservation intervention points, additional cross-cutting activities with other conservation role-players, and integration with a wider range of SANBI’s divisions. Via such alignment, CREW has often served as a bridge between herbaria and other

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9 This does not imply that CREW plays a leading role or necessarily undertakes each of these exact functions. For some of these functions, CREW plays a supporting, yet important role to other SANBI programmes and projects that enables the execution of these mandates.
divisions of SANBI. CREW currently contributes to 9 of the 16 targets of the SPC (see Table 4-1), 89% of SANBI staff interviewed expressed an opinion that the CREW programme is effectively aligned with SANBI’s mandate.

Table 4-1: Targets and intended outcomes of South Africa’s (National) Strategy for Plant Conservation (Raimondo et al., 2015) and outcomes that CREW contributes towards

<table>
<thead>
<tr>
<th>NSPC Target (with CREW areas of contribution highlighted)</th>
<th>NSPC Outcome (with CREW areas of contribution highlighted)</th>
<th>Specific contribution from CREW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target 1: An online Flora of all known plants.</td>
<td>1.1. e-Flora produced that includes descriptions, distribution information and images for taxa.</td>
<td>Specimens are provided to taxonomists to describe new species (30 new species described), 100,570 accurate distribution records provided for by CREW, images of species are provided by volunteers</td>
</tr>
<tr>
<td></td>
<td>1.2. Identification keys to genus level and where possible to species level included in e-Flora.</td>
<td></td>
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<tr>
<td>Target 2: An up-to-date assessment of the conservation status of all South African species.</td>
<td>2.1. Red List maintained and updated with all newly described species assessed.</td>
<td>CREW volunteers collect key data on populations of threatened plants that allow Red List assessments to be accurately updated to reflect most recent population numbers and impact of threatening processes. Population data for 2120 threatened and rare plants collected.</td>
</tr>
<tr>
<td></td>
<td>2.2. Species from priority areas under imminent threat reassessed.</td>
<td></td>
</tr>
<tr>
<td>Target 3: Information, research and associated outputs, and methods necessary to implement the Strategy, developed and shared.</td>
<td>3.1. Information on plant occurrences from herbaria, provincial conservation agencies and atlassing projects centralised, quality checked where feasible, and made available via a single portal.</td>
<td>CREW groups conduct ongoing monitoring of threatened species for key threatened ecosystems.</td>
</tr>
<tr>
<td></td>
<td>3.2. Plant taxa of conservation concern monitored.</td>
<td></td>
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<td></td>
<td>3.3. Under-sampled areas targeted for surveys.</td>
<td>CREW nodes target sites and areas of the country that have not previously been surveyed. A total of 2,382 visits were undertaken to 58 under-sampled areas between 2003 and 2018.</td>
</tr>
<tr>
<td></td>
<td>3.4. Taxonomic revisions of priority genera produced.</td>
<td></td>
</tr>
<tr>
<td>Target 4: Biodiversity targets for terrestrial ecosystems secured through effective management.</td>
<td>4.1. The protection levels of the 35 terrestrial ecosystems that were assessed in 2011 to be Critically Endangered or Endangered and also unprotected or poorly protected are substantially increased.</td>
<td>CREW contributed to working on management plans and landowner engagement for 99 sites.</td>
</tr>
<tr>
<td></td>
<td>4.2. The rate of loss of habitat in threatened ecosystems reduced with no further loss taking place in Critically Endangered ecosystems.</td>
<td>CREW volunteers act as local custodians of key sites, taking part in EIA processes as IAPs and guiding development away from sensitive and threatened ecosystems. Scale not quantified.</td>
</tr>
<tr>
<td>Target 5: Important areas for plant diversity identified and incorporated into conservation processes.</td>
<td>5.1. Important areas for plant diversity in South Africa identified based on botanical richness and endemism patterns.</td>
<td>560 highly restricted plant species that have a global range of less than 10 km² have been mapped in detail, the critical habitat where these species occur is going into the EIA screening tool as the</td>
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<td>Target 6: Initiatives in place to ensure the sustainable management of production lands, consistent with the conservation of plant diversity.</td>
<td>5.2. Important areas for plant diversity incorporated into biodiversity planning processes and protected area expansion strategies.</td>
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<td>CREW volunteers work with stewardship officials to identify key sites for protected area expansion, 99 sites worked on to date.</td>
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<td>Target 7: At least 75% of known threatened plant species conserved in situ.</td>
<td>6.1. Mainstream plant diversity into agricultural planning and implementation within priority catchments.</td>
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<td>6.2. Capacity of agricultural extension services strengthened and enforcement capacity improved</td>
<td>7.1. Protected area expansion strategies to incorporate layer of high priority unprotected threatened species sites.</td>
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<td>CREW volunteers work with stewardship officials to identify key sites for protected area expansion and support in their declaration, by providing key inputs into management plans, 99 sites worked on to date.</td>
<td>7.2. Biodiversity Stewardship programmes focused on areas with high concentrations of unprotected threatened species.</td>
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<td>Target 8: At least 60% of threatened plants in ex situ collections, preferably in the country of origin, and available for recovery (restoration) programmes, with 1% in active reintroduction programmes.</td>
<td>7.3. Legal protection of Critically Endangered plant species occurring at one site only, achieved.</td>
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<td>8.1. 60% of threatened plants conserved ex situ.</td>
<td>Volunteers collect seeds for 7% of the threatened plants banked by MSB programme (35 of the 514 species banked to date) since 2016.</td>
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<td>8.2. 1% of species with ex situ collections active in restoration programmes.</td>
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<td>Target 9: The genetic diversity of crops, including their wild relatives, and indigenous edible plant species conserved while respecting, preserving and maintaining associated indigenous and local knowledge.</td>
<td>9.1. Genetic diversity of 400 indigenous edible plant species and crop traditional varieties conserved in gene banks.</td>
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<td>9.2. Priority crop wild relatives conserved in situ and ex situ.</td>
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<td>Target 10: Effective management plans in place to prevent new biological invasions and to manage important areas for plant diversity that are invaded.</td>
<td>10.1. Invasive Species programme effectively detecting and documenting new invasions, providing reliable post-border risk assessments and coordinating implementation of national eradication plans.</td>
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<td>10.2. Important areas for plant diversity receiving priority attention by invasive alien clearing programmes.</td>
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<td>Target 11: No species of wild flora endangered by international trade.</td>
<td>11.1. Non-Detriment Findings for all cycad species conducted.</td>
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<td>11.2. Biodiversity Management Plan for Critically Endangered and Endangered cycads implemented.</td>
<td>11.3. Listing proposals for species threatened by international trade, but not yet included on one of the CITES appendices, completed.</td>
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<td>11.4. Early warning system to flag new species potentially threatened by international trade implemented.</td>
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<td>Target 12: All wild harvested plant-based products sourced sustainably.</td>
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<td>12.1. A landscape approach to the conservation of medicinal plants developed and implemented.</td>
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<td>12.2. The option of substituting wild-sourced medicinal plants with cultivated plants investigated.</td>
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<td>12.3. The demand for wild-sourced plants in the horticultural collectors’ trade diminished as a result of cultivated material being made available.</td>
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<td>12.4. Species harvested from the wild for bio-trade managed sustainably.</td>
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<td>Target 13: Indigenous and local knowledge innovations and practices associated with plant resources maintained or increased as appropriate to support customary use, sustainable livelihoods, local food security and healthcare.</td>
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<td>Future potential area for CREW support, knowledge recorders working on this programme need support to identify plants that are utilised by communities and training on how to collect specimens.</td>
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<td>13.2. Studies conducted to capture Indigenous Knowledge related to plant use by ethnic groups in regions not yet definitively researched.</td>
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<td>13.3. A national database on indigenous plant use knowledge available online.</td>
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<td>Target 14: The importance of plant diversity and the need for its conservation incorporated into communication, education and public awareness programmes.</td>
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<td>14.1. Plant conservation included in the life science curriculum across South Africa.</td>
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<td>14.2. Plant conservation awareness expanded by exposure to botanical gardens and by involving the public in citizen science projects.</td>
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<td>14.3. Plant conservation is promoted in relevant media.</td>
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<td>CREW involves 923 volunteers from the general public (2018 statistics) in monitoring and conservation of threatened plants. CREW writes articles in local newspapers and has an active presence on relevant social media platforms.</td>
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<td>Target 15: The number of trained people working with appropriate facilities sufficient according to national needs, to achieve the targets of this Strategy.</td>
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<td>15.1. Conservation courses offered in South Africa’s universities aligned with skills needed in the field of plant conservation.</td>
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<td>15.2. Work place mentorship opportunities available in plant conservation programmes.</td>
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<td>15.3. Postgraduate research studies required to ensure the conservation of South Africa’s plant species promoted.</td>
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<td>CREW provides internship opportunities on an ongoing basis at 4 nodes across the country. 43 individuals trained between 2005 and 2018.</td>
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<td>Target 16: Institutions, networks and partnerships for plant conservation established or strengthened at national, regional and international levels to achieve the targets of this Strategy.</td>
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<td>16.2. Working groups for each target ensuring that specified outputs are being achieved.</td>
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Clear alignment has been attained with the constitutional mandate, objects and associated core activities of the Botanical Society of South Africa (BotSoc). CREW is also highly synergistic with BotSoc’s current and proposed future focus areas (Z. Rabaney 2018, personal communication, 7 June 2018).

Activities and available resources are also strongly aligned with the programme’s objectives, although additional resources would facilitate broader programme reach.

CREW’s work is currently focused in the Fynbos and Grassland biomes which are the biomes with the highest numbers of threatened plants (SANBI, 2019). Expansion of CREW into other parts of South Africa for example the savanna areas of Limpopo and North West and Namaqualand, presents both an opportunity to facilitate greater demographic representation in the programme, but also various challenges. These typically include working with unemployed youth and women with limited interest in volunteer initiatives for which no remuneration will be provided, the length of time required to obtain the support of traditional leadership for such initiatives, the risk of traditional leadership requiring volunteer selection to not be based solely on the suitability of candidates for the required roles, security risks of operating in remote locations, and increased logistical requirements and costs, amongst others. Approaches to address these and other associated challenges must be carefully designed to facilitate success and optimal effectiveness.

An alternative approach to expand the demographic representation of the CREW programme may be to target the millennial generation. Awareness of environmental issues amongst the millennial generation involved in outdoors sports is generally good. This presents a further opportunity to draw a younger generation into CREW, but this will likely need to be achieved on the back of their interest in outdoor activities and environmental causes and the effective use of cell phone technologies and social media platforms. Outdoor brands such as Patagonia (through the Gone outdoor store in Cape Town)¹⁰ and K-Way (Cape Union Mart) actively support environmental causes. Whilst the majority of current CREW volunteers are active users of iNaturalist, this user-friendly online platform that includes a cell phone app could be more effectively used to attract a younger generation to contribute to the monitoring of plants.

4.2 Value-add to SANBI from citizen scientists’ approach

4.2.1 Effectiveness of monitoring from citizen scientists

CREW has leveraged the collection of accurate, reliable and recent plant species data across vast geographical regions of South Africa and a highly diverse array of families and genera.

A high frequency of targeted collection, high level of spatial accuracy, and high degree of sampling efficiency has been achieved across a vast array of botanical families. This has been undertaken via focussing data collection in areas were the land use pressures on threatened species are particularly high and the risk of species loss is greatest. Focus has also been placed on areas where the likelihood of occurrence of a threatened species is high, but no recent fieldwork has been undertaken to address geographical data gaps, including 2,382 visits to 58 under-sampled areas between 2003 and 2018 (SANBI, 2018e). The knowledge and expertise of the volunteers (in terms of local plant identification skills, awareness of flowering times for individual species or families, and the ecological functioning of the landscape) has been pivotal to such success. Due to this approach, as at end 2018, 100,570 records for 8,973 taxa (44% of the flora) including 2,120 threatened and rare plants across South Africa had been captured by the CREW programme since its inception in 2003.

¹⁰ Patagonia donates 1% of their turnover to local, environmental causes through the 1% for the Planet initiative. The Gone outdoor store hosts regular environmental talks.
By way of comparison, the Millennium Seed Bank Project collected 514 threatened species since 2005, of these 35 (7%) were collected by the CREW citizen science network since 2014 and sent to the MSB (V. Wilman 2018, personal communication, 7 September 2018). These collection statistics were achieved by the MSB with an average staff complement of 8.3 individuals per year since 2000, compared to CREW with an average of 4.5 staff members per year between 2003 and 2018 (V. Wilman 2018, emailed human resources numbers 7 September 2018; D. Raimondo 2019, human resources numbers11). This translates to the rate of collection of threatened plants data per year per employed staff member being nine times higher for the CREW programme in comparison to the MSB. As the MSB is the only other SANBI project to collect data on threatened plants it is the easiest to compare with, however it should be born in mind that the MSB has a mandate to collect seeds for all South Africa’s species and hence does not only target threatened species, in addition collecting for seed banking is more time consuming than simple monitoring of population status conducted by CREW.

A second comparison that is useful is with the rate of data collection from general botanical collecting. Between 2003 and 2013, general botanical collecting in South Africa resulted in an average of 1.7 records per taxa of conservation concern (TOCC). During this same period, CREW averaged 6.8 records per TOCC, a four-fold increase compared to general botanical collecting (SANBI, 2013). These two comparisons strongly support the business case for involving citizen scientists in targeted collection of threatened plants and the relatively small cost of employing staff across the country to co-ordinate the costs of citizen scientists’ collection activities.

CREW has on average achieved an increase in data collection each annum since the inception of the CREW programme (see Error! Reference source not found.). The substantial increase in sites surveyed from 2003 to 2006 was attributed to the growth in volunteer groups and their improved skill levels. Periodic reductions in sites surveyed from 2006 to 2013 were attributed to reduced programme or volunteer group capacity or the loss of volunteer group champions. The decrease in the number of sites visited between 2016 to 2017 was attributed to the drought conditions in the southern and eastern part of the country, most notably within the Cape Floristic Region. CREW maintained both the number of sites visited and the number of plant species surveyed during 2017 above the average since programme inception (SANBI, 2018a; SANBI, 2018b).

4.2.2. Value add of CREW data for biodiversity monitoring and conservation

Plant data generated by the CREW programme has informed a number of key strategic interventions in the country, including:

National Biodiversity Assessment (NBA). CREW data is a vital informant into the updating of the plant species and ecosystem components of the NBA and is of high scientific importance. The NBA is led by the South African National Biodiversity Institute (SANBI) in collaboration with the Department of Environmental Affairs and several other partner organisations.

Red Listing. The extent of data collected via CREW has facilitated the effective annual updating of the Red List of South African Plants. The Red List of South African plants (2009) was based on 88% of the records for threatened plants being more than 10 years old. For the Red List processes between 2010 and 2017, a total of 700 species were assessed on average each year, with the majority of these assessments based on recent records collected via the CREW programme (Red List of South African Plants www.redlist.sanbi.org). The recent production of the first Red List Index for plants for South Africa and the first indicator of protection level of plants that will be published in the 2018 National Biodiversity Assessment, depended heavily on the data provided by CREW volunteers to determine both change in threat status as well as protection level effectiveness.

11 Human resource statistics received from CREW.
Supporting conservation agencies. SANBI’s Threatened Species programme obtains and manages the spatial occurrence data for species of conservation concern, which are collected from data partners who retain ownership of these data. CREW data, combined with herbarium data and accurate distribution data for all threatened species surveyed during a year, are shared with SANParks, all nine provincial conservation agencies, and other key data users to date 21 data sharing agreements have been signed.

The data assists SANParks in planning and adaptive management of national protected areas, including the National Protected Area Expansion Strategy. It informs World Heritage Site and Natural Wonders of the World reporting. It supports the provincial agencies in the planning and managing of provincial protected areas, informs, the development of Provincial Systematic Biodiversity Plans and the identification of Critical Biodiversity Areas, Provincial Biodiversity Stewardship programmes, and Provincial Protected Areas Expansion Strategies, most notably for the KwaZulu-Natal, Eastern Cape, Northern Cape and Western Cape provinces. The data also informs land-use planning and decision-making processes. In addition to long standing support to KZN Wildlife and CapeNature, the CREW Eastern Cape node has partnered with the Eastern Cape Parks and Tourism Agency (ECPTA) to build the capacity of its rangers. This is resulting in the development of a plant species dataset for the ECPTA’s protected areas, including recent and accurate plant occurrence data in current gap areas and specimens being lodged at the Compton Herbarium.

CREW data is made available to all commenting authorities, but the extent thereof cannot be quantified at present due to the lack of the necessary infrastructure in South Africa to do so.

CREW volunteers have also provided vital information to conservation agencies to inform biodiversity stewardship and management of ecosystems and populations of threatened and rare plants, as well as observations of illegal activities that are negatively impacting biodiversity whilst in the field or during transit to sites. The duration and frequency of such interactions with landowners could not have been achieved via SANBI staff due to staffing, time and operational resource constraints.

Environmental Management. CREW data informs Provincial, District, Metropolitan and Local Municipal Systematic Biodiversity Plans, including biodiversity sector and bioregional plans; Environmental Impact Assessment (EIA) and Water Use License Application (WULA) processes; Provincial and Municipal Spatial Development Frameworks; Environmental Management Frameworks; Strategic Environmental Assessments; Land Reform planning processes; and Land Use Management decision making. Notably, CREW played a key role in supporting the SEAs undertaken for the national Department of Environmental Affairs (DEA) with CREW data used for the Renewal Energies SEA, the Electricity Grid Upgrade SEA, and plant surveys for the Shale Gas Development SEA.

Once operational, relevant CREW data will also be available via the DEA Environmental Screening Tool (EST), which identifies areas sensitive for development based on spatial data for threatened species. The plant data is currently being tested within the screening tool for planned release in April 2019. CREW data has been vital for developing occupancy models for each threatened plant and for accurately mapping critical habitat species which receive the highest level of sensitivity within the EST. The EST will guide development proponents, Environmental Assessment Practitioners (EAPs), biodiversity specialists, commenting and competent authorities. The integration of citizen science data into government land use planning and decision-making is novel globally.

Biodiversity Stewardship support. A vast number of threatened plant populations occur on fragments of natural vegetation, many of which are located on privately or communally owned land.

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12 This was confirmed via the interviews with key stakeholders.
One of the most effective ways to conserve threatened plant species is to engage with the local stewardship officers to build landowner awareness of the species that are present on their land.

Relationships have also been established by CREW with various Provincial and municipalities Biodiversity Stewardship programmes, including with CapeNature, Eastern Cape Parks and Tourism Agency (ECPTA) Ezemvelo KZN Wildlife, City of Cape Town, eThekwini Municipality, Nelson Mandela Bay Municipality as well as various non-governmental organisations (e.g. Wildlands Conservation Trust, Conservation Outcomes etc.) amongst others. Through CREW’s staff and volunteers, important technical support has been provided to these initiatives. Formal partnerships have been established with provincial (CapeNature and Ezemvelo KZN Wildlife) and municipal (eThekwini, Nelson Mandela Bay and the City of Cape Town) biodiversity stewardship programmes, including collaboration and data sharing agreements. CREW is an active member and participant in their Working Group meetings, which include discussions on candidate sites for stewardship. Collection of data has also been focussed on identified biodiversity priority sites or areas, such as provincial protected area expansion priorities, to inform on-the-ground operations. To date CREW staff and citizen scientists have conducted 276 site visits and contributed to supporting management plans and working with landowners for 99 stewardship sites.

The CREW citizen scientists have developed trust-based relationships with both private landowners and managers of state-owned land. These relationships have enabled the acquisition of permission to survey private land, which government officials have not been able to acquire in various instances. Through these relationships the volunteers have also raised awareness and understanding amongst a large number of landowners and a broad spectrum of other stakeholders across the country of the biodiversity importance of private and state-owned land. This has led to greater cognisance being taken of biodiversity on these properties, such as avoidance of important populations of species when new fields are being prepared, grazing and burning regimes etc. Efforts have recently been made to engage with conservancies, to make input into their management activities and to encourage their involvement in CREW.

**Municipality support.** In response to the poor conservation of the indigenous, highly endemic and species-rich, endangered and critically endangered vegetation, support has been provided to various municipalities. Notably support in recent times has been provided to eThekwini Municipality and the City of Cape Town’s. CREW groups have found a number of new populations of plant species of conservation concern within these priority areas. It also informs local authority biodiversity stewardship initiatives on the management requirements of threatened species (SANBI, 2018a; SANBI, 2018b).

**Taxonomy.** Via field surveys by CREW, the Biosystematics Division of SANBI has been able to describe 30 new plant species, including those under formal description at present. CREW has also provided a total of 19,437 additional new specimens, which has enabled the Biosystematics Division to accurately and effectively identify species and increase knowledge on the distributions of species of conservation concerns’ (SANBI, 2018e). The CREW programme typically introduces taxonomists to its citizen scientists via organising plant identification training courses and fieldtrips. Spending time with expert taxonomists has equipped citizen scientists with knowledge related to a particular plant group, which can then be used in effective targeted collection in the field. This has led to new species or new range extensions being discovered by the citizen scientists. The collected specimens are then sent to the taxonomists for description.

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13 This was confirmed through interviews with the various stakeholders.
14 This included a minimum of 127 properties.
Conclusion:

Leveraging the goodwill, expertise, time and financial resources of volunteer citizen scientists has enabled SANBI to acquire vastly more data via CREW than it would have had the programme been implemented using only SANBI staff.

This data has fed into multiple land use decision making and conservation initiatives. Without ongoing collection of new plant data, such processes would largely exclude recent, accurate and comprehensive plant species data. In the absence of this data, inappropriate land use management activities would be approved that would lead to the loss of threatened species and their associated habitats.

During the interview process, 95% of SANBI staff interviewed and 97% of all interviewees expressed an opinion that the citizen scientists’ approach of the CREW programme adds value to SANBI’s objectives and operations.

4.3 Areas where CREW could provide greater support for SANBI work

CREW collaborates principally with SANBI’s Biosystematics and Collections Initiatives, Biodiversity Data and Policy Advice Division, and Gardens Division. It also supports the Human Capital Development function of SANBI.

CREW plays key role in collecting plant data required for the National Biodiversity Assessment and the identified of Key Biodiversity Areas (KBAs) in South Africa. CREW could play a crucial future role by collecting essential new data for future additional KBA listings (e.g. the number of mature plants at a site locality).

CREW could also play a greater role in monitoring the status of priority plant populations, which is currently undertaken on a very limited basis, but this needs to be informed by regular analyses of monitoring priorities set out by SANBI’s Monitoring Framework which is under development. Potential exists for greater collaboration with the Conservation Gardens and Biosystematics Divisions in the current CREW nodes. The realisation of this potential rests primarily with the National Botanic Gardens. The Gardens have been provided with various support and technical advice by CREW, for example in 2016 and 2017 CREW ran a project with each botanic garden to identify threatened plants that occur within a radius of between 20 and 100 kms of each garden and then together with horticulturist staff prioritised which species need to be included in ex situ, education and reintroduction projects run by the garden in order to help achieve target 8 of South Africa’s Plant Conservation Strategy. The NBGs remain responsible to utilise this support to guide their functions, particularly in the arena of ex situ conservation of priority threatened species in the NBGs and via the MSB. Join planning between the MSB, NBGs, CREW and the herbaria to identify aspects of common interest and to build joint activities into their Annual Operations Plans to achieve active collaboration would be beneficial.

Ex situ conservation of threatened and rare species via the MSB, stock beds and pot collections, as well as the restoration of habitats that support or historically would have supported such species, presents a major frontier for SANBI in which it has been playing an increasingly important role in light of the associated actions identified in the SPC. CREW currently provides vital technical and logistical support to such efforts in the form of information of species localities and flowering times, liaison with landowners to obtain permission for seed collection fieldtrips by the MSB, seed collections from the wild via trained volunteers, and advice on priority species and areas to target for reintroduction and restoration work. The Conservation Coordinator for Gardens plays an important role as the interface between the Gardens, MSB, and CREW and is essential to facilitating effective collaboration and coordination. However, opportunity exists to deepen the relationship between the MSB, NBGs and CREW regarding ex situ conservation and restoration.
Key sites for threatened and rare plants are being lost within local municipalities due to a lack of awareness, ignorance or deliberate efforts to avoid addressing legal requirements by local municipal officials, councillors, engineers, contractors and private landowners, amongst others. CREW could implement targeted interventions to raise awareness of key sites for threatened and rare plants at a local municipal level. This would support the work being undertaken by SANBI’s Policy and Advice Branch. Such an initiative needs to be targeted and have longevity built into it, to address the challenge of working across such a vast number of municipalities and the high turnover of officials and councillors within them.

CREW could support the Department of Science and Technology’s National Recordal System project and SANBI’s biosystematics team by assisting with plant identifications, providing training on how to press plants, assisting the DST in obtaining provincial permits etc. Plant specimens collected as part of the National Recordal System project could be sent via the CREW nodes to SANBI’s for formal identification and storage in the Pretoria National Herbarium. Additional opportunities for collaboration are reflected in the human capacity development chapter below.

During the interview process, while there was widespread acknowledgement that the CREW programme works well across SANBI’s divisions, 100% of the SANBI staff interviewed expressed an opinion that the CREW could add greater support for SANBI’s work focused on the above areas.

### 4.4 Appropriateness of investment given SANBI’s needs and CREW’s objectives

The current investment in CREW is fully aligned with SANBI’s needs and CREW’s objectives regarding the development of taxonomic skills, species identification, assessment and monitoring of threatened plant species, and the development of human capital. At end 2018, a total of 78,979\(^{15}\) person hours had been funded by SANBI on the programme, with 52,713 person hours funded by BotSoc and the Mapula Trust. A further 178,803 person hours had been donated to the programme through volunteer involvement, which constituted 58% of all programme time. Volunteers’ time equates to the equivalent of 98 person years. The volunteering of time on a pro bono basis by citizen scientists to the identification of plant species and provision of accurate locality data has resulted in the programme having vast geographic reach, and very high rates of data collection and being cost effectiveness. To our knowledge, a more efficient and effective model to achieve the same outcomes does not exist anywhere in the world.

Funding for CREW is provided by SANBI, BotSoc (in its own right), and the Mapula Trust, with the Mapula Trust funding channelled through BotSoc to SANBI (see Figure 4-1 and Table F-1). Financial support from BotSoc and the Mapula Trust has been vital to the effective implementation of the programme, both in terms of staffing and operational cost and has ranged from covering 18% to 47% of the costs of the programme in different years.

SANBI’s budgetary provision for staff costs increased consistently from 2006/2007 to 2009/2010, but then reduced substantially in 2010/11 and remained constant into 2011/2012 (see Error! Reference source not found.). SANBI’s budgetary provision for salaries from 2012/13 onwards either increased slightly each year or remained constant.

From 2006/7 until 2012/13, SANBI’s budgetary provision for operations remained fairly constant. A substantial increase in operational budget was experienced in 2013/14, but this decreased by almost

\(^{15}\) This statistic was calculated by the CREW nodes based on the number of fieldtrips undertaken to date, the number of volunteer participants, and hours required for processing of data submissions.
50% the following year. A further almost 50% decrease was experienced in 2016/17. A constant annual allocation was provided thereafter.

The contribution of BotSoc, inclusive of the Mapula Trust support, has fluctuated over time, but their commitment to operational costs has on average increased since 2006. Notable annual reductions were experienced in 2011/12, 2012/13 and 2015/16. The reduction in SANBI budgetary provision for salaries during 2010/11 and 2011/12 was offset by an increased salary contribution by BotSoc. The BotSoc contribution to salaries however decreased in 2012/13.

BotSoc’s contribution, inclusive of the Mapula Trust support, to operational costs was very limited until 2010/11. This operation support remained fairly consistent until 2014/15, when a nearly five-fold increase was experienced. This level of support was temporarily reduced in 2015/16, but remained well above the historical average, and increased again in 2016/17. Operational cost increases above inflation have been experience each year thereafter.

The support from BotSoc has not been constant and has fluctuated annually, however since 2010 BotSoc’s commitment has been relatively stable with it contributing over 28% of the costs. This has primarily been as a result of the Mapula Trust supporting the CREW Cape Floristic Region expenses and channelling its funding via BotSoc. The partnership with the Botanical Society is crucial to the long-standing success and ongoing expansion of the scope of the programme. However, the current reliance of the programme on donor support from two external parties to achieve its objectives poses a risk. Should the donor funding from BotSoc and the Mapula Trust no longer be available, equivalent funding could potentially be sourced from other sources, but would likely include greater transaction costs in the form of more time-consuming proposal writing and reporting, amongst others. The need for ongoing and additional external funding is essential, due to regular reductions in government budgets.

**Figure 4-1: Contributions of SANBI and BotSoc (including Mapula Trust) to the CREW programme**
During the interview process, 11% of the SANBI staff interviewed expressed an opinion that CREW\textsuperscript{16} may be receiving a disproportionate amount of funding relative to other projects. A total of 16% of the SANBI staff interviewed were of the opinion that any additional funding for CREW should be secured via external parties. A total of 89% of SANBI staff interviewed were of the opinion that additional resources should be sourced to enable greater impact and reach by the programme.

4.5 Human Capacity Development

SANBI, through CREW, has placed substantial focus on the building of human capacity for plant conservation in South Africa. This has been undertaken via internship initiatives, training workshops and field trips, lectures, experiential training and mentorship, amongst other approaches.

During 2017/2018, CREW invested R207,073.53 (28%) of its R748,678.82 operating budget on training, including associated fieldwork (2018a).

During the interview process, 100% of SANBI staff and other stakeholders interviewed expressed an opinion that CREW had made a substantial contribution to human capacity development for plant conservation in South Africa. No other biodiversity agency in the country has demonstrated the ability to invest as substantially in this area as CREW has, which is a clear niche occupied by the Programme.

4.5.1 Training of conservation agencies

The CREW programme has worked closely with South African National Parks (SANParks), the Eastern Cape Parks and Tourism Agency (ECPTA), Ezemvelo KZN-Wildlife, eThekwini Municipality, CapeNature and other protected area agencies including field trips to various national, provincially and local authority protected areas to support these organs of state to effectively survey and conserve the plant species of conservation concern that occur in these protected areas and facilitate the provision of recent, accurate and reliable data to the Red Listing process (2017g).

4.5.2 Training of volunteers to gain plant identification skills

Each of the CREW nodes organise regular focussed hands-on training to better enable the citizen scientists to support the programme’s objectives. Annual regional workshops, a number of iNaturalist (previously iSpot) training courses, plant identification and plant pressing courses and practical training sessions are held each year (SANBI, 2018a).

The training of volunteers to gain plant identification skills has led to the highly effective collection of accurate and reliable data across a vast extent of priority geographical areas and immense diversity of plant families in South Africa. This has also led to a high frequency of data collection, including during the most suitable times of year, to enable accurate identification.

In light of the vast geographical extent of the country, the immense diversity of South Africa’s flora, and the depth of skills and experience needed to accurately identify species, the development of volunteer plant identification skills has delivered a very high return on investment.

It is important to note that acquisition of the necessary knowledge and experience to accurately identify a diverse array of plant families to a genus or species level within a local area alone is a very lengthy and time-consuming process. Compared to some of the other biological groups, such as mammals and birds, it is vastly more complex and challenging. The long-term nature of the CREW programme has enabled the development of the required depth of knowledge in the geographical focus areas to date. Similarly, in the new geographical areas where volunteers have recently been recruited by CREW, comparably long periods of time are required to deliver the ultimately desired levels of data

\textsuperscript{16} CREW is a long-term project under the Threatened Species Unit.
A comprehensive dataset of all volunteers trained to date in relation to the current total number of 923 volunteers at present does not exist. As a result, it has not been possible to undertake a quantitative assessment of the impact of training volunteers. However, the positive value is evident by the number of new records obtained and the relatively small financial investment required in training to achieve this (e.g. R 86,010.73 on the annual workshops and training for volunteers during the 2017/2018 reporting period) (SANBI, 2018a) and the submission of 2,390 records in that same year.

The annual workshops for the summer and winter rainfall regions have been very effective at building capacity. A total of 16 workshops have been held for the winter rainfall region since 2003, and 10 for the summer rainfall region since 2009. Approximately 1,800 volunteers have been trained via these workshops. This has also been coupled with ad hoc training opportunities, where required or possible.

CREW provides field guides, methodologies to monitor plant populations, species identification support, iNaturalist training, and guidance on focus areas for fieldtrips on an ongoing basis, where required, which has been crucial to the effectiveness of the CREW groups.

4.5.3 Training interns to gain a suite of conservation skills

The programme has supported internships for previously disadvantaged matriculants, as well as university graduates, via the Groen Sebenza programme and WWF and NRF internship programmes (see Appendix E for further information). These internships provide opportunities for the development of fieldwork, plant identification, specimen pressing and cataloguing, and Red Listing skills. Various core and soft skills are also developed, such as key computer programmes, presentation of information, project management etc. The interns are exposed to a broad array of research, policy, planning and implementation aspects that constitute the biodiversity conservation sector, including associated potential employment opportunities. A total of 43 young South Africans have gained work experience via internships or temporary contracts with the CREW Programme (Appendix E). Of these 36 (84%) were from targeted demographic groups and two thirds (67%) of individuals from targeted groups have found permanent or long-term employment within the plant conservation sector. A reflection that CREW has contributed to achieving Target 15 of the Plant Conservation Strategy (The number of trained people working with appropriate facilities sufficient according to national needs, to achieve the targets of the Strategy).

The training of interns in the fields of plant identification, project management, data collection and processing has provided these individuals with an introductory level of skills to be marketable in the workplace.

Where internships have been provided for only a single year, the level to which these skills have been developed has been relatively limited. Internships of 18 months or more have equipped interns to a far greater extent and also enabled CREW to begin to benefit from the new skills resident within such interns. Where internships have been for a duration of 18 months or more, the productivity of the interns and their contribution to CREW’s operations has started to become proportionate to the investment made by CREW in the development of these interns.

The trade-off of capacity development of interns without a high level of academic training (e.g. MSc, PhD), as a non-core mandate, needs to be balanced with the resources that CREW has available to invest in such experiential training that has an influence on CREW’s implementation of core mandate
functions\textsuperscript{17}.

A number of the interns have developed and demonstrated capability to the point where they have been appointed by SANBI, BotSoc or other conservation organisations to continue making contributions in the biodiversity sector. In the last few years, examples include Dewidine van der Colff, a Red List Scientist at SANBI, Mahlatse Mogale the CREW co-ordinator for the Limpopo node, Anri Marais now employed at Compton Herbarium, and Mbali Mkhize employed by SANBI's Biological invasions Directorate, amongst others.

A formal set of core and soft skills training is typically provided to interns. However, the training opportunities are also influenced by the institutional activities being undertaken at the site of their internship. As a result, interns based at the Pretoria and Kirstenbosch Botanical Gardens are typically exposed to a greater depth and breadth of SANBI's functions and the activities of its parent body, the national Department of Environmental Affairs (DEA), and other partners, due to these sites being the two major centres of SANBI's operations. At such sites, research days, herbarium days, and lectures by in-house and guest speakers, amongst others, are held more frequently. Where interns are placed at alternative locations, the internship programmes should ideally be designed and resourced to provide means to overcome these barriers and deliver equitable learning opportunities to interns at all SANBI facilities.

\textbf{4.5.4 Exposing university students to work on threatened plant conservation and associated employment opportunities}

In light of plant conservation being a scarce skill, the CREW programme introduced a Human Capital Development project to the scope of its activities in 2009. The project is designed for second- or third-year Botany, Environmental Science, Horticulture and Nature Conservation students at higher education institutions across the country. Through this project CREW staff conduct an hour lecture covering topics including an overview of South Africa's biodiversity, the country Plant Conservation Strategy, Red Listing, the CREW programme, iNaturalist and employment opportunities within the plant conservation field. Where universities have requested a fieldtrip to complement the lecture, this is undertaken to expose students to threatened species monitoring or various plant family characteristics (SANBI, 2018a). The CREW summer-rainfall node initiated this project in 2009 at the University of KwaZulu-Natal (PMB campus) and the Durban University of Technology. The project has been expanded to include the University of Zululand and Mangosuthu University of Technology. During 2016 to 2018, CREW engaged with students from the University of the Witwatersrand, University of Pretoria and Tshwane University of Technology. This engagement has increased the number of students participating in the CREW fieldtrips in Gauteng and the KwaZulu-Natal Midlands. The University of the Free State has also expressed an interest to host a CREW lecture in 2018. The Winter Rainfall (CFR) node worked with the University of the Western Cape, Cape Peninsula University of Technology (CPUT) and Stellenbosch University during 2016 - 2018. In addition to conducting lectures and fieldtrips, the Eastern Cape node assisted the Botany Department of Rhodes University with bi-weekly practical sessions (as per the Memorandum of Understanding between the university and SANBI) and helped the academic staff with a plant collecting fieldtrip (SANBI, 2018a). The Limpopo

\textsuperscript{17} This perspective is not held in the absence of an appreciation of the importance of capacity building of previously disadvantaged individuals and associated nation building. It is based on the formal legal mandate assigned to SANBI and need for a balance to be struck between core mandates ("musts" in terms of NEM:BA) and voluntary mandates ("mays") in relation to available resources and an associated ability to deliver on core mandates.
node provided lectures and fieldtrips for students from the University of Limpopo and University of Venda (SANBI, 2018d).

Exposing university students to work on threatened plant conservation and associated employment opportunities has delivered mixed results for the CREW programme to date. Past and current examples exist of students that have benefited from exposure to CREW and became not only CREW champions but also emerging leaders in various fields of botany, such as Sachin Doarsamy, Adriaan Grobler, the late Stephen Cousins, and Brian du Preez, amongst others. Furthermore, WWF’s noting of an increase in the number of internship applications received from the various higher education institutes has been linked to internship opportunities discussed during the CREW lecture.

A global phenomenon of very few individuals taking up active involvement in volunteer activities after completion of their post-school studies until they reach a late stage of their careers must be taken into consideration.

The consensus from the interviewees was that engagement with university students has derived value but should remain highly focussed and undertaken in the most efficient yet effective manner possible. An annual lecture and field trip for third year or honours level students at key universities currently appears to be the most effective approach at present.

4.6 Available technologies for monitoring species

Prior to 2017, data from CREW groups was obtained by SANBI via data sheets and iSpot18. However, an upgrade to iSpot software during 2017 led to major dysfunctionality of the site, rendering it no longer suitable for supporting citizen science work in South Africa. Consequently, SANBI chose to migrate from iSpot to iNaturalist, which is a more powerful tool with greater functionality. SANBI instituted training nationally to increase awareness of iNaturalist and enable effective uploading of data (SANBI, 2018a; SANBI, 2018b). The CREW programme has made effective use of both the iSpot and iNaturalist platforms with approximately 40% of the most active contributors to iNaturalist being CREW volunteers.

iNaturalist is a more powerful tool than iSpot, with additional functionality. Although iNaturalist is the preferred means for CREW groups to submit data, they are still able to submit site sheet forms without utilising iNaturalist if they wish to.

The transition to iNaturalist did result in a few volunteers finding the learning curve too onerous, but most volunteers have made the transition. Most prefer using iNaturalist, compared to iSpot, with the exception of some functional aspects that are not available, such as interactions between species (such as pollinators, parasites and bio-controls). SANBI is currently lobbying iNaturalist to include such key functionality.

A host of online biodiversity-focussed citizen science platforms exist. However, most have been developed to be focussed on specific biological families or countries, such as iSeahorse, MantaMatcher, eButterfly, The Atlas of Living Australia, India Biodiversity Portal (IBP), NatusFera (Spain), National Biodiversity Network (United Kingdom) and PlantWatch (Canada), amongst others. The four current major international online platforms for biodiversity-focussed citizen science are iNaturalist, iSpot, eBird, and Observation/Observado. A further platform is Spotteron, which provides a customised mobile phone application solution for citizen science.

iNaturalist (like eBird) also has a smartphone app (for both Android and iPhone), which greatly facilitates data capture, especially by younger users. Projects on iNaturalist allow data entry as part of the upload process, allowing targeted, standardised and required options for data acquisition tailored

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18 An online platform previously used by CREW for the uploading of field trip site data.
to specific projects, that can be rapidly recorded in the field and extracted for analysis at any time. For CREW, the “Red List” and “CREW data sheet” projects are two such examples, but CREW groups also provide data to other projects such as SANBI’s Alien Early Detection and Rapid Response and EWT’s Roadkill initiatives, to name but two.

In addition, the Places pages on iNaturalist, which allow the recording of checklists and facilitate the creation of field guides that can be converted to offline cellular (mobile) phone applications for field use, are invaluable. iNaturalist also has an artificial intelligence identification option, as well as a browser tool to facilitate online identification by novices, and an identification tool to facilitate curation of identification across higher taxa by professionals and expert amateurs.

Based on its botanical relevance, global applicability, depth of functionality, user-friendly interface and extensive international use, we believe that iNaturalist is currently the most appropriate online citizen science platform for application by CREW.

Notwithstanding the challenges of the CREW iNaturalist leadership and oversight role, to help foster ongoing volunteer input to iNaturalist engagement by SANBI with iNaturalist contributors should always be constructive and pro-active to the greatest extent practically possible.

4.7 Improved representation of South Africa’s different demographic groups

The development of interns via the CREW programme has, and continues to make, an important contribution to the up-skilling and involvement of historically disadvantaged individuals in the identification, assessment and monitoring of threatened plant species, including their progression into formal employment in the sector. This is actively supporting a broad range of demographic groups being involved in this field (see section 4.5.3 above and Appendix E for further information). To date, a total of 43 individuals have participated in CREW’s internship programme, with 36 (84%) of these individuals being from previously disadvantaged backgrounds.

Notable barriers exist to the involvement of previously disadvantaged demographic groups in voluntary plant conservation in South Africa, including (amongst others):

- No or very limited available time to engage in non-income generating activities.
- Insufficient financial resources to engage in such activities that are not free due to transportation costs.
- A perceived limited cultural interest in investing time in nature to identify plants.

Notwithstanding this, CREW has developed into a highly effective learning institution in which an older generation of experienced volunteer botanists generously give of their time and resources to mentor citizen science botanists across all demographic groups, but with an emphasis on previously disadvantaged individuals. The older generation engage with the younger generations in a very open and nurturing manner, as though they are their own children for whom they care deeply and wish to see them progress in life to achieve their fullest potential. In this regard, CREW is making a meaningful contribution to nation building.

The programme has resulted in 70% of interns to date being retained in the biodiversity sector, either via permanent employment (56%) or current further study (14%). The current benefits of the

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19 This perception has been based on the interviews held with various previously disadvantaged individuals, as per the list of interviewees. Almost all these individuals expressed the view that many previously disadvantaged communities have reservations about spending time in nature due to security concerns associated with crime, the potential to be viewed as trespassing on private property, fear of wildlife, and the observation of plants being of little personal value to them.
The programme has and continues to make an ongoing, sustainable contribution to transformation in the biodiversity sector. Continuity is key to achieving deep and meaningful change and CREW should continue building transformation objectives into its Annual Operational Plans.

Expansion of CREW into new biodiversity hotspots in South Africa presents both an opportunity to facilitate greater demographic reach as desired by SANBI and the geographic reach required to ensure plant data is representative of the entire country. This could potentially be undertaken through existing local actors with local knowledge (e.g. umzimvubu Catchment Partnership Programme, Kruger to Canyons Biosphere Programme, etc.). Partnering with existing medicinal plant collectors who already know a vast number of species in the landscape, understand their traditional and commercial applications, are familiar with their local area, and are comfortable working in nature may present a further suitable strategy. The existing successful model of partnering with lecturers and technicians at South African universities should be expanded, particularly where existing permanent plant expertise are already present. In addition, some of the more established universities in South Africa have set-up satellite campuses in rural parts of the country, which may present opportunities for effective pooling of intellectual and operational resources.

The Department of Science and Technology’s National Recordal System project works to document the indigenous knowledge held by South Africans. The project operates under the Indigenous Knowledge Systems Policy 2004. It is the largest South African initiative to record, document preserve and protect indigenous knowledge for the benefit of the communities of the country. The NRS has knowledge management hubs set up in all nine provinces and is currently working with 92 communities. The project has 50 indigenous knowledge recorders that are young South Africans employed from the communities where the work is taking place, these recorders could become part of the CREW programme. DST has already entered into an agreement with SANBI to support the identification of plants collected during the process of documenting indigenous knowledge. However, despite training conducted by SANBI’s Biosystematics division only a handful of plant specimens have been received, DST again approached SANBI for further assistance during a meeting held in July 2018. CREW’s presence across South Africa’s provinces and the fact that it has nodes in many of the same provinces where the NRS is operating ideally places CREW to support this important government initiative, which directly contributes to Target 13 of the Global Strategy for Plant Conservation (Indigenous and local knowledge innovations and practices associated with plant resources, maintained or increased, as appropriate, to support customary use, sustainable livelihoods, local food security). Strengthening of the relationship between the National Recordal System project and CREW presents an imminent opportunity to expand CREW’s demographic reach, whilst assisting the DST within the bounds of CREW’s existing human and financial resources.

During the interview process, 100% of SANBI staff and other stakeholders interviewed expressed an opinion that CREW had made a substantial contribution to improved representation of South Africa’s different demographic groups in South African plant conservation. All the interviewees with opinions on this matter identified challenges to improving demographic representivity, but all believed that greater future impact could be achieved.
4.8 Operational effectiveness

The financial support CREW receives from external parties, namely BotSoc and the Mapula Trust, is fundamental to its operations.

The short-term nature of the current Collaboration Agreement signed between SANBI and BotSoc, which runs from March 2017 to March 2020, imposes constraints on longer-term programme planning. The extension of this agreement and exploration of additional collaboration opportunities with BotSoc to increase their financial support for CREW would enable greater reach and impact by the programme.

The CREW staff are located within SANBI from an organisational perspective. However, the financial contribution that BotSoc makes towards the salary costs of some of the team are based on BotSoc salary bands, not those of SANBI. As a result, salary parity is not implemented at present across the programme team.

The CREW node managers are operating at full capacity. For extended periods of time they also operate beyond a sustainable long-term level of capacity due to the needs of the programme. It is vital that node managers are supported by dedicated node co-ordinators, over and above any interns, to ensure the optimal performance of the node and avoid the potential of burn-out by the managers and/or them leaving the programme.

The current effectiveness of the CREW team can be attributed to the experience of the node managers, and the passion, commitment and cohesion of the team. Should major changes be implemented to the programme, the risk exists that core staff may leave CREW and the current momentum and cohesiveness of the programme would be lost. This would likely result in a substantial reduction in the effectiveness of the programme.

The passion, motivation and dedication of the CREW team was noted and appreciated by all CREW volunteers that were interviewed. These attributes have fostered a reciprocal attitude and approach by the champions of most CREW groups and many members of the groups themselves.

The CREW team has not engaged with volunteers as employees of SANBI, but rather as voluntary partners. Their participation has been fostered via patience and various forms of motivation, encouragement and recognition. This approach has been very effective, but requires emotional intelligence and maturity, which should not be overlooked as key attributes of suitable CREW team members.

Instead of prescribing a single modus operandi, CREW has also allowed flexibility in the way in which different volunteers engage with the programme, which has facilitated involvement and avoided participant fatigue.

The CREW programme currently has 923 volunteers (Parbhoo, 2018). CFR node currently has 491 volunteers, with 432 in the SRR (198 in KwaZulu-Natal, 113 in Mpumalanga, 67 in Limpopo and 54 in the Eastern Cape). In this regard, the longer operational time of the CFR node and historical inheritance of volunteers via the CFR-based former Protea Atlas Project must be borne in mind. At present, the operating budget assigned to the CREW Summer Rainfall Region (SRR) is only 70% of that provided to the Cape Floristic Region node. The later node is supported by Mapula Trust and the former by Botanical Society Head Office funds. There are currently a greater number of staff in the SRR compared to the CFR, but it must be recognised that the SRR operates out of four different centres and covers a much larger geographical area. At present the operational budget for CREW supports key tasks, but overall is estimated to be between 15 to 20 percent less than what would enable the nodes to support volunteer groups at a more optimal level. Specifically, fuel costs and/or transportation are current constraints to the frequency of fieldtrip by volunteers, particularly to remote
sites, and the recruitment of new volunteers. Partial or full subsidisation of fuel and transportation costs for volunteers would support volunteer recruitment and promote more frequent fieldtrips.

An operational manual was developed for CREW to guide both the programme at a management and co-ordination level, as well as volunteers at an operational level. The current version was finalised in 2009. This manual has been updated and is undergoing graphic design layout.

The annual summer and winter rainfall workshops held by CREW have been pivotal to the development and motivation of individual volunteers and the respective groups. This has been achieved through the facilitated reporting of activities undertaken during the past year, exciting findings, lessons learnt, specific training, fostering relationships, and conveying key operational developments and new protocols. Providing opportunities for volunteers to interact with experts has also been a key attraction and motivational factor for the citizen scientists. The use of low-cost venues, which has required volunteers to attend to fund only their travel costs to attend has been key to support high levels of participation.

The annual workshops, joint fieldtrips and training have been very effective at facilitating the sharing of knowledge and experiences between volunteers, as well as building strong relationships. Many of the groups expressed the need for more frequent training, to facilitate more rapid and timely upskilling. Optimisation of the outputs of these activities could be achieved through more frequent and joint training with multiple groups.

After completion and submission of site sheet forms by volunteer groups to SANBI or the uploading of data to iNaturalist, the data is used by SANBI’s Plant Red List Scientist to update the database of threatened plant species and the Red List. In some limited instances, volunteers provide data to the CREW nodes with all essential information, but not in a fully comprehensive state. Consequently, the node staff have to complete some of the forms prior to submission to the SANBI Red List scientist. Due to other commitments, periodically this process is delayed resulting in a small subset of the data not being provided to the Red List Scientist in time and the data not being reflected in the CREW annual report in terms of the number of species recorded. CREW, through its nodes, regularly engages with relevant volunteer groups to address this challenge. However, it is likely to persist as one of the few limitations of partnering with citizen scientists and simply needs to be managed to the greatest extent practically possible. It remains crucial though that all collected, accurate data feeds into the Red List process and CREW’s annual report in a timely manner.

Maintenance of iNaturalist by SANBI is a very onerous and time-consuming task, which requires an expert level of skill in species identification, immense patience, and dedication. The level of expertise for this task is very well addressed by SANBI and the level of commitment by the responsible staff member is exceptional. This staff member is due for retirement within the next five years. The development of long-term capacity to fulfil this role within SANBI is likely to present a challenge if not developed in a timely manner. The need for ongoing constructive and pro-active engagement with volunteer inputs to iNaturalist remains crucial to the success of the CREW programme.

The Plant Red List database is well curated and reliably managed. This effective management has facilitated the regular updating of South Africa’s plant Red List. As a result, the South African Plant Red List website is one of the most popular amongst similar sites. Prior to 2019, the database had been maintained in the same format for several years due to financial and human resource constraints. At the commencement of 2019 SANBI funded the development of a new database, which should improve the structure of the database to enable greater quality control and functionality.

Data from the latest Red List plant update is provided to key government departments (e.g. provincial and municipal conservation agencies), through formal data-sharing agreements. However, due to limited clarity in the agreements on the roles and responsibilities of the technical point person in the organ of state to whom the data is being provided, in certain instances the data is not distributed to all
key role-players within the conservation agencies. This results in the data not being used to inform planning and decision-making to an optimal extent in some provinces. CREW could improve this by widening the number of stakeholders in each state institution that the data is provided to and strengthening the stipulated roles and responsibilities in the agreements.

CREW’s engagement with schools and universities has supported the growth of the volunteer base, but nationally the impact has been modest. The feeding of CREW-related content into materials developed by BotSoc and SANBI’s education section would raise greater awareness of the need for species and habitat conservation and the work CREW undertakes. The building of capacity of educators by CREW partners (e.g. BotSoc branches or new partners) may also achieve greater effectiveness and duration of impact.

The CREW team has used digital media (e.g. SANBI website, CREW newsletters, Facebook, SANParks website, CREW volunteer blog sites etc.) and print media (Veld and Flora, Plants in Peril book, various local newspapers etc.) to good effect to raise awareness and foster participation in the programme.

Species identification in the Thicket biome, particularly by volunteers, is currently hampered in part by the lack of suitable and comprehensive field guides. The development of such a field guide would greatly support species identification in this biome.

SANParks and all provincial conservation agencies require CREW to acquire permits for fieldwork. CREW has an existing permit for specific national parks and individual permits for each Province in which fieldwork is to be undertaken. However, where fieldwork has been proposed or required in national parks not covered by the permit, extensive delays in approval for such fieldwork have been experienced. In addition, the time-frame for acquisition of permits from provincial conservation agencies after submission of applications is often lengthy. In limited instances where permit renewal applications have not been submitted by CREW with substantial lead time, short-term operational challenges have been experienced. Where practically possible, CREW should schedule and submit permit renewals with even greater lead times, to avoid delays. SANParks has also advised that should additional parks or parts of parks need to be added, this could easily be addressed via an addendum to the existing permit, which would fast-track the process when compared to the issuing of a new permit for an additional area. Ideally, CREW and SANParks should work towards a new single permit for all the national parks.
5 Recommendations

The following recommendations are made to improve the effectiveness of the programme:

5.1 Achievement of objectives and alignment with SANBI and the BotSoc objectives

a. Biannual staff planning sessions should be lengthened in duration to enable consideration of stronger linkages with other SANBI programmes and initiatives.

b. The Annual Operations Plans should be linked to a monitoring and evaluation plan, including appropriate measurable indicators to enable tracking of relevance, quality of design/results chain, effectiveness, impact, efficiency, sustainability and adaptive management. Such indicators must be directly linked to the core objectives of the CREW programme, South African’s Plant Conservation Strategy, SANBI’s mandate, and the reporting requirements of the SANBI Board to the Parliamentary Portfolio Committee with regard to relevant aspects of SANBI’s mandate. The monitoring component should also be designed to support adaptive management and flexibility within the programme.

c. Annual assessments of impact, effectiveness etc. via the monitoring programme must include consideration of actions not completed during the year. Efforts to address these gaps in the following year must be implemented, where still relevant.

d. Annual reports should include a summary of key results of the monitoring and evaluation plan, to demonstrate annual performance and trends over time. At present, current trend data is only readily available for the entire programme for the last two years. This data needs to be collated by CREW to enable effective trend analyses.

e. The monitoring and evaluation plan should clearly document the extent to which the species data was incorporated into provincial systematic biodiversity plans, biodiversity sector or bioregional plans, and biodiversity management plans for species, amongst other relevant tools. To support the monitoring and evaluation of this and other species programmes, provincial and bioregional plans should be required to explicitly document the extent to which key species data has been incorporated into such plans.

f. CREW should consider applying the Open Standards for the Practice of Conservation when undertaking their biannual review and planning processes, to further strengthen their approaches. This would allow CREW to apply a more detailed and thorough understanding of the programme goals; objectives; targets; opportunities; critical threats and risks; conservation, socio-economic, political and institutional situation; assumptions; and an associated results-chain to the development of its strategies, actions, monitoring and evaluation.

g. In light of its rigour and methodology, which enables outcome optimisation, the Open Standards for the Practice of Conservation should be considered by SANBI as its primary methodology for biodiversity programme/project design, implementation, monitoring, evaluation and review.

h. SANBI’s mandate includes all biodiversity. Proportionately, CREW has a relatively large staff complement compared to threatened and rare faunal activities. However, the high levels of plant diversity and endemism (20,000 plant taxa, 13,000 endemic taxa) in South Africa, the programme’s length of operation and ability to attract external partners and financial support must

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20 The Open Standards for the Practice of Conservation help teams be systematic about planning, implementing, and monitoring their conservation initiatives so they can learn what works, what does not work, and why - and ultimately adapt and improve their efforts. The Open Standards for the Practice of Conservation are a product of the collaborative work of the Conservation Measures Partnership.
be borne in mind. The relative size of the CREW team should not be measured against the current size of existing SANBI initiatives, but rather against the optimal size of such initiatives in the future. Based on these considerations, we do not believe that the CREW programme should be rationalised or restructured, but rather geared to achieve greater impact.

i. CREW should be expanded to enable it to achieve the demographic reach desired by SANBI and the geographic reach required to ensure data is representative of the entire country. The CREW model has potential to be scaled-up, but due to resource constraints upscaling would best be achieved through partnerships with existing biodiversity and allied actors and a highly focussed, modular approach. Should CREW expansion be proposed, it should be underpinned by pilot projects with a broader suite of operational partners. Retaining the core programme partnership, whilst strengthening and expanding CREW’s network through existing local actors with local knowledge within nodes and/or pilot projects is recommended. This approach presents the most viable option to expand CREW’s impact, as it would facilitate the greatest stability to achieve successful expansion (e.g. uMzimvubu Catchment Partnership Programme, Kruger to Canyons Biosphere Programme). Less formal collaboration is ongoing with the Wilderness Foundation, the EcoSchools programme of the Wildlife and Environmental Society of South Africa (WESSA), and Indigo Development and Change, amongst others. The existing formal and informal partnerships and levels of collaboration should be further strengthened where aligned with the focussed, modular approach.

j. Where CREW wishes to expand into new biodiversity hotspots it is recommended that they partner with existing medicinal plant collectors. These individuals already know a vast number of species in the landscape, understand their traditional and commercial applications, are familiar with their local area, and are comfortable working in nature, which likely presents the most effective strategy for such expansion. The provision of stipends to such individuals to collect plant species data would help overcome competition with other income generating activities they undertake. Where relevant, such individuals could also be trained on how to harvest species more sustainably. However, beyond such specific instances, stipends should only be provided to temporary CREW staff, and not to volunteers generally.

k. Expanding the existing partnership approach with interested and committed lecturers and technicians at local universities, particularly where existing permanent plant expertise are already present, should be considered as a second approach to expansion.

l. Volunteers must be vetted though, to minimise the potential of them joining CREW with the sole purpose of learning which species are important and where they are located, for the purposes of illegally harvested.

m. Input from social scientists is recommended during the development of future pilot projects and any other proposed CREW expansion plans related to communities and/or citizen scientists, to ensure the results-chain is sound and effectiveness is optimised.

n. Efforts to draw volunteers into the programme have been focussed on groups that undertake outdoor activities similar to what is required for CREW fieldwork, such as hiking. The practical focus of such groups is not always fully compatible with a CREW fieldtrip due to differing objectives of the participants (e.g. climbing a mountain as fast as possible versus stopping regularly to inspect plants and take notes). Nonetheless, complementarity does exist with allied activities. Greater interaction with the Mountain Club of South Africa (MCSA) and local hiking groups present an opportunity to draw new and potentially younger volunteers into CREW, as such individuals or groups are already investing time in the outdoors.
o. CREW should consider raising greater awareness of the programme by profiling it on key internet, Facebook and Instagram sites in South Africa related to travel, hiking, nature walks, trail running etc. (e.g. Getaway, Go etc.)

p. Partnerships with outdoor brands such as Patagonia (through the Gone outdoor store) and K-Way (Cape Union Mart) should be investigated to draw a younger demographic into the programme and to access financial support.

q. Without negatively impacting the activities of other organisations, CREW should consider engaging with other conservation volunteer initiatives to determine if their members would have an interest in being involved in CREW also (e.g. the Umzimvubu Catchment Partnership Programme of Conservation South Africa, SANParks Honorary Rangers, WESSA Friends Groups etc.). As some of these groups are already involved in CREW, but to a limited extent. Engagement with the Field Guides Association of Southern Africa (FGASA) may also be beneficial.

5.2 Value-add to SANBI from citizen scientists’ approach

a. CREW should ensure that data sharing agreements are in place with all relevant organs of state (e.g. relevant competent authorities, provincial protected area agencies and municipalities), including through offline platforms due to internet access constraints, to ensure effective consideration of such data in land use planning and decision-making. The data sharing agreements must clearly specify the roles and responsibilities of the custodians of this information within the organs of state (e.g. to disseminate the data to relevant key departments or divisions). CREW should ensure that these custodians are aware of these requirements.

5.3 Areas where CREW could provide greater support for SANBI work

a. CREW could play a crucial future role by collecting essential new data for future additional KBA listings (e.g. the number of mature plants at a site locality). CREW could also play a key role in monitoring the status of priority plant populations, which is currently undertaken on a very limited basis.

b. Joint planning should be undertaken between the MSB, NBGs, the SANBI herbaria and CREW to identify aspects of common interest and to build joint activities into their Annual Operations Plans. Such active collaboration would improve the implementation of core aspects of SANBI’s mandate.

c. The Conservation Coordinator for Gardens should continue to play an interface role between the Gardens, MSB, and CREW and is essential to facilitating effective collaboration and coordination.

d. Deepening of the relationship between the MSB, NBGs and CREW regarding ex situ conservation and restoration should be actively encouraged and formal cooperation should continue to be supported by the SANBI Chief Director: Conservation Gardens and Tourism, Director: Conservation Gardens and Tourism, Chief Director: Biodiversity Research, Assessment and Monitoring, Director: Biodiversity Assessment and Monitoring, MSB National Project Manager, Conservation Coordinator for Gardens, Threatened Plant Programme Manager, and other key staff.

e. The educational media within the NBGs could be used to raise greater awareness of CREW.

f. Geographically, the Pondoland region of the Eastern Cape Province has not been sampled extensively, representatively or frequently. As Pondoland falls within a global biodiversity hotspot,
efforts should be considered to address these current data gaps, both spatially and temporally. The viability of establishing a new CREW node in Pondoland should be assessed, to address current spatial and temporal data gaps. The Pondoland area may present an opportunity to access a Foundational Biodiversity Information Programme (FBIP) grant for a special project to collect data in this area, which should be explored. The presence of a current Conservation South Africa partnership programme in the Umzimvubu catchment presents an existing hub of synergistic activity where such a node could be located. The location of the node should take due consideration of proximity to key areas to be sampled, institutions that CREW would primarily wish to partner with, and a suitable institutional home for the node co-ordinator or manager that would effectively support the achievement of the node objectives. The institutional arrangements must also avoid isolation of the node staff in terms of knowledge sharing, capacity building and national programme co-ordination.

g. CREW should hold a workshop with key stakeholders to identify the most important and effective intervention points to raise awareness of key sites for threatened and rare plants at a local municipal level. The proposed interventions should be targeted and have longevity built into them, to address the challenge of working across a vast number of municipalities and the high turnover of officials and councillors within them. The installation of sign boards at key sites should be considered as one such intervention, linked to a public relations and awareness drive focussed on senior municipal councillors and officials, other key stakeholders (e.g. construction industry), and the public. Such boards should convey the biodiversity importance of the site, be constructed of materials that would have a long lifespan and not be sought for alternate uses, could be site-specific or generic, but should not include information on key species to avoid or minimise illegal harvesting. The installation of such boards should be undertaken in conjunction with the local municipality to raise awareness of the sites at a political level, amongst officials, key stakeholders (e.g. construction industry), and the public.

h. The lessons reflected in this report should be expanded upon by the CREW team and documented in a journal article for submission to a suitable scientific publication and the popular media thereafter.

5.4 Appropriateness of investment given SANBI’s needs and CREW’s objectives

a. CREW must continue to nurture the current relationship with BotSoc and the Mapula Trust. Opportunity to expand CREW’s impact through additional financial support from these two donors should be explored. Expansion through new partners should also be explored, but in a complementary manner to BotSoc and the Mapula Trust’s involvement and support.

5.5 Human Capacity Development

5.5.1 Training of volunteers to gain plant identification skills

a. A comprehensive dataset of all volunteers trained to date should be developed, to enable quantitative assessment of the impact of CREW through training volunteers.

b. The annual workshops for the summer and winter rainfall regions should be continued, as should the ongoing ad hoc training opportunities.

c. Where appropriate, CREW should continue to provide field guides, methodologies to monitor plant populations, species identification support, iNaturalist training, and guidance on focus areas for fieldtrips to facilitate the effectiveness of the CREW groups. More frequent training of volunteers should be provided where required and possible.
5.5.2 Training interns to gain a suite of conservation skills

a. The trade-off of capacity development of interns without a high level of academic training (e.g. MSc, PhD) by CREW, as a non-core mandate, should be balanced with the resources that CREW has available to invest in such experiential training, as it has an influence on CREW’s implementation of core mandate functions.

b. SANBI should develop an over-arching strategy and structured training programmes for future internships within the organisation to ensure optimal recruitment, placement and the application of the core skills that are to be developed.

c. Internship programmes should result in participants receiving formally accredited training, so that they leave the programme with a formal South African National Qualifications Framework (NQF) qualification that will make them marketable in the workplace.

d. Where interns are placed at locations other than Kirstenbosch or the Pretoria NBGs, the internship programmes should be designed and resourced to provide means to overcome the existing barriers to equitable training across the country.

5.5.3 Exposing university students to work on threatened plant conservation and associated employment opportunities

a. Engagement with university students should remain highly focussed and undertaken in the most efficient yet effective manner possible. An annual lecture and field trip for third year or honours level students at key universities currently appears to be the most effective approach at present.

b. Any efforts to engage universities should include a focus on building the awareness and capacity of lecturers, to achieve greater effectiveness and duration of impact.

c. Any efforts to engage with schools and universities should be structured around the feeding of CREW-related content into materials developed by BotSoc and SANBI’s education section. The building of capacity of educators by CREW partners (e.g. BotSoc branches or new partners) may also achieve greater effectiveness and duration of impact.

b. The incorporation of a module on Threatened Species into university curricula should be investigated for potential future development, in partnership with BotSoc and SANBI’s education unit, to raise greater awareness of the need for species and habitat conservation and the work that CREW undertakes to encourage participation in CREW.

c. If such a curriculum module was implemented, CREW should pilot a greater number of fieldtrips and associated increased experiential learning to determine their efficacy.

5.6 Available technologies for monitoring species

a. To ensure the iNaturalist platform (or similar) remains relevant into the future, CREW should track societal trends and adapt its approach accordingly.

b. CREW groups should be allowed to continue submitting site sheet forms without utilising iNaturalist if they wish to. However, volunteers should equally be encouraged to submit the full, and not only the essential information into, these forms and to make increasing use of iNaturalist. As some volunteers struggle to complete the full forms, CREW should develop templates to capture the critical information on the status of plant populations of conservation concern via iNaturalist postings.

c. SANBI should continue to lobby iNaturalist to include important, currently absent functionality that was present in iSpot.
d. The precautionary principle must be applied to the availability of threatened species data on iNaturalist, particularly the localities of key groups such as the orchids, specific succulents and very rare plants of the Iridaceae family. At present, certain measures are in place, but volunteers should be regularly reminded to only submit sensitive observations to SANBI via datasheets, not via iNaturalist. This should be clearly reflected in the update to the current CREW manual.

e. CREW volunteers must continue to be encouraged to submit suitable physical specimens on a regular basis and not only post photographic records on iNaturalist.

5.7 Improved representation of South Africa’s different demographic groups

a. CREW should continue with its current transformation efforts.

b. Transformation objectives should continue to be integrated into CREW Annual Operational Plans, as continuity is key to achieving deep and meaningful change.

c. CREW’s current approach of partnering with citizen scientists irrespective of their age and race should be continued, as the benefit to SANBI is an optimal return on investment. The continuation of the programme will provide a greater number of previously disadvantaged individuals with meaningful training, increase demographic representivity in the sector, and facilitate growth in volunteer recruitment.

d. CREW should seek to work with existing projects who work with communities in areas with many threatened plants (e.g. uMzimvubu Catchment Partnership Programme).

e. SANBI should optimise the outcomes of its relationship with the Department of Science and Technology’s National Recordal System project, which works to document indigenous knowledge of South Africans, by involving CREW to a greater extent. CREW could support this project by assisting with plant identifications; providing training on how to press plants, assisting the DST in obtaining provincial permits etc. Plant specimens collected as part of the National Recordal System project could be sent via the CREW nodes to SANBI’s biosystematics team for formal identification and storage in the Pretoria National Herbarium.

f. Monitoring of the utilisation of medicinal plants would be well aligned with CREW’s objectives and should be considered as a future pilot project, subject to dedicated additional resources and the avoidance of dilution of current CREW activities.

g. Both indigenous knowledge and medicinal plant monitoring pilot projects may be of interest to BotSoc and should be discussed with them to determine the potential for additional financial support.

5.8 General

a. CREW should actively raise greater awareness within SANBI of the programme’s impact. This would benefit the programme by generating increased executive level appreciation of, and support for, CREW.

d. CREW should consider applying the Open Standards for the Practice of Conservation when undertaking their biannual review and planning processes, to further strengthen their approaches. This would allow CREW to apply a more detailed and thorough understanding of the programme goals; objectives; targets; opportunities; critical threats and risks; conservation, socio-economic, political and institutional situation; assumptions; and an associated results-chain to the development of its strategies, actions, monitoring and evaluation.
e. In light of its rigour and methodology that enables outcome optimisation, the Open Standards for the Practice of Conservation should be considered by SANBI as its primary methodology for biodiversity programme/project design, implementation, monitoring, evaluation and review.

f. SANBI should look to have a longer-term Memorandum of Understanding signed with BotSoc for at least a five-year period. SANBI should also explore opportunities with BotSoc to increase their financial support for CREW to enable greater reach and impact.

g. The lack of salary parity across the CREW team, relative to the respective roles and responsibilities of the team members, needs to be addressed to ensure alignment with the systems of the host organisation for the programme.

h. It is vital that node managers are supported by dedicated node co-ordinators, over and above any interns, to ensure the optimal performance of the node. A node co-ordinator should be appointed to support the manager in the CFR node. As the Limpopo and Eastern Cape CREW nodes become more established and achieve greater momentum, it would be ideal to have both a manager and co-ordinator in place for each node to support effective implementation.

i. Major changes should not be implemented to the programme, to avoid a reduction in the current momentum, cohesiveness and impact of the programme. Any changes should be incremental and complementary.

j. The current effectiveness of the CREW team can be attributed to the experience of the node managers, and the passion, commitment and cohesion of the team. Should major changes be implemented to the programme, the risk exists that core staff may leave CREW and the current momentum and cohesiveness of the programme would be lost. This would likely result in a substantial reduction in the effectiveness of the programme.

k. The current and future node co-ordinators should be provided with ongoing species identification training, as well as opportunities for future graduate or post-graduate training, to enable them to be more effective in the technical aspects of their roles.

l. SANBI’s policy enables the appointment of research assistants. Such opportunities should be explored as a useful mechanism to strengthen CREW’s human resource capacity.

m. Emotional intelligence and maturity to employ patience and various forms of motivation, encouragement and recognition when engaging with volunteers should be key attributes that form part of the selection process for CREW team positions.

n. Where CREW intends appointing new staff, the types of individual/s that will be best suited to understand the primary sectoral, socio-economic and demographic conditions and foster relationships must be carefully considered and incorporated into the terms of reference for the appointment to facilitate a good fit.

o. CREW should continue allowing flexibility in the way in which different volunteers engage with the programme, to facilitate involvement and avoid participant fatigue.

p. The CREW nodes should continue to identify and develop volunteer champions within their geographic areas. Focus should not be placed on the nodes becoming or being viewed as centres of taxonomic excellence, but rather as catalytic support centres to volunteer groups.

q. CREW should continue to engage with volunteers as voluntary partners. Various forms of motivation, encouragement and recognition must continue to be employed.

r. Greater annual budgetary support needs to be provided to the CREW SRR to enable it to achieve equivalent levels of reach and effectiveness as in the CFR.
s. At present the operational budget for CREW supports key tasks, but an increase of 15 to 20 percent should be sought via internal and external sources to enable the nodes to support volunteer groups at a more optimal level for the current suite of activities. This in turn would facilitate high levels of targeted data collection.

t. The CREW operational manual should ideally be revised as soon as major changes have been implemented to the programme (e.g. migration from iSpot to iNaturalist), but at least every five years, to ensure new approaches and lessons learnt are captured. As the various CREW groups operate in different ways, providing at least two examples in the manual of operational models would be helpful. In addition, the updated manual should reflect that when private landowners don’t grant permission to volunteers to post records on iNaturalist, this must be respected.

u. The CREW annual workshops for the SRR and CFR have been fundamental to the programme and should continue to be undertaken.

v. CREW groups should continue to be encouraged to capacitate their “members”, develop their group to the point of self-sufficiency, build redundancy within the team, and avoid the bulk of responsibility for the group’s activities resting on the group champion.

w. Joint and more frequent training with multiple volunteer groups should be undertaken, to facilitate more rapid and timely upskilling and optimisation of the outcomes of these activities.

x. Formal data-sharing agreements between CREW and organs of state must include details of the roles and responsibilities of the technical point person in the organ of state to whom the data is being provided.

y. CREW should engage with key stakeholders to encourage the development of a field guide for the Thicket biome, which would greatly support species identification in this biome.

z. CREW and SANParks should work towards a new permit for fieldwork covering all the national parks. CREW should also ensure that applications for the renewal of this permit, any required addenda, and provincial permits are submitted with enough lead time to avoid delays to time sensitive fieldwork.

aa. Partial or full subsidisation of fuel costs and/or transportation support for a greater number of CREW groups should be explored to enable a greater number of fieldtrips, particularly to remote sites, but also remove some of the barriers to recruiting new volunteers.

6 Lessons learnt

The following key lessons as documented during the review are likely to be of value to the programme and other biodiversity related initiatives:

a. The involvement of competent citizen scientists can greatly expand the geographical reach and frequency of rigorous data collection, as well as cost efficiency, beyond what could be achieved solely by relevant organs of state.

b. Facilitating the development of relationships between volunteer citizen scientists and associated shared learning via hosting of annual workshops is a successful and cost-effective means to build capacity and develop an internal learning institution.

c. The ongoing participation and support of volunteers in CREW has been facilitated via the provision of regular motivational support, operational flexibility within the bounds of a project’s objectives, and opportunities for continuous learning, networking and relationship building.

d. The capacitation of volunteer groups, supporting them to develop to the point of self-sufficiency, build redundancy within the groups, and avoiding the bulk of responsibility for the group’s activities
resting upon a single champion in a group greatly improves group effectiveness and likelihood of long-term sustainability.

e. Capacity building initiatives need to be effectively structured to optimise the breadth and depth of content, duration, quality, and ultimate effectiveness. In additional to experiential training, the provision of SETA-accredited training to interns and staff is crucial so that they obtain formal qualifications that make them increasingly marketable in the workplace.

f. Conservation programmes and projects should implement effective monitoring and evaluation at appropriate intervals (e.g. at least every five years) to identify design, planning and operational strengths and weaknesses, risks, and opportunities for improvement.

g. Whilst most programmes and plans must strike a balance between various competing objectives and interests, it is imperative that priority actions and associated principal resources are aligned to the core objectives. Institutions should guard against a large proportion of human, financial and other resources (e.g. greater than 10%) being directed to secondary objectives at the expense of the primary objectives. In instances where pressures emerge for the elevation of secondary objectives, sufficient additional resources should be provided to address these objectives without detracting from the primary objectives or separate programmes or projects should be developed to address these.

h. Expansion of the CREW programme should not be undertaken at the expense of the primary objectives. Proposed expansion should be designed to effectively build upon successes and lessons learnt, based on a thorough understanding of the programme/ project goals; objectives; targets; opportunities; critical threats and risks; conservation, socio-economic, political and institutional situation; assumptions; strategies; actions; and an associated results-chain; and

i. Continuity is key to achieving deep and meaningful transformation in any sector. The provision of ongoing and effective development opportunities for previously disadvantaged groups is crucial to achieving the intended objectives.

Prepared by

Warrick Stewart
Managing Director and Principal Environmental Advisor
7 References


Botanical Society of South Africa. 2013b. SANBI and BotSoc: Strategic partners for 100 years. Kirstenbosch, South Africa.


Appendix A: SANBI institutional mandate and approach in terms of NEM:BA, structure and objectives, and role as focal point for the Global Strategy for Plant Conservation
SANBI’s mandate and approach

SANBI is a statutory institution established under the National Environmental Management: Biodiversity Act No. 10 of 2004 (NEMBA), and the National Environment Laws Amendment Act No. 14 of 2009 and No. 14 of 2013. SANBI derives its core and voluntary mandates from Section 11 of NEMBA, namely:

“The Institute-

(a) must monitor and report regularly to the Minister on-
   (i) the status of the Republic’s biodiversity;
   (ii) the conservation status of all listed threatened or protected species and listed ecosystems; and
   (iii) the status of all listed invasive species;

(b) must monitor and report regularly to the Minister on the environmental impacts of all categories of genetically modified organism, post commercial release, based on research that identifies and evaluates risk;

(c) may act as an advisory and consultative body on matters relating to biodiversity to organs of state and other biodiversity stakeholders;

(d) must coordinate and promote the taxonomy of South Africa’s biodiversity;

(e) must manage, control and maintain all national botanical gardens;

(f) may establish, manage, control and maintain-
   (i) herbaria; and
   (ii) collections of dead animals that may exist;

(g) must establish facilities for horticulture display, environmental education, visitor amenities and research;

(h) must establish, maintain, protect and preserve collections of plants in national botanical gardens and in herbaria;

(i) may establish, maintain, protect and preserve collections of animals and micro-organisms in appropriate enclosure;

(j) must collect, generate, process, coordinate and disseminate information about biodiversity and the sustainable use of indigenous biological resources, and establish and maintain databases in this regard;

(k) may allow, regulate or prohibit access by the public to national botanical gardens, herbaria and other places under the control of the Institute, and supply plants, information, meals or refreshments or render other services to visitor;

(l) may undertake and promote research on indigenous biodiversity and the sustainable use of indigenous biological resources;

(m) may coordinate and implement programmes for-
   (i) the rehabilitation of ecosystems; and
   (ii) the prevention, control or eradication of listed invasive species;

(n) may coordinate programmes to involve civil society in-
   (i) the conservation and sustainable use of indigenous biological resources; and
   (ii) the rehabilitation of ecosystems;

(o) on the Minister’s request, must assist him or her in the performance of duties and the exercise of powers
(p) on the Minister’s request, must advise him or her on any matter regulated in terms of this Act, including-

(i) the implementation of this Act and any international agreements affecting biodiversity which are on
the Republic;

(ii) the identification of bioregions and the contents of any bioregional plans;

(iii) other aspects of biodiversity planning;

(iv) the management and conservation of biological diversity; and

(v) the sustainable use of indigenous biological resources;

(q) on the Minister’s request, must advise him or her on the declaration and management of, and development
in, national protected areas; and

(r) must perform any other duties-

(i) assigned to it in terms of this Act; or

(ii) as may be prescribed.

(3) When the Institute in terms of subsection (1) gives advice on a scientific matter, it may consult any
appropriate organ of state or other institution which has expertise in that matter.

In executing its mandate, SANBI is also influenced by international agreements and initiatives to which South
Africa is both a signatory and participant, national macro-policies, and sectoral policy contexts. Key
international agreements SANBI contributes to include:

- Convention on Biological Diversity (CBD).
- Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES).
- Convention on Wetlands (Ramsar).
- United Nations Framework Convention on Climate Change (UNFCCC).

Key priorities are also derived from the National Biodiversity Strategy and Action Plan (NBSAP), the National
Biodiversity Framework (NBF), government delivery agreements, other national priorities (e.g., wildlife trade,
the green economy), and specific mandates such as the National Climate Change Response White Paper.

SANBI leads and coordinates research, as well as monitors and reports on the state of biodiversity in South
Africa. The Institute is mandated to provide knowledge and information, planning and policy advice, and to
pilot best-practice management models in partnership with stakeholders to support the sustainable use of the
country’s biodiversity. Giving effect to this mandate, SANBI plays an important role in supporting the translation
of science into policy.

SANBI makes a valuable contribution to national development through inputs to the National Development
Plan 2030, which aims to eliminate poverty and reduce inequality. It achieves this by linking biodiversity and
sustainable development. SANBI contributes to a number of the critical actions outlined in the NDP, but makes
a direct contribution to Critical Action 7 that relates to interventions to ensure environmental sustainability and
resilience to future shocks. SANBI is also guided by the 2014-2019 Medium Term Strategic Framework (MTSF)
which provides a 5-year building block towards the 2030 vision of the National Development Plan.

SANBI has adopted a ‘managed network’ institutional model, which consists of partner organisations,
institutions and bodies with whom SANBI has (or is seeking to have) formal agreements that contribute towards
delivering on SANBI’s mandate as determined by NEMBA and SANBI’s Strategic Plan.

SANBI’s work is conceptualised as a value chain in which biodiversity science forms part of a continuum that
starts with very basic information on biodiversity and builds on these foundations with classification systems, assessments, experiments, models and tools to reach a point at which focused advice can be provided to policy makers and contribute to Government’s higher objectives of poverty alleviation, job creation and improving human wellbeing. SANBI’s value chain is illustrated in Error! Reference source not found.. SANBI’s programmes as described below in chapter Error! Reference source not found. are imbedded in this value chain.

Figure A-1: SANBI’s value chain

**SANBI’s structure and objectives**

SANBI works according to a Corporate Strategic Plan that is revised annually, but contains its plan of work for a five-year period. The Corporate Strategic Plan outlines how SANBI will achieve its vision, mission and goals through structured programmes of work and strategic objectives. SANBI’s strategic objectives fall under seven programmes, namely:

- Programme 1: Render effective and efficient corporate services.
- Programme 2: Manage and unlock benefits of the network of National Botanical Gardens as windows into South Africa’s biodiversity.
- Programme 3: Build the foundational biodiversity science.
- Programme 4: Assess, monitor and report on the state of biodiversity and increase knowledge for decision making (including adaptation to climate change).
- Programme 5: Provide biodiversity policy advice and access to biodiversity information; and, support for climate change adaptation.
- Programme 6: Provide human capital development, education and awareness in response to SANBI’s mandate.
- Programme 7: National Zoological Gardens (NZG).

The CREW programme relates directly to programme 4 (Assess, monitor and report on the state of biodiversity and increase knowledge for decision making) and programmes 6, with lesser contributions to 3 and 5.
The objectives of programme 4 are as follows:

- New knowledge created to inform assessments and decision making relating to biodiversity.
- The status of biodiversity, including biological invasions, is systematically assessed to determine current state and trends and to identify risks or benefits to the environment and people (SANBI, 2017f; SANBI, 2018c).

Programme 4 builds on foundational biodiversity information (programme 3) through additional research, assessment and analysis. The aim is to deliver comprehensive assessments of the state of biodiversity and to strengthen the knowledge base that informs SANBI’s contributions to policy and decision-making relating to managing biodiversity as well as optimizing its benefits to people.

The strategic objectives focus on high level outputs, most specifically the production of scientific evidence to support policy and decision making relating to biodiversity and high-level assessments of the state of biodiversity. The reports and assessments on the state of biodiversity are the end result of research, monitoring and assessment activities undertaken by SANBI and partner organizations. The indicators and targets are appropriate for the high-level objectives, but it is important to note that SANBI’s mandate obligations are strongly integrated into the activities that SANBI will undertake to achieve these objectives. This includes, amongst others:

- Monitoring and reporting on the status of biodiversity (NEMBA 11.1 (a.i)), including Red List assessments.
- Listed threatened species and ecosystems (NEMBA 11.1(a.ii)).
- Listed invasive species (NEMBA 11.1(a.iii)) (SANBI, 2017f).

SANBI's Biodiversity Assessment and Monitoring (BAM) Directorate is mandated to monitor and report on the conservation status of South Africa's indigenous plant and animal species. SANBI has a strong focus on citizen science and has developed and supported projects and virtual museum platforms to facilitate the submission of field monitoring records from the public. Through these various platforms SANBI channels the South African public's interest and passion for biodiversity conservation into expanding SANBI's monitoring capacity. BAM employs staff to co-ordinate the collection of information on species through long term programmes involving volunteers from the public, scientists, taxonomists and conservationists from partner institutions across the country. Citizen science platforms that have been or are actively supported include: the Southern African Bird Atlas Project, the Virtual Museums, iNaturalist for South Africa, the Rural Citizen Science Birding Project and the Custodians of Rare and Endangered Wildflowers (CREW) programme.

Programme 6 on human capital development, education and awareness is a cross cutting programme with the intention to ensure that the sector is transformed through identification, attraction and retention of priority and rare skills amongst South Africans especially the youth. It is also the programme’s intention to up-skill those already within the biodiversity sector to address not only historical legacies of a bottom-heavy sector but also chronic capacity shortages of leadership especially by black South Africans.

The CREW programme plays an important role in informing the updating of the Red List of South African plants (SANBI programme 4), most notably via the identification of new species, new populations and data on pressures to such species. CREW also supports the objectives and functions of various SANBI Directorates, programmes and projects, including Foundational Biodiversity Science (SANBI programme 3), the Millennium Seed Bank Partnership (MSBP), iNaturalist, the National Biodiversity Assessment (programme 4), elements of Policy Advice and Biodiversity Information such as the National Protected Area Expansion Strategy and the National List of Threatened Terrestrial Ecosystems (programme 5), and Human Capital Development, Education and Awareness (programme 6) (SANBI, 2016; SANBI, 2017d).

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22 Each of these aspects address identified knowledge gaps.
23 This project is described in detail in Chapter 3.3.
24 This is one of the species data platforms that SANBI hosts.
SANBI’s role as focal point for the Global Strategy for Plant Conservation

In 2015, SANBI developed South Africa’s first Strategy for Plant Conservation in response to the country’s commitments under the CBD, including South Africa’s endorsement of the Global Strategy for Plant Conservation (GSPC) and adoption of Decision X/17. The country strategy is aligned with the CBD-endorsed GSPC. The South African strategy was developed simultaneously with the review of South Africa’s National Biodiversity Strategy and Action Plan, and all activities in South Africa’s Strategy for Plant Conservation nest under activities within the National Biodiversity Strategy and Action Plan (Raimondo et al., 2015).

This strategy was developed under the leadership of SANBI, the focal point for the implementation of the Global Strategy for Plant Conservation nationally, with support from the Botanical Society of South Africa (BotSoc). The strategy includes 16 outcome-oriented targets, each of which, if effectively implemented, will support improved conservation of plants in South Africa. The targets range from documenting, describing and assessing the conservation status of plants, to the setting of targets to conserve plants in situ and ex situ.

Various targets of South Africa’s Strategy for Plant Conservation are relevant to the CREW programme’s objectives, but the most significant contribution is to Target 7, which advocates for at least 75% of known threatened plant species to be conserved in situ by 2020. CREW is aligned with and makes an important contribution towards South Africa’s Plant Conservation Strategy (DEA, 2015), with the programme actively contributing to 9 of the 16 targets.

The outputs of the CREW programme ultimately contribute to Target 14 (the importance of plant diversity is incorporated into communication, education and public awareness programmes) and Target 15 (trained people working with appropriate facilities sufficient to meet national needs). The programme also plays an important role in efforts related to Targets 3 (monitoring populations of threatened plants), 5 (identifying and conserving important plant areas) and 8 (assisting with ex situ collections via seed banking for threatened species (DEA, 2015; SANBI, 2018a). CREW also contributes by identifying priority sites for the conservation of threatened plants and provides technical ad training support to biodiversity stewardship programmes.

The targets and intended outcomes of the country’s Strategy for Plant Conservation are provided in Table 4-1, including the highlighting of targets and outcomes that the CREW programme is contributing towards.
Appendix B: List of interviewees and dates of interviews
Table B-1: List of interviewees and dates of interviews

<table>
<thead>
<tr>
<th>Name</th>
<th>Organisation</th>
<th>Position</th>
<th>Date of Interview</th>
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<tbody>
<tr>
<td>Domitilla Raimondo</td>
<td>SANBI</td>
<td>Threatened Species Programme Manager</td>
<td>11 May 2018</td>
</tr>
<tr>
<td>Suvarna Parbhoo</td>
<td>SANBI</td>
<td>Manager of the CREW Summer Rainfall Region (SRR) node</td>
<td>17 May 2018</td>
</tr>
<tr>
<td>Di Turner</td>
<td>CREW Volunteer</td>
<td>Group champion</td>
<td>18 May 2018</td>
</tr>
<tr>
<td>Mike Cameron</td>
<td>CREW Volunteer</td>
<td>Group member</td>
<td>18 May 2018</td>
</tr>
<tr>
<td>Nicki van Berkel</td>
<td>CREW Volunteer</td>
<td>Group member</td>
<td>18 May 2018</td>
</tr>
<tr>
<td>Ismail Ebrahim</td>
<td>SANBI</td>
<td>Manager of the CREW Cape Floristic Region (CFR) node</td>
<td>21 May 2018</td>
</tr>
<tr>
<td>Deshni Pillay</td>
<td>SANBI</td>
<td>Director Biodiversity Assessment and Monitoring</td>
<td>29 May 2018</td>
</tr>
<tr>
<td>Vathiswa Zikishe</td>
<td>SANBI</td>
<td>Co-ordinator of the Eastern Cape CREW node</td>
<td>29 May 2018</td>
</tr>
<tr>
<td>Anthony Magee</td>
<td>SANBI</td>
<td>Taxonomist</td>
<td>07 June 2018</td>
</tr>
<tr>
<td>Dewidine van der Colff</td>
<td>SANBI</td>
<td>Previous Groen Sebenza intern with CREW, now SANBI Red List Scientist</td>
<td>07 June 2018</td>
</tr>
<tr>
<td>John Manning</td>
<td>SANBI</td>
<td>Taxonomist</td>
<td>07 June 2018</td>
</tr>
<tr>
<td>Tony Rebelo</td>
<td>SANBI</td>
<td>Researcher and Curator of iNaturalist</td>
<td>07 June 2018</td>
</tr>
<tr>
<td>Zaitoon Rabaney</td>
<td>Botanical Society</td>
<td>Director of the Botanical Society</td>
<td>07 June 2018</td>
</tr>
<tr>
<td>John Donaldson</td>
<td>SANBI</td>
<td>Chief Director of Biodiversity Assessment and Monitoring</td>
<td>08 June 2018</td>
</tr>
<tr>
<td>Carina Lochner</td>
<td>CREW Volunteer</td>
<td>Group champion</td>
<td>09 June 2018</td>
</tr>
<tr>
<td>Helene Preston</td>
<td>CREW Volunteer</td>
<td>Group champion</td>
<td>09 June 2018</td>
</tr>
<tr>
<td>Rupert Koopman</td>
<td>CAPE Nature</td>
<td>CAPE Nature botanist and ex intern</td>
<td>09 June 2018</td>
</tr>
<tr>
<td>Stephen Cousins</td>
<td>CREW Volunteer</td>
<td>Group champion</td>
<td>09 June 2018</td>
</tr>
<tr>
<td>Luc Strydom</td>
<td>CREW Volunteer</td>
<td>Group member</td>
<td>09 June 2018</td>
</tr>
<tr>
<td>Hlengiwe Mtshali</td>
<td>SANBI</td>
<td>Red List Scientist and CREW Co-ordinator for KZN</td>
<td>11 June 2018</td>
</tr>
<tr>
<td>Richard Boon</td>
<td>eThekwini Municipality</td>
<td>eThekwini Municipality. Manager: Biodiversity Planning</td>
<td>11 June 2018</td>
</tr>
<tr>
<td>Caryl Logie</td>
<td>CREW Volunteer</td>
<td>Group champion</td>
<td>12 June 2018</td>
</tr>
<tr>
<td>Kate &amp; Graham Grieve</td>
<td>CREW Volunteer</td>
<td>Volunteer Pondoland</td>
<td>12 June 2018</td>
</tr>
<tr>
<td>Name</td>
<td>Organization</td>
<td>Position/Role</td>
<td>Date</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Kristal Maze</td>
<td>SANBI</td>
<td>Chief Director of Biodiversity Information and Policy Advice</td>
<td>12 June 2018</td>
</tr>
<tr>
<td>Bongani Mnisi</td>
<td>City of Cape Town</td>
<td>Manager</td>
<td>13 June 2018</td>
</tr>
<tr>
<td>Lize von Staden</td>
<td>SANBI</td>
<td>Plant Red List Scientist</td>
<td>13 June 2018</td>
</tr>
<tr>
<td>Petra Brodelle</td>
<td>CREW Volunteer</td>
<td>Group champion</td>
<td>13 June 2018</td>
</tr>
<tr>
<td>Adriaan Grobler</td>
<td>CREW Volunteer</td>
<td>Group champion</td>
<td>15 June 2018</td>
</tr>
<tr>
<td>Benny Bytebier</td>
<td>UKZN</td>
<td>Taxonomist</td>
<td>18 June 2018</td>
</tr>
<tr>
<td>Victoria Wilman</td>
<td>SANBI</td>
<td>Gardens division and MSB</td>
<td>18 June 2018</td>
</tr>
<tr>
<td>Anri Marais</td>
<td>SANBI</td>
<td>Former Groen Sebenza intern with CREW. Now Compton Herbarium assistant</td>
<td>20 June 2018</td>
</tr>
<tr>
<td>Carly Cowell</td>
<td>SANPARKS</td>
<td>Conservation management</td>
<td>25 June 2018</td>
</tr>
<tr>
<td>Odette Curtis</td>
<td>CREW Volunteer</td>
<td>Group champion and conservation partner</td>
<td>27 June 2018</td>
</tr>
<tr>
<td>Somileze Mcuwa</td>
<td>SANBI</td>
<td>Former Groen Sebenza intern with CREW. Now Karoo BioGaps plant digitiser in the Eastern Cape.</td>
<td>27 June 2018</td>
</tr>
<tr>
<td>Anthony Hitchcock</td>
<td>SANBI</td>
<td>Former SANBI Nursery, Living Collections and Threatened Species Manager: Kirstenbosch NBG</td>
<td>28 June 2018</td>
</tr>
<tr>
<td>Bettina Koelle</td>
<td>CREW Volunteer</td>
<td>Indigo development and change, community interactions with CREW</td>
<td>28 June 2018</td>
</tr>
<tr>
<td>Mahlatse Mogale</td>
<td>SANBI</td>
<td>CREW Champion and botanist seconded to Limpopo LEDET</td>
<td>28 June 2018</td>
</tr>
<tr>
<td>Mervyn Lotter</td>
<td>PSG/MPTA</td>
<td>CREW Champion and Provincial Biodiversity Planner</td>
<td>29 June 2018</td>
</tr>
<tr>
<td>Livhuwani Nkuna</td>
<td>SANBI</td>
<td>MSB Gardens Division: Ex situ/restoration</td>
<td>04 July 2018</td>
</tr>
</tbody>
</table>
Appendix C: Botanical Society of South Africa’s mandate and objectives
Botanical Society of South Africa's mandate, objectives and role in CREW

The mission of the Botanical Society of Southern Africa (BotSoc) is as follows:

"Mindful of the role of the people of South Africa as custodians of the world's richest floral heritage, it is our mission to win the hearts, minds and material support of individuals and organisations, wherever they may be, for the conservation, cultivation, study and wise use of the indigenous flora and vegetation of southern Africa".

The objects of BotSoc are as follows:

1. To promote a caring attitude towards the indigenous flora and vegetation of southern Africa amongst all people and to provide a forum for positive collective action by offering its membership to all individuals and organisations sharing its mission.
2. To promote and actively be involved in the conservation, cultivation and wise, sustainable use of the indigenous flora and vegetation of southern Africa and encourage public interest in the attainment of this object.
3. To increase knowledge and understanding of the indigenous flora and vegetation of southern Africa through educational programmes and general enlightenment, aimed primarily at the people of South Africa and to support appropriate study and research projects.
4. To liaise, co-operate and work in partnership when considered appropriate, with organisations such as the South African National Biodiversity Institute (SANBI) and its successor and others with similar objects in the attainment of the above. To interest the people of South Africa and other countries in the progress and development of all the National Botanical Gardens that have been and may be established by the Board of the South African National Biodiversity Institute and its successor and to encourage active support of local National Botanical Gardens by the Branches of the Society (Botanical Society of South Africa, 2013a).

The BotSoc's activities are aligned under the following pillars:

1. Conservation
2. Environmental Education and Outreach
3. Membership, Branch support and Operations. The BotSoc work in partnership and collaborate with various other conservation bodies, agencies, government bodies as well as other organisations in the pursuance of its mission.

The Botanical Society of South Africa (BotSoc) is SANBI's primary partner in the delivery of the CREW programme. BotSoc encourages the conservation, cultivation, study and wise use of the indigenous flora and vegetation of southern Africa.

After 93 years of partnership between BotSoc and SANBI, through the former National Botanic Gardens (NBG) and the National Botanical Institute (NBI), 2010 saw the formulation and joint signing of a structured and formalised Memorandum of Understanding (MoU) between SANBI as a public entity and BotSoc as a membership-based non-profit organisation to guide their partnership.

The Botanical Society/NBI Development Fund, which had been used very successfully during the 1990s, was transformed into the Botanical Society/SANBI Partnership Fund. This fund continues to be used extensively to support critical projects and garden-based developments across all NBGs today. Through the MoU, BotSoc's support expanded to the CREW programme, as well as supporting education, marketing and awareness projects jointly with SANBI (Botanical Society of South Africa, 2013b).

BotSoc has directly funded the summer rainfall operations of the CREW programme and employed support staff to work on the programme since 2006. More than 90% of CREW volunteers are BotSoc members. The programme provides a valuable means through which BotSoc members can directly contribute to plant conservation in a practical hands-on manner, which many members desire to do (Z. Rabaney 2018, personal communication, 6 July).
Appendix D: Summary of CREW programme process flow
Figure D-1: Summary of CREW programme process flow
Appendix E: List of individuals trained by the CREW programme
Table E-1: List of individuals trained by the CREW programme

<table>
<thead>
<tr>
<th>Node</th>
<th>Name</th>
<th>Period employed</th>
<th>Status</th>
<th>Race</th>
<th>Sex</th>
<th>Current status</th>
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</thead>
<tbody>
<tr>
<td>Cape Floristic Region</td>
<td>Rosanne Stanway</td>
<td>2004</td>
<td>Intern</td>
<td>White</td>
<td>F</td>
<td>CSA Green Choice</td>
</tr>
<tr>
<td></td>
<td>Rene Jasson</td>
<td>2004</td>
<td>Intern</td>
<td>Coloured</td>
<td>F</td>
<td>MSC/unknown</td>
</tr>
<tr>
<td></td>
<td>Jabu Sithole</td>
<td>2004</td>
<td>Intern</td>
<td>Black</td>
<td>F</td>
<td>SANBI Invasives Programme</td>
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<tr>
<td></td>
<td>Caitlin Von Witt</td>
<td>2005-2008</td>
<td>Project assistant - Project Coordinator</td>
<td>White</td>
<td>F</td>
<td>MSc/Self-employed restoration company</td>
</tr>
<tr>
<td></td>
<td>Vathiswa Zikishe</td>
<td>2007-Current</td>
<td>Project assistant-Project manager</td>
<td>Black</td>
<td>F</td>
<td>SANBI permanent employee, CREW EC co-ordinator</td>
</tr>
<tr>
<td></td>
<td>Carlo Van Tonder</td>
<td>2007</td>
<td>Intern</td>
<td>White</td>
<td>M</td>
<td>Cape Nature ecological coordinator</td>
</tr>
<tr>
<td></td>
<td>Shela Patrickson</td>
<td>2007</td>
<td>Research assistant</td>
<td>White</td>
<td>F</td>
<td>WWF Public Sector Partnerships coordinator</td>
</tr>
<tr>
<td></td>
<td>Marvin Wagenaar</td>
<td>2007-2008</td>
<td>Intern</td>
<td>Coloured</td>
<td>M</td>
<td>Unknown</td>
</tr>
<tr>
<td></td>
<td>Zikhona Mdalase</td>
<td>2011-2012</td>
<td>Secondment - Botsoc</td>
<td>Black</td>
<td>F</td>
<td>WWF administration</td>
</tr>
<tr>
<td></td>
<td>Martina Treunicht</td>
<td>2010-2011</td>
<td>Intern</td>
<td>White</td>
<td>F</td>
<td>PhD/Researcher, Stellenbosch University</td>
</tr>
<tr>
<td></td>
<td>Mzwandile Peter</td>
<td>2010</td>
<td>Secondment - Cape Flats Nature</td>
<td>Black</td>
<td>M</td>
<td>City of Cape Town Environmental Education</td>
</tr>
<tr>
<td></td>
<td>Lerato Hoveka</td>
<td>2012</td>
<td>Intern</td>
<td>Black</td>
<td>F</td>
<td>SANBI Herbarium</td>
</tr>
<tr>
<td></td>
<td>Sarah Leigh Hutchinson</td>
<td>2012</td>
<td>Research assistant</td>
<td>White</td>
<td>F</td>
<td>Self Employed</td>
</tr>
<tr>
<td></td>
<td>Anri Marais</td>
<td>2014-2016</td>
<td>Intern</td>
<td>Coloured</td>
<td>F</td>
<td>SANBI permanent employee, herbarium technician</td>
</tr>
<tr>
<td></td>
<td>Dewidine Van Der Colff</td>
<td>2014-2016</td>
<td>Intern</td>
<td>Coloured</td>
<td>F</td>
<td>SANBI permanent employee, TSP Animal Red List Scientist</td>
</tr>
<tr>
<td></td>
<td>Marius Lombard</td>
<td>2014-2015</td>
<td>Biodiversity facilitator</td>
<td>Coloured</td>
<td>M</td>
<td>Breeede Valley Municipality, Touwsrivier</td>
</tr>
<tr>
<td></td>
<td>Karin Herman</td>
<td>2014-2016</td>
<td>Intern</td>
<td>Coloured</td>
<td>F</td>
<td>West Coast Fossil Park tour guide</td>
</tr>
<tr>
<td></td>
<td>Brittany Arendse</td>
<td>2014-2015</td>
<td>Intern</td>
<td>Coloured</td>
<td>F</td>
<td>Natures Valley Trust</td>
</tr>
<tr>
<td></td>
<td>Andrea Von Gunten</td>
<td>2015-2016</td>
<td>Intern</td>
<td>White</td>
<td>F</td>
<td>City of Cape Town, Reserve manager</td>
</tr>
<tr>
<td></td>
<td>Mikhaila Gordon</td>
<td>2016-2017</td>
<td>Intern</td>
<td>Coloured</td>
<td>F</td>
<td>PhD: SANBI</td>
</tr>
<tr>
<td></td>
<td>Randall Josephs</td>
<td>2017-2018</td>
<td>Intern</td>
<td>Coloured</td>
<td>M</td>
<td>Internship, Compton Herbarium</td>
</tr>
<tr>
<td>KwaZulu-Natal</td>
<td>Name</td>
<td>Years</td>
<td>Role/Position</td>
<td>Gender</td>
<td>Race</td>
<td>Position</td>
</tr>
<tr>
<td>-------------</td>
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<td>----------------</td>
<td>---------------------------------------</td>
<td>--------</td>
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</tr>
<tr>
<td>Fezile Mathenjwa</td>
<td>2017-2019</td>
<td>Intern</td>
<td>Black F</td>
<td>SANBI Biodiversity Data Technician</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joti Daya</td>
<td>2018-2020</td>
<td>Intern</td>
<td>Indian F</td>
<td>Current</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desiree Marimuthu</td>
<td>2007-2009</td>
<td>Coordinator</td>
<td>Indian F</td>
<td>Religious nun</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suvarna Parbhoo</td>
<td>2006-current</td>
<td>Coordinator</td>
<td>Black F</td>
<td>SANBI permanent employee, CREW Manager</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nomvume Petela</td>
<td>2012-2013</td>
<td>NRF Intern</td>
<td>Black F</td>
<td>Master’s degree at Walter Sisulu University</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Khumbuzile Zulu</td>
<td>2013-2014</td>
<td>NRF Intern</td>
<td>Black F</td>
<td>Teacher</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hlengiwe Mtshali</td>
<td>2013-2018</td>
<td>GS intern</td>
<td>Black F</td>
<td>SANBI employee CREW co-ordinator, Red List Scientist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mbali Mkhize</td>
<td>2014-2015</td>
<td>NRF Intern</td>
<td>Black F</td>
<td>SANBI employee Project assistant, Herbarium technician</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kaveesha Naicker</td>
<td>2015-2016</td>
<td>NRF Intern</td>
<td>Indian F</td>
<td>Project assistant, CREW coordinator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sachin Doarsamy</td>
<td>2016</td>
<td>SANBI intern</td>
<td>Indian F</td>
<td>Master’s degree at UKZN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Renira Boodhraj</td>
<td>2017-2018</td>
<td>WWF-SA intern</td>
<td>Indian F</td>
<td>Unknown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Khalipha Xhanti</td>
<td>2018</td>
<td>Project assistant</td>
<td>Black F</td>
<td>Unknown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lutendo Mudzielwana</td>
<td>2018-current</td>
<td>Project assistant</td>
<td>Black M</td>
<td>Current</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limpopo</td>
<td>Name</td>
<td>Years</td>
<td>Role/Position</td>
<td>Gender</td>
<td>Race</td>
<td>Position</td>
</tr>
<tr>
<td>Mahlatse Mogale</td>
<td>2013-current</td>
<td>GS pioneer</td>
<td>Black M</td>
<td>CREW Coordinator, Limpopo node</td>
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</tr>
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</table>
Appendix F: Summary of CREW financial contributions since inception
### Table F-1: Contributions of SANBI, BotSoc and Mapula Trust to the CREW programme

<table>
<thead>
<tr>
<th>Year</th>
<th>SANBI staff</th>
<th>SANBI operations</th>
<th>% SANBI</th>
<th>Botanical Society &amp; Mapula Trust Staff</th>
<th>Botanical Society &amp; Mapula Trust Operations</th>
<th>% BotSoc</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006/2007</td>
<td>R 329,000.00</td>
<td>R 466,000.00</td>
<td>75%</td>
<td>R 230,000</td>
<td>R 30,000</td>
<td>25%</td>
<td>First year of the project's national operation: Two nodes each with 2 staff each</td>
</tr>
<tr>
<td></td>
<td>2 staff members: level 9, level 7</td>
<td>Funding raised from Norway (R180 300 &amp; R285 700 from SANBI MTEF)</td>
<td></td>
<td>2 staff members level 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007/2008</td>
<td>R 599,450.00</td>
<td>R 605,120.00</td>
<td>82%</td>
<td>R 231,000</td>
<td>R 30,000</td>
<td>18%</td>
<td>Expanded project into KZN (KZN node funded by Norway and MDTP): 3 nodes two staff at each node</td>
</tr>
<tr>
<td></td>
<td>4 staff members: 1 level 9, 2 staff member level 7, 1 level 5</td>
<td>Funding raised from Norway (R192 921 Norway, R106500 MTDP for KZN &amp; R305 700 from SANBI MTEF)</td>
<td></td>
<td>2 staff members level 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008/2009</td>
<td>R 634,002.50</td>
<td>R 647,478.40</td>
<td>82%</td>
<td>R 242,550.00</td>
<td>R 30000.00</td>
<td>18%</td>
<td>Continued with 3 nodes similar operations to 2007/2008</td>
</tr>
<tr>
<td></td>
<td>4 staff members: level 9, 2 staff member level 7, 1 level 5</td>
<td>Funding raised from Norway (R 206 425.47; R 113955 MTDP for KZN &amp; R32,7097.93 from SANBI MTEF)</td>
<td></td>
<td>2 staff members level 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009/2010</td>
<td>R 858,103.28</td>
<td>R 548,000.00</td>
<td>82%</td>
<td>R 306,000.00</td>
<td></td>
<td>18%</td>
<td>Norway funding completed. Private funder from CFR Mapula trust takes over funding CFR work.</td>
</tr>
<tr>
<td></td>
<td>3 staff members: level 10, level 9, level 8</td>
<td>R332500 From private CFR funder R 215500 SANBI MTEF</td>
<td></td>
<td>2 staff members level 6</td>
<td></td>
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</tr>
<tr>
<td>2010/2011</td>
<td>R 366,748.72</td>
<td>R 505,050.00</td>
<td>53%</td>
<td>R 549,687.50</td>
<td>R 210,569.50</td>
<td>47%</td>
<td>First formal signing of MoU with BotSoc</td>
</tr>
<tr>
<td></td>
<td>2 staff members: 1 level 10 (10% salary), level 9</td>
<td>Operations CFR and PRE</td>
<td></td>
<td>2 staff members level 7 + 1 transitional staff (70% time)</td>
<td>Operations KZN node R62k from EKZNW</td>
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<td></td>
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<tr>
<td>Year</td>
<td>Total Budget</td>
<td>Previous Year</td>
<td>Increase</td>
<td>Staff and Operations</td>
<td>Notes</td>
<td></td>
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<td>-------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011/12</td>
<td>R 392,421.13</td>
<td>R 540,424.90</td>
<td>56%</td>
<td>2 staff members: 1 level 10 (10% salary), level 9</td>
<td>44% Expansion into Eastern Cape</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Operations CFR node and PRE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012/13</td>
<td>R 644,268.52</td>
<td>R 565,901.16</td>
<td>69%</td>
<td>3 staff members: 1 level 11 (10% salary), level 10; 50% of staff member level 7; 25% of staff member level 10</td>
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<td></td>
<td></td>
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<td></td>
<td>Operations CFR node and PRE</td>
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<tr>
<td>2013/14</td>
<td>R 689,367.31</td>
<td>R 835,599.75</td>
<td>68%</td>
<td>3 staff members: 1 level 11 (10% salary), level 10, 50% of staff member level 7, 25% of staff member level 10</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Operations CFR node and PRE, KZN Node office, paid by Invasive Species</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014/15</td>
<td>R 1,100,763.94</td>
<td>R 452,200.00</td>
<td>67%</td>
<td>4 staff members: level 11 (10% salary) and 2 level 10, 1 level 8</td>
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<td></td>
<td></td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td>Operations PRE, Office, KZN Node office, paid by Invasive Species</td>
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<td></td>
<td></td>
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<tr>
<td>2015/16</td>
<td>R 1,159,312.44</td>
<td>R 466,900.00</td>
<td>70%</td>
<td>4 staff members: level 11 (10% salary) and 2 level 10, 1 level 8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Operations PRE; Office, KZN Node office paid by Invasive Species</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>Total Budget</td>
<td>SANBI CREW</td>
<td>Operations</td>
<td>Remarks</td>
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<tr>
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<td>------------</td>
<td>------------</td>
<td>---------</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>2016/2017</td>
<td>R 1,689,966.23</td>
<td>R 242,200.00</td>
<td>R 564,000.00</td>
<td>R 866,766.93</td>
<td>BotSoc salary scale more than 50% less than SANBI equivalent G. Laidler seconded to CREW CFR (salary level 10)</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>5 staff members: level 11 (10% salary), 3 level 10, level 8</td>
<td>KZN Node office, paid by Invasive Species</td>
<td>57%</td>
<td>4 staff: coordinator KZN and Limpopo, project assistant EC+KZN</td>
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<td></td>
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<tr>
<td>2017/2018</td>
<td>R 1,881,528.94</td>
<td>R 242,200.00</td>
<td>R 384,000.00</td>
<td>R 921,840.53</td>
<td>38%</td>
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</tr>
<tr>
<td></td>
<td>5 staff members: level 11 (10% salary), 3 level 10, level 8</td>
<td>KZN Node office, paid by Invasive Species</td>
<td>62%</td>
<td>3 staff: coordinator KZN &amp; Limpopo, project assistant EC</td>
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<td></td>
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<td></td>
<td></td>
<td>Operations CFR (R510 006 from Mapula Trust), remainder for EC, KZN nodes</td>
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<tr>
<td>2018/2019</td>
<td>R 1,885,942.57</td>
<td>R 242,200.00</td>
<td>R 477,000.00</td>
<td>R 986,369.36</td>
<td>41%</td>
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<tr>
<td></td>
<td>4 staff members: 3 level 10, level 8</td>
<td>KZN Node office, paid by Invasive Species</td>
<td>59%</td>
<td>3 staff members: on different salary scales (R19k, R17k, R12k)</td>
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<td></td>
<td></td>
<td>Operations CFR (R545 706 from Mapula Trust), remainder for EC, KZN nodes</td>
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</tbody>
</table>