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Pressed for impact: Unleashing the potential of South African National Parks plant records

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Introduction

Knowing which species occur in protected areas, and where they are found, is fundamental to effective conservation management (McGeoch et al. 2011). This knowledge is especially important in the face of global change, where species are increasingly vulnerable to climate change (Gioia 2010), development-related disturbances and the threat of invasive species (Duenas et al. 2021).

Herbaria are invaluable sources of information about which species have occurred where and when (Cantrill 2018; Heberling 2021). The occurrence and trait data provided by herbarium specimens can be used to understand biodiversity and inform conservation efforts (Greve et al. 2016). Herbaria offer both physical specimens and valuable temporal and spatial data that can help to detect changes over time and across landscapes (Heberling 2021; James et al. 2018; Lavoie 2013; Pyke & Ehrlich 2010).

Herbarium data can indicate spatial and temporal trends in biological invasions (Aikio, Duncan & Hulme 2010; Fuentes et al. 2013), and plant phenology (Brenskelle et al. 2019; Davis et al. 2015; Miller-Rushing et al. 2006), including phenological shifts in response to climate change (Davis & Ellison 2018). For example, variations in carbon dioxide and environmental conditions can be examined by analysing the isotopic signature of specimens (Cantrill 2018).

Information on herbarium voucher labels can be used to develop species checklists, generate geographical distribution maps (Besnard et al. 2018) and model distribution shifts under future climate scenarios (Cantrill 2018; Newbold 2010). Additionally, the physical herbarium specimens themselves can aid plant identification (Besnard et al. 2018), species classification and description (Besnard et al. 2018; Greve et al. 2016), DNA extraction for genome sequencing (Staats et al. 2013), phylogeographic studies (Cantrill 2018) and investigations into morphological variations (Greve et al. 2016). Additionally, they provide source data for Red List assessments (Willis, Moat & Paton 2003) and material for the successful discovery of new hyperaccumulators (Van der Ent et al. 2019).

In South Africa, the three most well-known herbaria are managed by the South African National Biodiversity Institute (SANBI): the National Herbarium (PRE), the Compton Herbarium (NBG) and the KwaZulu-Natal Herbarium (NH). Together, they house over two million herbarium specimens (Sebola & Willis 2025). To increase the accessibility of these data, herbarium specimen and label information has been digitised and incorporated into the Botanical Database of Southern Africa (BODATSA): Botanical Collections, which includes data from the three SANBI herbaria – two of which are located within national botanical gardens: Pretoria National Botanical Garden and Kirstenbosch National Botanical Garden. This extensive dataset is publicly available through the Global Biodiversity Information Facility (GBIF) and SANBI's Biodiversity Advisor (https://posa.sanbi.org/), and it has been widely used to inform botanical research (e.g. Hoveka et al. 2020).

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However, there are many other reference collections in South Africa that form part of the Natural Science Collection Facility (NSCF) network. The NSCF is a virtual hub that was established by the Department of Science and Technology and based at the National Herbarium in Pretoria, to support the preservation, enhancement and promotion of these collections. The NCSF network includes 19 partner institutions that house national science collections. Among these, six institutions maintain herbaria; that is, South African National Parks (SANParks), SANBI, McGregor Museum, University of KwaZulu-Natal, University of Cape Town and University of the Witwatersrand.

Herbaria data from SANParks have significant potential to contribute to scientific research of protected areas and neighbouring land. Despite being publicly accessible, these data remain largely unknown. In our experience, even some SANParks biotechnicians and scientists are unaware of its existence – let alone researchers at South African universities and beyond. This article outlines SANParks' three formal herbaria and one active field herbarium, highlighting their collections and their contributions to both science and conservation.

South African National Parks herbaria

South African National Parks is the custodian of several natural history collections, including pressed plant specimens housed in three herbaria managed by the Scientific Services Department: the Skukuza Herbarium (Kruger National Park (KNP); Scientific Services, Skukuza, Kruger National Park); the Kimberley South African National Parks Herbarium (KSAN; Scientific Services, Kimberley) and the Garden Route National Park Herbarium (GRNP; Scientific Services, Thesen Island, Knysna). In addition to these formal herbaria, field herbaria have been developed for many of the parks, including the actively maintained Richtersveld Desert Botanical Garden Field Herbarium. These field guide herbaria intended for use by park staff and visiting researchers, often contain duplicates of voucher specimens housed in the three SANParks herbaria.

The SANParks herbaria play a key role in supporting conservation efforts across South Africa's national parks. The collections serve as inventories of the floral diversity within each park, also documenting threatened and endemic species. Herbaria data are used to develop species checklists and inform monitoring plans for species of special concern, which are typically rare, threatened and protected species (see McGeoch et al. 2011). The specimens also act as taxonomic references for plant identification by SANParks staff and researchers from national and international institutions. Beyond identification, herbarium specimens are used to address broader scientific questions, including taxonomic clarification and species delimitation. Additionally, the Skukuza and KSAN Herbaria contribute to capacity building through mentorship and educational outreach. For example, students, SANParks staff and other interested parties visit the Skukuza Herbarium to learn about plant collection and curation techniques. Similarly, students from the Sol Plaatje University, as well as young school learners from the surrounding area, visit the KSAN Herbarium to learn about the importance of the herbaria, plant mounting, curation techniques and plant biodiversity in national parks.

The plant specimens housed in the SANParks herbaria have been collected by SANParks staff, such as Johan Baard in the Garden Route National Park, Pieter van Wyk in Richtersveld National Park, Hermanus van der Schijff and Guin Zambatis in Kruger National Park, Dr Hugo Bezuidenhout in various other parks (housed in the KSAN Herbarium), botanists from national herbaria (e.g. see Steyn, Bester & Bezuidenhout 2013) and researchers from universities, many of whom have deposited duplicate voucher specimens in SANParks herbaria. Historically, specimens were identified by specialist plant taxonomists from national and international herbaria, including the Compton Herbarium (NBG), National Herbarium Pretoria (PRE), Bolus Herbarium (BOL) and the Herbarium Hamburgense (HBG).

The Skukuza Herbarium collection was initiated in 1951 by Mr H.P. van der Schijff, who collected ~4000 plant specimens. The ~16 000 specimens currently housed in the herbarium were collected from across the Kruger National Park and is managed by Nikisha Singh (Senior Biotechnician: Collections). The oldest specimen in the collection – *Nesaea crassicaulis* (Guill. & Perr.) Koehne – was collected by A.A. Obermeyerin 1930 at Klopperfontein in the Punda Maria area.

The KSAN herbarium was established in 1991 by Hugo Bezuidenhout, and with the help of Gideon Smith, it was officially registered with Index Herbariorum. Kimberley South African National Parks Herbarium has maintained long-standing collaborations with various institutions, including the SANBI herbaria (PRE in Pretoria and NBG in Kirstenbosch) for more than 20 years, as well as the McGregor Museum Herbarium (KMG) and the herbarium at the National Museum Bloemfontein (NMB). The KSAN herbarium consolidated several smaller, informal collections from national parks into one formal repository. The KSAN collection comprises 11 756 specimens from 15 national parks: Addo Elephant (929 specimens), Augrabies Falls (695 specimens), Camdeboo (405 specimens), Golden Gate Highlands (909 specimens), Kalahari Gemsbok (1273 specimens), Karoo (1181 specimens), Mapungubwe (411 specimens), Marakele (289 specimens), Mokala (444 specimens), Mountain Zebra (1344 specimens), Namaqua (1495 specimens), Richtersveld (925 specimens), Table Mountain (41 specimens), Tankwa Karoo (1354 specimens) and West Coast (61 specimens). The custodian of this collection was Dr Hugo Bezuidenhout (Plant Ecologist), and the current custodian is Dr Nthabeliseni Munyai (Plant-Herbivore Scientist). The oldest plant specimen (*Tetrachne dregei* Nees) in the KSAN collection was collected by A.M. Brynard in 1952 in Mountain Zebra National Park. Plant specimens from Garden Route National

Park (3450 in total) are housed in the GRNP Herbarium, which is managed by Johan Baard, who personally collected 1860 of the collection (Figure 1 and Figure 2). The oldest specimen in this collection is *Vernonia mespilifolia*, which was collected in 1923 by J.F.V. Phillips.

The Richtersveld Desert Botanical Garden Field Herbarium was originally established with 200 specimens, which were discovered in a storeroom by Pieter Van Wyk, who has managed and expanded the collection since 2013 to ~4000 specimens, with more than 90% collected by him. Over 50% of these voucher specimens are lodged as duplicates in national herbaria. The field herbarium was initiated to document ongoing research in the high mountains and quartz fields of the Richtersveld National Park. The oldest specimen in the collection, *Mesembryanthemum marlothii Pax*, was collected in 1987 by N. Jürgens. The Bolus Herbarium, along with the Compton Herbarium (NBG) and the National Herbarium of Namibia (WIND), has played an integral role in the taxonomy of the Richtersveld and northern Namaqualand flora. The BOL, together with the NBG and the National Herbarium of Namibia (WIND), has played an integral role in advancing the taxonomy of the Richtersveld and northern Namaqualand flora. Specimens collected from the Richtersveld have been compared against vouchers in these herbaria to ensure accurate identification, while duplicate vouchers are also housed in these herbaria to support long-term reference and curation.

South African National Parks herbaria contain valuable taxonomic information but require further curation, which is currently limited by expertise to validate identifications. Collectively, the SANParks herbaria include specimens collected from nine of South Africa's Biomes: Albany Thicket (166 specimens), Azonal vegetation (772 specimens), Desert (145 specimens), Forests (832 specimens), Fynbos (2571 specimens), Grassland (333 specimens), Nama Karoo (844 specimens), Savanna (14838 specimens) and Succulent Karoo (2498 specimens). The plant families with the highest representation of taxa, including species, subspecies and varieties, in the collections from across the parks are Asteraceae (785 taxa), Fabaceae (608 taxa), Poaceae (479 taxa), Aizoaceae (281 taxa) and Malvaceae (219 taxa). Additionally, the collections include 203 alien, 13 critically endangered, 53 endangered, 110 vulnerable and 73 rare taxa.

Each plant specimen is mounted on a standard herbarium sheet, and a label is attached with all relevant bio-ecological data recorded at the time of collection. This includes taxa name,

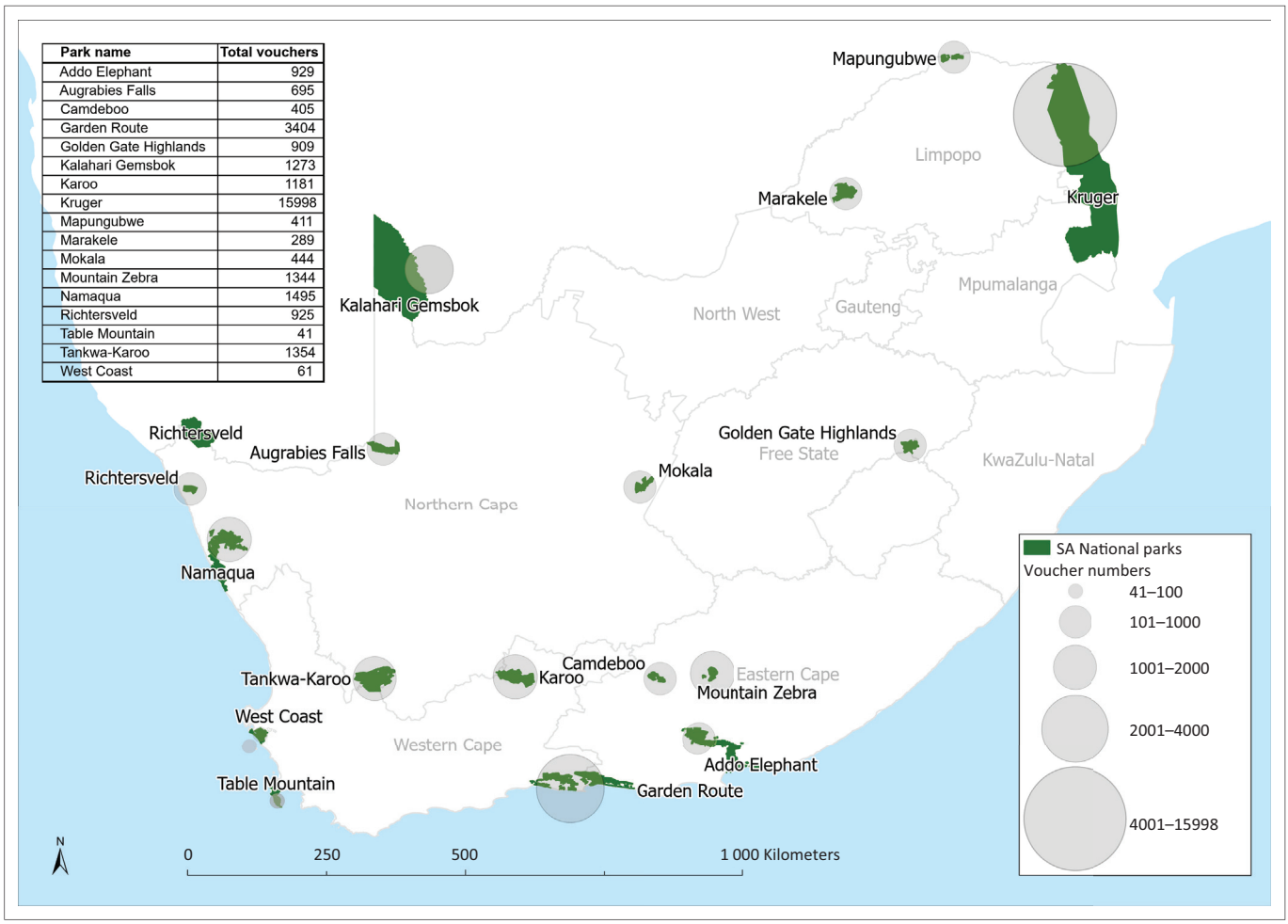
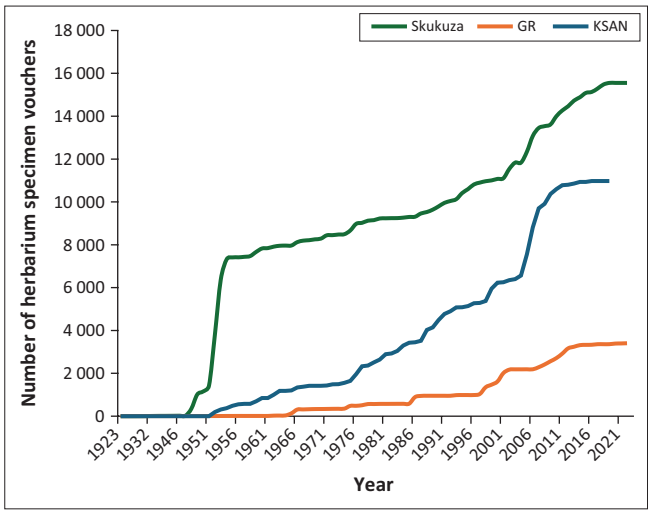


FIGURE 1: Number of herbarium voucher specimens collected per South African National Park between 1923 and 2020.



GR, Garden Route; KSAN, Kimberley South African National Parks.

FIGURE 2: Accumulation of herbarium voucher specimens over time for the Skukuza, Garden Route and Kimberley South African National Parks herbaria.

collection date, collector's name and number, locality coordinates since the advent of Global Positioning System (GPS) or quarter degree square values (pre-GPS), as well as other pertinent habitat details. The pressed plant specimens are housed in either standard steel or wooden herbarium cabinets.

Management of South African National Parks herbarium data

Several measures are necessary to ensure that biodiversity data remain comprehensible, high-quality, accessible and usable into the future (Costello & Wieczorek 2014). The method used to identify species should be clearly indicated on voucher specimens, with identification references properly cited. Taxa names should be verified against authoritative taxonomic checklists, such as the International Plant Names Index (IPNI; www.ipni.org) or the taxonomic backbone of the GBIF. Duplicate voucher specimens should be deposited in well-curated natural history collections, and their associated data should be digitised (Costello & Wieczorek 2014).

Information from herbarium voucher specimens housed in SANParks herbaria have been transcribed into Microsoft Excel by curators, herbarium assistants, environmental monitors (EMs) and honorary rangers. The KSAN herbarium was digitised between 1991 and 2024 by herbarium assistants and a skilled EM – Hugo Bezuidenhout (Curator), Fayeriel Moolgie, Michelle Harck, Olivia Pekeur, Ernest Daemane, Lufuno Munyai and Letlhogonolo Mokopelo. The Garden Route Herbarium data were transcribed primarily by two honorary rangers, Bets and Paul Kerr, from 2022 to 2023. The Richtersveld Desert Botanical Garden Field Herbarium data were transcribed by the curator and the nursery staff. For specimens that have been identified, human errors have occurred during the data transcription process. Common errors include incorrect spelling of species names, entry of coordinates in inconsistent formats and irregular formatting of date and units of measurement. The datasets also include inconsistent use of place names with a mix of Afrikaans and English place names (e.g. *Elandsbosrivier* vs Elandsbos River).

All SANParks herbaria are catalogued using the genspec number from Germishuizen and Meyer (2003), a unique code for each genus, to organise specimens for easy access. In the KSAN herbarium, specifically, the specimens are stored in genus folders according to genspec code in cubicles and specific cabinets for different parks. The Garden Route Herbarium arranges specimens beginning with mosses and ferns, followed by monocotyledons and dicotyledons according to genspec numbers. The Richtersveld field herbarium currently stores its specimens in three wooden cupboards and are yet to be labelled. While data from the KSAN, Garden Route and Richtersveld herbaria have primarily been captured in Microsoft Excel, the Skukuza Herbarium data were stored in Excel and imported into BRAHMS 7 (Botanical Research and Herbarium Management System) in 2018. It is anticipated that the Richtersveld herbarium data will eventually be uploaded to the IrisBG Collection Management collection management database (https://irisbg.com/). IrisBG Collection Management is widely adopted by botanical gardens, arboreta, herbaria and private estates for managing and sharing plant collection data globally (https://irisbg.com/).

Extensive data cleaning has been undertaken across these datasets. This includes updating place (locality) names in the Skukuza herbarium dataset using *Place Names in the Kruger National Park* by Kloppers and Bornman (eds. 2005), replacing abbreviations with full terms, converting imperial to metric measurements (e.g. miles to kilometres) and standardising units of measurement to centimetres (replacing mixed units: mm, cm, m and inches), validating and correcting coordinates and dates for outliers and inconsistencies and correcting typographical errors in taxon names, including spelling and capitalisation. Additionally, work has been completed to match taxon names to the 2023 South African National Plant Checklist (SANBI 2023) and allocating information to appropriate fields when data had been lumped or incorrectly entered.

In 2022, a project was initiated to photograph each herbarium voucher specimen in the Skukuza Herbarium following a standardised imaging protocol, made possible through funding from the KwaZulu-Natal and Bankenveld Honorary Rangers. The imaging setup included a Godox lightbox, Canon Powershot SX70 HS camera and colour checker. Training was provided by a specimen imaging specialist to ensure that the image quality met the NSCF protocols, which are based on global best practices (see De la Hidalga et al. 2020). With assistance from the Bankenveld Honorary Rangers, a trial run was conducted in March 2023 to test the setup. Further imaging is planned but has not yet been undertaken.

Challenges with the management of South African National Parks' herbarium data

In addition to the limited contribution of newly collected specimens to the SANParks herbaria, a major challenge lies in limited capacity to accurately identify new specimens. For example, fynbos specimens from the Garden Route had to be sent to the Compton and Pretoria National Herbaria for identification. Alien invasive species from the Garden Route have similarly been sent to the National Herbarium in Pretoria. However, the capacity of SANBI to identify plant species has declined in recent years following the retirement of key taxonomic experts and the limited expertise among remaining staff. As a result, many herbarium vouchers remain unidentified or are only identified to genus level. To address this problem, Richtersveld herbarium voucher specimens have been identified by Pieter van Wyk with assistance from external specialists.

Maintenance of the physical herbarium collections also presents ongoing challenges. Pest control has proven difficult: mothballs were previously used until their carcinogenic risks were recognised. Vapona strips, containing the active ingredient dichlorvos (DDVP), and Phostoxin (aluminium phosphide) were later used, although both were discontinued because of hazards in public buildings. While dedicated curators oversee the Skukuza and Richtersveld Desert Botanical Garden Field herbaria, the KSAN and Garden Route herbaria currently lack such roles. Until now, specialist botanists have championed the curation of these collections, but both are retiring in the near future. Proper care and curation of the collections are essential, as specimens are vulnerable to threats such as fire, as plant specimens are packed in flammable paper, as well as being fragile, prone to insect attack, water, fluctuations in relative humidity and temperature, light exposure, pollutants and theft (Bromberg 2020; Cantrill 2018). Mishandling and improper storage practices further lead to specimen degradation (Graham 2018). For example, a study of Brazilian herbaria showed that a portion still lacked basic fire prevention measures, such as fire extinguishers and smoke detectors (Cantrill 2018). South African National Parks herbaria face similar challenges because of budget constraints and limited resources, making it difficult to improve storage conditions or regulate temperature and relative humidity.

Applications of South African National Parks herbarium collections

Voucher specimens from the SANParks herbaria have contributed to a number of outputs (see Appendix 1), including the development of plant checklists for Kruger National Park (Macdonald & Gertenbach 1988; Van der Schijff 1968), the Garden Route (Baard & Kraaij 2014), Golden Gate Highlands (Daemane, Van Wyk & Moteetee 2010) and other national parks (Spear et al. 2011), as well as checklists for broader geographic areas, for example, Greater Griqualand West area (Van Staden et al. 2020).

South African National Parks herbarium records have also been used to obtain distribution records (Bester et al. 2012; Frisby et al. 2019; Siebert & Struwig 2019; Williams, Falcão & Wojtasik 2011), assist with species identifications (Baard, Kraaij & Cowell 2015; Herman 2005) and conduct taxonomic investigations (Stinca & Mei 2019). Additionally, botanists have visited the Skukuza Herbarium multiple times to obtain distribution and morphological data for tree species in Kruger National Park. These efforts contributed to the development of a photographic reference library, now hosted on a dedicated website, which assists in the identification of tree species in the park.

Herbarium records in the Skukuza herbarium have also been used to inform researchers from universities, for example, providing locality information for work on *Barleria* species. The Richtersveld field herbarium has been used for taxonomic revisions, ecological research, monitoring and identifications. The search and collection of plants for herbarium specimens have led to the discovery of new plant species in the Richtersveld.

Future of the South African National Parks herbaria

Data sharing forms a critical component of increasing the visibility and utility of herbarium records in support of conservation efforts. The NSCF will be assisting SANParks with the imaging of voucher specimens of the KSAN Herbarium in the near future. The end goal is to ensure global accessibility to SANParks herbarium specimen images and their associated bio-ecological data.

To achieve this, images and records will be made available on online platforms such as the GBIF, Biodiversity Advisor (developed by SANBI: Daly & Ranwashe 2023) and the SANParks Biodiversity Information Management System (BIMS). Records from the Skukuza and KSAN herbaria have recently been uploaded to GBIF and will soon be accessible via BIMS and Biodiversity Advisor. It is hoped that this increased accessibility will encourage the use of SANParks herbarium data by researchers and conservation practitioners to inform scientific research and decision-making for biodiversity management.

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Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors' contributions

D.S. conceived the original idea. N.S. and D.S. drafted the manuscript with input from H.B., J.B. and P.v.W., J.B., N.L., K.B. and M.M. curated the data and developed the visual outputs. D.S., N.S., H.B. and J.B. reviewed and edited the manuscript and everyone approved the final version for submission and publication.

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Data availability

The data that support the findings of this study are available from the corresponding author, N.S., upon reasonable request.

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Appendix 1

APPENDIX 1: List of peer-reviewed contributions of the three South African National Parks herbaria and active field herbarium.

Contribution of herbarium to study	Reference
Garden Route National Park Herbarium	
Checklist development	Baard, J.A. & Kraaij, T., 2014, 'Alien flora of the garden route National Park, South Africa', *South African Journal of Botany* 94, 51–63. https://doi.org/10.1016/j.sajb.2014.05.010
Species identifications	Kraaij, T. & Baard, J.A., 2019, 'Use of a rapid roadside survey to detect potentially invasive plant species along the Garden Route, South Africa', *Koedoe: African Protected Area Conservation and Science* 61(1), 1–10. https://doi.org/10.4102/koedoe.v61i1.1515
Kimberley South African National Parks Herbarium	
Checklist development	Daemane, M.E., Van Wyk, B.E. & Moteetee, A., 2010, 'Checklist of ferns and seed plants of the Golden Gate Highlands National Park, South Africa', *Bothalia* 40(2), 205–218. https://doi.org/10.4102/abc.v40i2.222
Checklist development	Simelane, T., 2011, 'Are traditionally used resources within conservation areas a function of their sizes?', *Natural Resources* 2(2), 130. https://doi.org/10.4236/nr.2011.22018
Checklist development	Spear, D., McGeoch, M.A., Foxcroft, L.C. & Bezuidenhout, H., 2011, 'Alien species in South Africa's national parks: Checklist', *Koedoe: African Protected Area Conservation and Science* 53(1), 1–4. https://doi.org/10.4102/koedoe.v53i1.1032
New distribution records	Bester, S.P., Herman, P.P. & Klopper, R.R., 2012, 'National Herbarium Plant Collecting Programme reveals new country and provincial distribution records from South African National Parks (Apocynaceae, Asteraceae & Xanthorrhoeaceae: Asphodeloideae)', *Phytotaxa* 62(1), 44–56. https://doi.org/10.11646/phytotaxa.62.1.9
New distribution records	Bester, S.P., Steyn, H.M., Klopper, R.R. & Bezuidenhout, H., 2012, 'New plant records for Tankwa Karoo National Park, South Africa', *Koedoe: African Protected Area Conservation and Science* 54(1), 1–9. https://doi.org/10.4102/koedoe.v54i1.1066
Species identifications and new distribution records	Bester, S.P. & Steyn, H.M., 2013, 'Nemesia arenifera (Scrophulariaceae), a new species from the Sandveld, Northern Cape Province, South Africa, and the ectotypification of N. viscosa', *Phytotaxa* 126(1), 49–54. https://doi.org/10.11646/phytotaxa.126.1.6
Specimen examination	Frisby, A.W., Siebert, S.J., Struwig, M. & Cilliers, D.P., 2019, 'Plant endemism in Griqualand West, South Africa', *South African Journal of Botany* 124, 127–137. https://doi.org/10.1016/j.sajb.2019.03.041
Distribution records	Stinca, A. & Mei, G., 2019, 'Ehrharta erecta Lam. (Poaceae, Ehrhartoideae): Distribution in Italy and taxonomy of one of the most invasive plant species in the world', *BioInvasions Record* 8(4), 742–752. https://doi.org/10.3391/bir.2019.8.4.02
Checklist development	Van Staden, N., Siebert, S.J., Cilliers, D.P., Wilsenach, D. & Frisby, A.W., 2020, 'Floristic analysis of semi-arid mountain ecosystems of the Griqualand West centre of plant endemism, Northern Cape, South Africa', *Biodiversitas Journal of Biological Diversity* 21(5), 1989–2002. https://doi.org/10.13057/biodiv/d210526
Checklist development	Van Wyk, P., Bezuidenhout, H. & Jürgens, N., 2024, 'A checklist of indigenous flora in the Richtersveld National Park confirms high plant diversity in the arid north-western tip of South Africa', *Koedoe* 66(1), 1–10. https://doi.org/10.13057/biodiv/d210526
Checklist development	Pond, U., Beesley, B.B., Brown, L.R. & Bezuidenhout, H., 2002, 'Floristic analysis of the Mountain Zebra National Park, Eastern Cape', *Koedoe* 45(1), 35–57. https://doi.org/10.4102/koedoe.v45i1.18
Checklist development	Steyn, H.M., Bester, S.P. & Bezuidenhout, H., 2003, 'An updated plant checklist for Tankwa Karoo National Park', *South African Journal of Botany* 88, 247–251. https://doi.org/10.1016/j.sajb.2013.07.018
Checklist development	Van Rooyen, N. & Bezuidenhout, H., 1997, 'New records of flowering plants and ferns from the Kalahari Gemsbok National Park', *Koedoe* 40(2), 105–116. https://doi.org/10.4102/koedoe.v40i2.276
Checklist development	Zietsman, P.C. & Bezuidenhout, H., 1999, 'Flowering plant biodiversity of Augrabies Falls National Park: A comparison between Augrabies Falls National Park, Kalahari Gemsbok National Park, Vaalbos National Park, and Goegap Nature Reserve', *Koedoe* 42(2), 95–112. https://doi.org/10.4102/koedoe.v42i2.235
Skukuza Herbarium	
Checklist development	Van der Schijff, H.P., 1968, 'The affinities of the flora of the Kruger National Park', *Kirkia* 7(1), 109–120.
Checklist development	Macdonald, I.A.W. & Gertenbach, W.P.D., 1988, 'A list of alien plants in the Kruger National Park', *Koedoe* 31(1), 137–150. https://doi.org/10.4102/koedoe.v31i1.491
Specimen identification	Herman, P.P.J., 2005, 'RUBIACEAE', *Bothalia* 35(1), 84–87. https://doi.org/10.4102/abc.v35i1.380
Distribution records	Williams, V.L., Falcão, M.P. & Wojtasik, E.M., 2011, 'Hydnora abyssinica: Ethnobotanical evidence for its occurrence in southern Mozambique', *South African Journal of Botany* 77(2), 474–478. https://doi.org/10.1016/j.sajb.2010.09.010
Distribution records	Williams, V.L., Wojtasik, E.M. & Witkowski, E.T.F., 2011, 'Ethno-ecological evidence for Hydnora abyssinica occurring in Johannesburg and Durban traditional medicine markets', *South African Journal of Botany* 77(2), 268–279. https://doi.org/10.1016/j.sajb.2010.08.005
Specimen identification	Devine, A.P., Stott, I., McDonald, R.A. & Maclean, I.M., 2015, 'Woody cover in wet and dry African savannas after six decades of experimental fires', *Journal of Ecology* 103(2), 473–478. https://doi.org/10.1111/1365-2745.12367
Specimen identification and distribution records	Siebert, S.J. & Struwig, M., 2019, 'Borassus aethiopum Mart. (Arecaceae) in Limpopo province with a key to South African palms', *Bothalia-African Biodiversity & Conservation* 49(1), 1–6. https://doi.org/10.4102/abc.v49i1.2374
Richtersveld Desert Botanical Garden Field Herbarium	
Checklist development	Van Wyk, P., Bezuidenhout, H. & Jürgens, N., 2024, 'A checklist of indigenous flora in the Richtersveld National Park confirms high plant diversity in the arid north-western tip of South Africa', *Koedoe-African Protected Area Conservation and Science* 66(1), 1822. https://doi.org/10.4102/koedoe.v66i1.1822