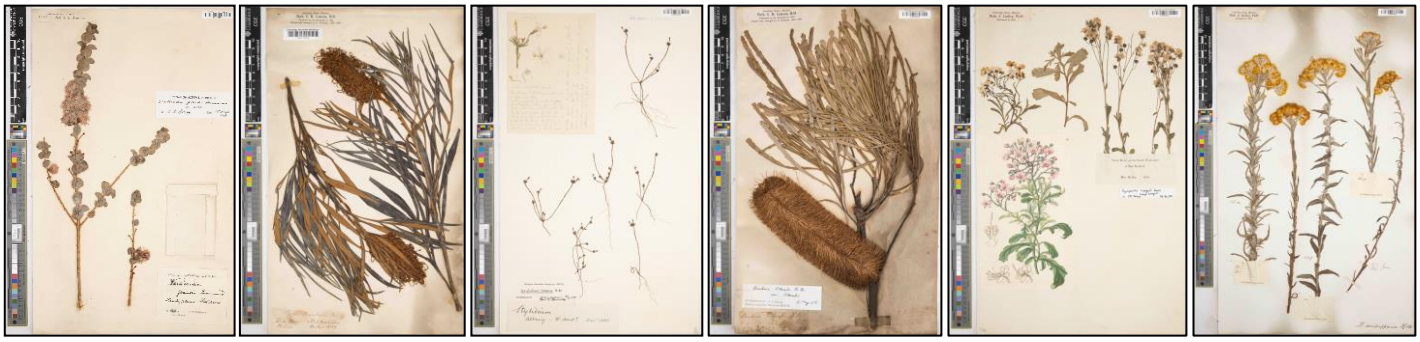
Mobilizing Australian historical and type collections at the Cambridge University Herbarium



Shelley A. James, 2023 Churchill Fellow

Department of Biodiversity, Conservation and Attractions,
Western Australian Herbarium

THE WINSTON CHURCHILL MEMORIAL TRUST

Winston Churchill Trust
Learn globally, inspire locally.

I acknowledge the Custodians of the lands and waters from where Australian plant collections have been gathered and are housed and pay respect to their Elders past and present.

THE WINSTON CHURCHILL MEMORIAL TRUST

Mobilizing Australian historical and type collections at the Cambridge University Herbarium

Report by Shelley A. James, Churchill Fellow

2023 Churchill Fellowship to mobilize Australian historical and type collections at the Cambridge University Herbarium

Signed..... Date 11/11/2024

Acknowledgements

I am indebted to the Winston Churchill Trust for their faith and willingness to support this amazing project. Many thanks go to Madeleine Garrett, Nicola Raymond, and Jessica Bujeya (FCM Travel) for their helpful assistance in making this Fellowship a success.

At the Cambridge University Herbarium, many thanks go to Sam Brockington, Lauren Gardiner (Curator), Amber Horning (former Collections Manager) and Maria Del Mar Pita for their support and allowing me to access the CGE collections. This project would not have been a success without Sally Loesch and volunteer Ella Boston, tirelessly imaging the collections as they came out of the vault and helping with image processing and online delivery. Thanks also go to several volunteers and interns (Preeya Kaushal, Lavender Lu, Tobias Fitzgerald, Emma Russell, and Christine Newell) for their assistance and enthusiasm. The administrative team at the University of Cambridge (Mark Devlin, Wendy Godfrey and staff in the Sainsbury Building) provided invaluable logistical support while in Cambridge, and for the Cambridge University Botanic Gardens for allowing me to stay in the wonderfully convenient and comfortable Superintendent's House.

I am extremely grateful to the Department of Biodiversity, Conservation and Attractions and the Western Australian Herbarium team for allowing me to take time away from the office to fulfill this project. John Huisman and Marco Duretto provided encouragement from the inception of this project idea, and I thank them for their continuing support. Thanks also go to the Australian botanical community, and particularly the Managers of Australasian Herbarium Collections (MAHC) and Council Heads of Australasian Herbaria (CHAH) for contributing to the project. Support was received from the Society for the Preservation of Natural History (SPNHC) and Biodiversity Information Standards (TDWG) to attend the SPNHC-TDWG 2024 conference held in Okinawa, Japan, at which this project was shared with international natural history collections and biodiversity data communities.

I look forward to working further with the Atlas of Living Australia (ALA) team, and in particular Ely Wallis, Peggy Norton and Niels Klazenga, to make these invaluable specimens available online for the Australian community. The continued support of ALA in providing infrastructure and resources for this project is greatly appreciated.

Finally, many thanks to my parents for their ongoing and limitless support for everything I do.

Department of **Biodiversity, Conservation and Attractions**

Western Australian Herbarium

Biodiversity and **Conservation Science**

UNIVERSITY OF CAMBRIDGE

Cambridge University
HERBARIUM
Department of Plant Science

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Introduction

From the earliest days of Australian colonization and exploration, botanical specimens have been sent to herbarium collections overseas for western scientific study. Where there is a duplicate set, specimens have been repatriated back to Australia with time, but many specimens remain housed overseas. These specimens document the floral diversity of Australian ecoregions that may have now been altered, and in some cases of species that have not been formally described and may now be lost to our ecosystems. Many collections contain type specimens, the preserved specimen designated as a permanent reference for a new taxon, and others have historical exploration and botanical significance, yet are not readily available for taxonomic and cultural research. One herbarium holding such specimens is the Cambridge University Herbarium (CGE). CGE is the fourth largest herbarium in the United Kingdom (Gardiner, 2018) and was initially estimated in 2022 to contain more than 12,000 specimens of Australian origin not readily available physically or digitally for botanical study or informing conservation decision making within Australia. This preliminary assessment inspired this Winston Churchill Fellowship project, a collaboration between the Western Australian Herbarium (PERTH) and CGE, enabling Australian collections to be located, updated, digitized, mobilized, and shared – essentially decolonization and repatriation in digital form.

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Keywords

biodiversity collections, botany, decolonisation, herbarium, repatriation, taxonomy

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Executive Summary

From the earliest days of Australian colonization and exploration, botanical specimens have been sent to herbarium collections overseas for western scientific study. While some specimens have been repatriated back to Australia with time, many remain housed overseas. These specimens document the floral diversity of Australian ecoregions that today may have been altered, provide evidence of species potentially lost to our ecosystems, or may be of taxa not yet formally described. Many specimens are types, the preserved specimen designated as a permanent reference for a new taxon, and others have historical exploration and cultural significance, yet are not readily available for study. One herbarium holding such specimens is the Cambridge University Herbarium (CGE), the fourth largest herbarium in the United Kingdom (Gardiner, 2018).

A collaborative project between the Western Australian Herbarium (PERTH) and CGE, supported by the Winston Churchill Trust, enabled Australian collections to be located, updated, digitized, mobilized, and shared, enabling decolonization and repatriation in digital form. With only five weeks to undertake collection-based activities at CGE, efforts focused on the Australian vascular plant collections. These were systematically located and retrieved from the world collections of flowering plants and ferns, and from the John Lindley and Charles Fox Bunbury collections, which were stored separately from the world collections. Type specimens were placed within separate red folders for easy future identification and annotation. Barcodes were adhered to each sheet, and basic metadata was databased prior to imaging, including the country of origin, taxonomic name on the sheet, storage location, and type status. Later databasing captured information about the collector, collection date, collection number, locality information, and other collection metadata. Sheets were imaged using two Nikon D850 digital single-lens reflex cameras in lightboxes; image files were converted to 16-bit TIFF image files for archival storage, full-sized JPEGs, and 2MB JPEGs for online delivery.

As of September 2024, approximately 41% of the more than 14,100 digitized specimens have been fully transcribed. Preliminary findings include:

- More than 13,700 specimens of Australian origin are housed in CGE.
- The majority of the Australian collections are from Western Australia, Tasmania and New South Wales, with fewer collections from other Australian states and territories. About one third have no specific locality information.
- Collections are primarily from the 1800s and early 1900s, with dominant collectors being James Drummond, Ronald Gunn, William Philip Hiern, John Lhotsky, Joseph Jackson Lister, Sir Thomas Livingstone Mitchell, Georgiana Molloy, Fredrick Stimpson Salisbury, and William John Swainson.
- Prominent private collections owned by individuals and now housed in CGE include John Stevens Henslow, Charles Morgan Lemann, John Lindley, and Charles Edward Moss.
- More than 475 type specimens were located and digitized.
- 145 vascular plant families, 875 genera, and ca. 4,500 (many non-current) species are housed within the collections.

Transcription of label data and taxonomic curation is ongoing. Data and high-resolution images will be made available soon to the scientific community, historians, traditional owners and the public for study, data curation and annotation through the Atlas of Living Australia and other online digital platforms. Access to these specimens will be invaluable for botanical research in this age of accelerated biodiversity loss, and as travel to, or shipping of, physical specimens is increasingly fraught and costly.

Itinerary

6 June. 2024	7 June 2024		Travel to Cambridge, UK
8 June 2024	12 July 2024	Cambridge, UK	Cambridge University Herbarium, Cambridge, UK 47 Bateman Street, Cambridge, CB2 1LR herbarium@plantsci.cam.ac.uk Digitization project activities – five weeks
13 July 2024	27 July 2024	Madrid, Spain	Conference: XX International Botanical Congress https://ibcmadrid2024.com/ Presentations about Churchill Fellowship project. Attended both scientific sessions and the nomenclatural section (during which the rules governing the naming of plants are decided).
23 July 2024	23 July 2024	Madrid, Spain	Real Jardín Botánico Plaza de Murillo 2, Madrid, Madrid 2801, Spain Visit herbarium to study Australian collection holdings (about 60 specimens annotated) and discuss collections management with staff.
30 July 2024	1 Aug. 2024		Travel to Australia

Main Body

In June and July 2024, Dr. James travelled to Cambridge, UK to spend five weeks working in the Cambridge University Herbarium (CGE) collections. The herbarium is located in the lower level of the Sainsbury Building of the University of Cambridge, adjacent to the Cambridge University Botanic Gardens (Figure 1, 2).

Figure 1. University of Cambridge, Sainsbury Building, housing the Cambridge University Herbarium.

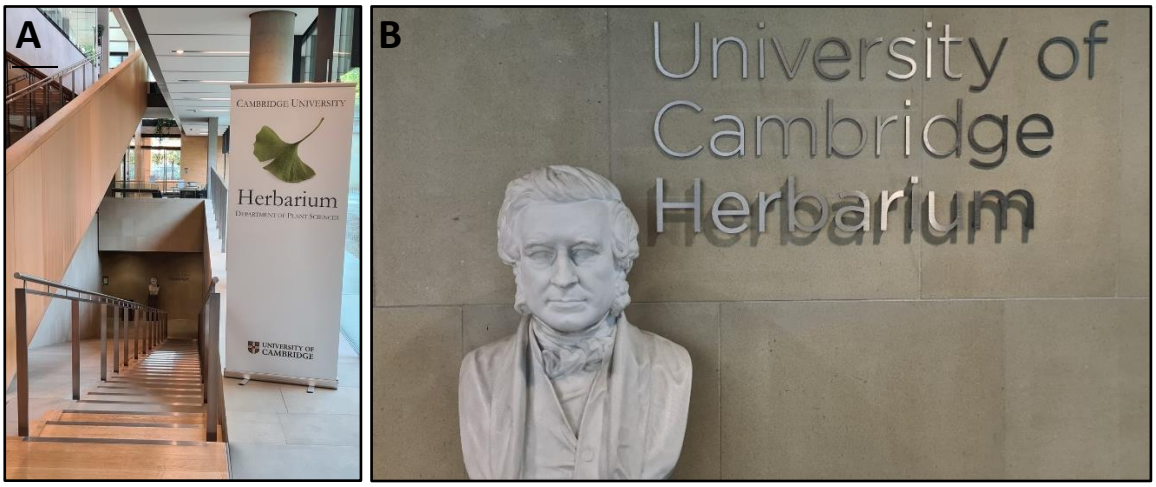

Figure 2. A) Entrance to the Cambridge University Herbarium (CGE). B) Bust of John Henslow, entrance to CGE.

Methods

With limited time in the physical collections, the digitization effort focused on the Australian vascular plant collections. These were located in the world collection of flowering plants (Figure 3) and fern collection which were both geographically arranged (Figure 4A). The collections of John Lindley (Figure 4B) and Charles Fox Bunbury not incorporated into the world collection were taxonomically arranged (i.e., Australian specimens were not stored in separate folders) and stored in separate storage areas (Figure 3). Occasionally, Australian species cultivated in botanic gardens or specimens from New Zealand or the Pacific region were housed with Australian collections. In this case, all specimens within the folders were opportunistically digitized. Taxonomically, the collections were

arranged according to Bentham and Hooker (1862-1883). The already separated type collection (Figure 5) was not a target for the project.

Figure 3. Vault of the Cambridge University Herbarium and the collection storage compactus. The world collection is located to the left with the Lindley and Bunbury collections housed separately at the far end. The United Kingdom and European collections are housed to the right.

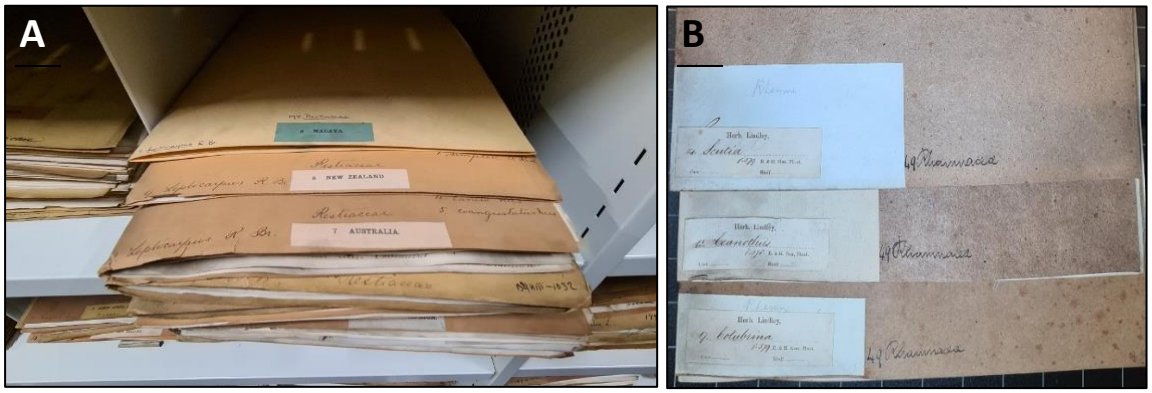

Figure 4. Examples of the arrangement of the collections in the CGE. A) World collection geographically arranged, and B) Lindley collection, taxonomically arranged.

Figure 5. Type specimen collection,
as indicated by the red folders, housed in CGE.

Curation of specimens was limited to significant repairs and incorporation of unfiled specimens into the collections, along with cleaning of some of the sheets (Figure 6). Specimens were extracted from the collection compactus storage units for digitization (Figure 7A). Unincorporated specimens in other storage areas were also located and digitized, resulting in the majority of Australian specimens being incorporated into the world collection. Type specimens were identified and placed within red 'type' folders for easy future identification, annotation and storage in the type collection. Barcodes were adhered to each sheet (Figure 7B) giving each specimen a unique identifier (CGEXXXXXXX); where two unique specimens were identified on a sheet, two barcodes were assigned but where more than two specimens were identified, only a single barcode was applied and each specimen given a letter annotation (CGEXXXXXXX_a, CGEXXXXXXX_b, etc.). Basic metadata was databased prior to imaging, including taxonomic name on the sheet, storage location, country of origin, and type status.

Figure 6. Example of curatorial cleaning undertaken by volunteers on several historical sheets covered with soot and dirt. The vulcanized rubber to the top of the image used in cleaning are cream-coloured when fresh.

Figure 7. A) Dr James retrieving specimens in the CGE vault compactus. B) Barcoding specimens and databasing basic metadata found on the specimens.

Sheets were imaged using two Nikon D850 45.7MP digital single-lens reflex (DSLR) cameras in lightboxes (Figure 8). RAW files were converted to 16-bit TIFF for archival storage, full-sized JPGs, and 2MB JPGs for online delivery. These images are available on the Cambridge University Herbarium publicly-accessible server, and can be retrieved using the URI https://gbifimages.plantsci.cam.ac.uk/australia/CGExxxxxxxx.jpg (e.g., https://gbifimages.plantsci.cam.ac.uk/australia/CGE00010782.jpg).

Post imaging, the second transcription step from the images involved the databasing of further metadata (if present), including collector, collection date, collection number, locality information, and any other collection information.

Figure 8. Ella Boston (left) and Sally Loesch (right) imaging the Australian CGE sheet specimens.

Preliminary findings

During the five weeks spent at CGE, almost 14,080 specimens were digitized, and as of September 2024, the data of more than 5,850 collection items have been fully transcribed. The findings described below are primarily based on these transcribed records.

More than 13,700 Australian collection items were retrieved from the CGE vault, databased and imaged. For Australian collections, the majority of specimens were gathered from Tasmania and Western Australia along with New South Wales (Figure 9), but more than 30% of collections are flagged simply as, for example, New Holland, or have no specific data and will require further research to add precision to the locality description. Due to the arrangement of the collections, New Zealand (ca. 250 specimens), horticultural specimens of Australian taxa (>100 specimens), and a few Pacific specimens were also digitized. The majority of collections are from the 1800's and early 1900's (Figure 10).

Scientific illustrations have been found on more than 40 specimen sheets.

There were several prominent personal collections incorporated into CGE containing Australian material (Gardiner, 2018):

- **John Stevens Henslow** (1796–1861; https://www.wikidata.org/wiki/Q703925), the fourth professor of botany in Cambridge, beginning 1825. He received many specimens as a result of his connections to other members of the British scientific community of the age.
- **Charles Edward Moss** (1870–1930; https://www.wikidata.org/wiki/Q5077291), curator of CGE in 1907.
- **John Lindley** (1799-1865; https://www.wikidata.org/wiki/Q378629) whose collection was purchased 1866, excluding the orchids.
- **Charles Morgan Lemann** (1806-1852; https://www.wikidata.org/wiki/Q19661416) whose herbarium was donated to CGE in 1852 after curation by George Bentham (1800-1884; https://www.wikidata.org/wiki/Q731808).

The top 10 collectors to date include:

- **Ronald Gunn** (1808-1881) who collected primarily in Tasmania (https://www.wikidata.org/wiki/Q4133320).
- **James Drummond** (1787-1863) who collected in Western Australia (https://www.wikidata.org/wiki/Q2589989).
- **Georgiana Molloy** (1805-1843; https://www.wikidata.org/wiki/Q5548105) was the most prominent female (of the three women collectors represented), collecting in the Vasse region of Western Australia.
- **Frederick Stimpson Salisbury** (1877-1976; https://www.wikidata.org/wiki/Q113446581), **Joseph Jackson Lister** (1857-1927; https://www.wikidata.org/wiki/Q1707314) and **Wiliam Philip Hiern** (1839-1925; https://www.wikidata.org/wiki/Q3568881) collected in Australia in the late 1800's and early 1900's. These collections are not represented as duplicate specimens in Australian herbarium collections.
- **Sir Thomas Livingstone Mitchell** (Major Mitchell) (1792–1855; https://www.wikidata.org/wiki/Q2142133), the Scottish surveyor and explorer of south-eastern Australia.
- **Allan Cunningham** (1791-1839; https://www.wikidata.org/wiki/Q545888), British botanist and explorer, circumnavigating Australia and botanizing New South Wales.
- **Sir Joseph Dalton Hooker** (1817–1911; https://www.wikidata.org/wiki/Q157501), former director of the Royal Botanic Gardens, Kew.
- **Samuel Mossman** (1850-1880; https://www.wikidata.org/wiki/Q88840470) who collected primarily in New South Wales.

Other collectors of interest include **William John Swainson** (1789-1855; https://www.wikidata.org/wiki/Q444164) who illustrated several of his collections, the Austrian collectors **John Lhotsky** (1795-1866; https://www.wikidata.org/wiki/Q9012388) and **Johann Preiss** 1765-1850; https://www.wikidata.org/wiki/Q21389723), and **Barron Field** (1786-1846) who was a judge and poet in the colony of New South Wales (https://www.wikidata.org/wiki/Q4863806).

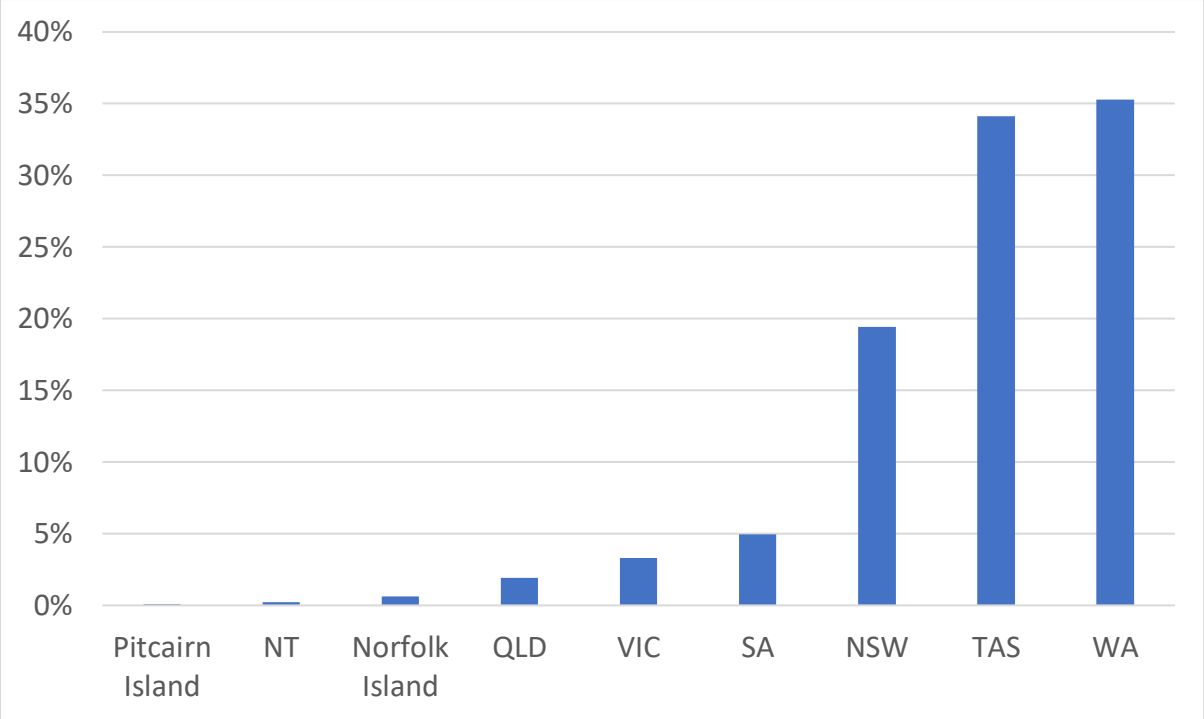

Figure 9. Percentage of the total number of Australian specimens (as of September 2024) from Australian states and territories and Pitcairn and Norfolk Islands.

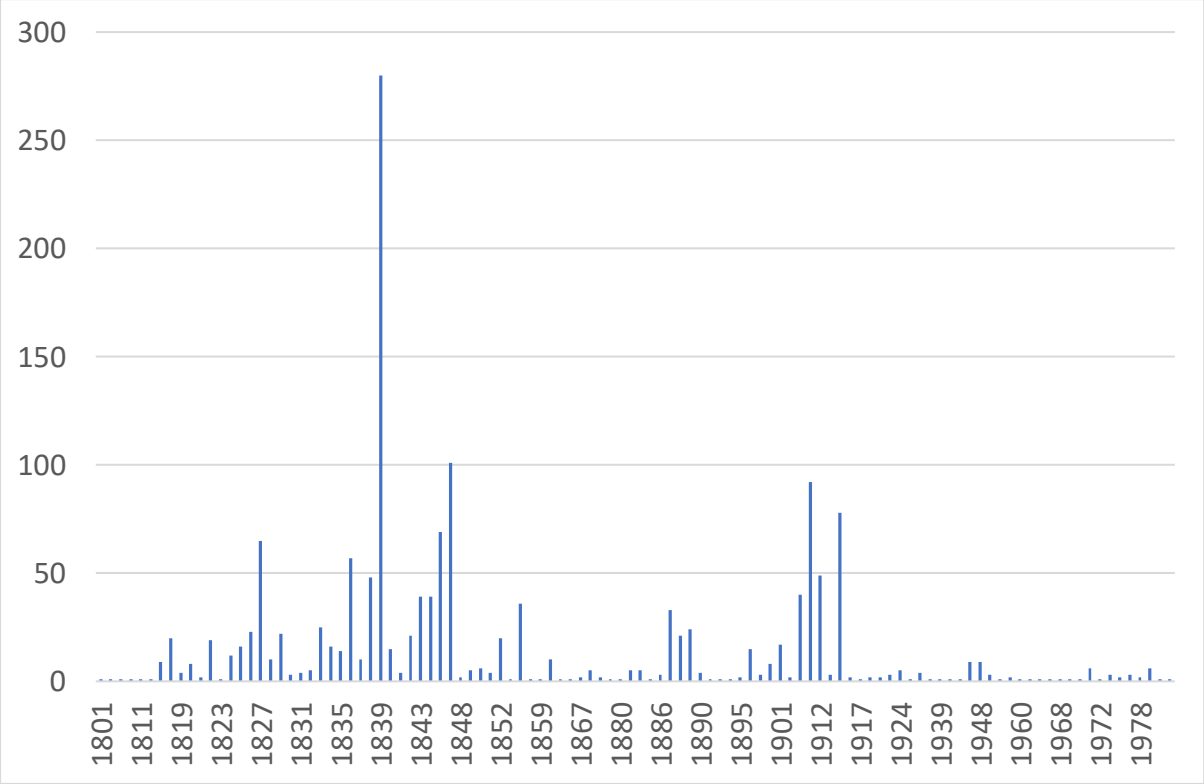

Figure 10. Number of Australian collections at CGE gathered per year (as of September 2024).

More than 470 type specimens were located and digitized. This number will increase with further verification and research on the collection. Approximately 15% of the vascular flora of Australia was represented in the collections. More than 145 vascular plant families, 875 genera and 4,500 species (many non-current) were digitized. The nomenclature and taxonomy are currently being updated along with completion of the transcription of collection label data. Unique Wikidata identifiers (https://www.wikidata.org/wiki/Wikidata:Main_Page) are being assigned to each of the individuals (collectors, determiners) found in the collections for future ease of linking their work through projects such as Bionomia (https://bionomia.net). It is expected that the transcribed data will be delivered to the Atlas of Living Australia (https://www.ala.org.au) by the end of 2024.

The volume of images generated by this project resulted in CGE implementing a more sustainable cloud data storage solution, rather than relying on external storage hardware. Access to specimen data and images is already being requested for botanical research projects.

Other relevant activities

Several social media posts were published during the Fellowship (Appendix 1).

At the completion of the collections work at Cambridge, Dr James attended the XX International Botanical Congress in Madrid, Spain, participating in both the nomenclatural section (15-19 July 2024) and scientific sessions (21-27 July 2024). During the nomenclatural section, more than 433 proposals to amend the International Code of Nomenclature for algae, fungi, and plants were discussed and approved or rejected. Dr James represented three institutions, namely the Western Australian Herbarium, Kings Park and Botanic Gardens, and Murdoch University in institutional voting.

The project was also presented at two conferences: the 2024 International Botanical Congress in Madrid, Spain (James et al. 2024a; Appendix 2, 3), as a poster presentation and in the symposium entitled “The role of research infrastructure to advance botanical knowledge and research” (James et al. 2024d; Appendix 3); and at the Society for the Preservation of Natural History Collections and Biodiversity Information Standards joint meeting (SPNHC-TDWG 2024) in Okinawa, Japan in September 2024 (James et al. 2024b, 2024c).

Conclusions and Recommendations

Access to the CGE specimens will be invaluable for botanical research in this age of accelerated biodiversity loss, and as travel to, or shipping of, physical specimens is increasingly fraught and costly. The repatriation of data and images of botanical collections from international institutions is an invaluable step in the decolonization process, providing a conduit for the sharing of historical collections 'acquired' from Australia. Most of the specimens at CGE are not duplicated in Australia, and the opportunity to see and study the physical collections is not something afforded to scientists or cultural practitioners, let alone the Australian public. This project aims to rectify this, with the data and images directly contributing to the documentation and visualization of the botanical collections made during the colonial and post-colonial eras of Australia. Scientifically, the data and images will contribute nationally to the work documenting the flora of Australia. Collaborative curation of this international collection by Australian botanical specialists will benefit biodiversity and conservation science, especially given the limited funding for taxonomy (the description and naming of plants).

Recommendations arising from this project include:

- Advocacy and creation of funding sources or philanthropic support within Australia for similar digital repatriation projects at other international institutions.
- Increased collaboration between Australian and international herbarium communities to accelerate the digital repatriation and curation of botanical specimens not readily accessible for scientific and cultural study in Australia.
- Support within the Australian scientific community to assist with the curation of specimens housed internationally, for species discovery and documentation, and to benefit all Australians.

Dissemination and Implementation

Once initial data transcription and cleaning of the collection metadata is completed, data and high-resolution images will be made available to the scientific community, historians, traditional owners and the public for annotation and data curation, and use, through the Atlas of Living Australia and other online digital platforms. Much help is needed to curate and improve the collection data, provide taxonomic identifications for specimens, and help to identify type specimens and collectors from handwriting on the labels. For this, the scientific botanic and library and archive communities will be engaged in the near future to assist with further curation of the data and ultimately the physical specimens. The data will also be incorporated into the CGE database, and further shared with data aggregators such as the Global Biodiversity Information Facility (GBIF - https://www.gbif.org/).

This project was conceived as a seed project for accelerating the digitization of internationally housed Australian and Australasian botanical collections. Opportunities for undertaking similar projects at other institutions are being explored. It is anticipated that the success of this project will inspire other international herbaria to collaborate in the mobilization of their Australian specimens.

Glossary/Abbreviations/Definitions

ALA – Atlas of Living Australia (https://www.ala.org.au/)
CGE – Cambridge University Herbarium
CHAH – Council Heads of Australasian Herbaria (https://chah.gov.au/)
GBIF – Global Biodiversity Information Facility https://www.gbif.org/
JPEG (JPG) – Joint Photographic Experts Group (https://www.wikidata.org/wiki/Q27996264)
MAHC – Managers of Australasian Herbaria (https://chah.gov.au/managers-of-australasian-herbarium-collections/)
PERTH – Western Australian Herbarium (https://www.dbca.wa.gov.au/science/research-tools-and-repositories/western-australian-herbarium)
TIFF - Tagged Image File Format (https://www.wikidata.org/wiki/Q215106)
URI - Uniform Resource Identifier (https://www.wikidata.org/wiki/Q61694)

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James,' S.A., Loesch, S., Boston, E., Gardiner, L., and Horning, A. (2024b). Mobilizing International Australian Collections Locally for Global Benefit. SPNHC-TDWG 2024 Conference, Okinawa Japan. https://www.youtube.com/watch?v=MEtQPSvWuFg&t=42s

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Appendices

Appendix 1. Social media posts of the CGE digitization project.

Cambridge University Herbarium (...
@CUHerb

Welcome to visiting Churchill Fellow Shelley James of the Western Australia Herbarium. In just 2 weeks Shelley and the team have barcoded and imaged over 4,500 specimens from Australia and New Zealand, including over 160 type specimens! #WAHerbarium @ChurchillTrust @plantsci

8:53 pm · 21 June 24 · **275** Views

7 Likes

Cambridge University Herbarium (...
@CUHerb

At the end of week 3 of her Churchill Fellowship, Shelley James of the Western Australian Herbarium and our dedicated team of volunteers have barcoded and imaged 7,649 specimens, including all of the Myrtaceae family! #WAHerbarium @ChurchillTrust @plantsci

11:19 pm · 28 June 24 · **2,162** Views

5 Reposts **1** Quote **32** Likes **1** Bookmark

Cambridge University Herbarium (...
@CUHerb

Week 4 of work on the Australian collection with Shelley James of the Western Australian Herbarium has brought us past the 10,000 image mark, with 442 probable type specimens including these beautiful Verticordia and Darwinia. #WAHerbarium @ChurchillTrust @plantsci

11:26 pm · 05 July 24 · **1,227** Views

5 Reposts **23** Likes

Cambridge University Herbarium (...
@CUHerb

This week we say goodbye to Shelley James after 5 whirlwind weeks of digitisation. A huge congratulations to Shelley for a total of 13,887 Australian specimens imaged, including 472 probable type specimens & some beautiful illustrations. #WAHerbarium @ChurchillTrust @plantsci

10:37 pm · 12 July 24 · **1,306** Views

4 Reposts **29** Likes

Appendix 2. Poster presentation at the XX International Botanical Congress, Madrid, Spain, 2024. A) Poster. B) Digital display at the conference centre.

A

IBC2024 XX International Botanical Congress Madrid Spain

July, 21st - 27th, 2024 ibcmadrid2024.com • info@ibcmadrid2024.com

Ref. 613/956

Mobilizing international Australian historical and type collections – online activation!

Shelley A. James [1], **Sally Loesch** [2], **Ella Boston** [2], **Lauren Gardiner** [2], **Amber Horning**[3]

[1] Western Australian Herbarium, Dept of Biodiversity, Conservation and Attractions, Kensington, WA, Australia
[2] Cambridge University Herbarium, Cambridge, UK
[3] University of Colorado Boulder, Museum of Natural History - Botany Collection, Boulder, Colorado, USA

From the earliest days of Australian colonization and exploration, botanical collections have been sent to herbaria overseas for western scientific study. Where there is a duplicate set, collections have been repatriated back to Australia with time, but many specimens remain housed overseas. These specimens document the floral diversity of Australian ecoregions that have now been altered, and of species that have not yet been described and may now have been lost to our ecosystems. Many such collections are type specimens, and others have historical exploration and botanical significance, many of which are not readily available for taxonomic and cultural research. One such collection, the Cambridge University Herbarium (CGE), is the fourth largest herbarium in the United Kingdom and contains more than 13,800 specimens of Australian origin.

A collaborative project between the Western Australian Herbarium (PERTH) and CGE, supported by The Winston Churchill Memorial Trust, Australia, has enabled Australian collections to be located, updated, digitized, mobilized, and shared - decolonization and repatriation in digital form.

Preliminary findings:

- The majority of the Australian collections in CGE are from Western Australia, Tasmania, New South Wales, and South Australia with significantly fewer collections from other Australian states and territories.
- The majority of collections are from the 1800's and early 1900's, with dominant collectors being James Drummond, Ronald Gunn, William Philip Hiern, John Lhotsky, Joseph Jackson Lister, Sir Thomas Livingstone Mitchell, Georgiana Molloy, Fredrick Stimpson Salisbury, and William John Swainson.
- Charles Morgan Lemann (1806-1852), John Lindley(1799-1865), John Stevens Henslow (1796-1861) and Charles Edward Moss (1870-1930) are the prominent individual collections represented.
- Most specimens have little locality information.
- More than 450 type specimens have been located and digitized.
- More than 100 vascular plant families and 600 (many non-current) genera have been digitized to date.
- Transcription of label data and taxonomic curation is ongoing.

Methods:
With limited time, the digitization effort focused on the Australian vascular plant collections. These were systematically located in the CGE World collections of flowering plants and ferns (conveniently geographically arranged), and the Lindley collection.

Curation was limited to significant repairs and incorporation of loose specimens into the collections. Annotated Type specimens were placed within separate folders for easy future identification and curation. Barcodes were adhered to each sheet; where two unique gatherings were identified on a sheet, two barcodes were assigned. For sheets with more than two gatherings, a single barcode was applied with each gathering given a letter annotation. Basic metadata was gathered prior to imaging (taxonomic name on the sheet, storage location, type status).

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Access to these specimens will be invaluable for botanical research in this age of accelerated biodiversity loss, and as travel to, or shipping of, physical specimens is increasingly fraught and costly. Data and high resolution images will be made available soon to the scientific community, historians, and the public for curation and annotation and data curation through the Atlas of Living Australia and other digital platforms.

Acknowledgements: Many thanks to Sam Brockington and Maria Del Mar Millan Pita for their ongoing support for the project, and significant assistance by volunteers and interns (Preeya Kaushal, Lavender Lu, Tobias Fitzgerald, Emma Russell & Christine Newell) at CGE.

Questions? shelley.james@dbca.wa.gov.au

Cambridge University HERBARIUM Department of Plant Science

Department of Biodiversity, Conservation and Attractions Western Australian Herbarium

Biodiversity and Conservation Science

Winston Churchill Fellow Learn globally, inspire locally.


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Mobilizing international Australian historical and type collections – online activation!
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Preliminary findings:
Methods
Acknowledgements

Appendix 3. Abstracts submitted for and presented at the XX International Botanical Congress, Madrid, Spain, 2024.

Mobilizing international Australian historical and type collections - online activation!

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Category: Abstract

Track: Pending

Proposed Symposium Title: Mobilizing international Australian historical and type collections - online activation!

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Abstract:
From the earliest days of Australian colonization and exploration, botanical collections have been sent to herbaria overseas for western scientific study. Where there is a duplicate set, collections have been repatriated back to Australia with time, but many specimens remain housed overseas. These specimens document the floral diversity of Australian ecoregions that have now been altered, and of species that have not yet been described and may now have been lost to our ecosystems. Many such collections are type specimens, and others have historical exploration and botanical significance, all of which are not readily available for taxonomic and cultural research. The Cambridge University Herbarium (CGE) is the fourth largest herbarium in the UK, and contains an estimated 12,000 specimens of Australian origin. A collaborative project between the Western Australian Herbarium (PERTH) and CGE, supported by the The Winston Churchill Memorial Trust, Australia, will enable Australian collections to be located, updated, digitized, mobilized, and shared - decolonization and repatriation in digital form. Data and high resolution images will be made available to the scientific community, historians, and the public via a citizen science platform for curation and annotation by taxonomists and the public alike. Access will be invaluable for botanical research in this age of accelerated biodiversity loss, and as travel to, or shipping of, physical specimens is increasingly fraught and costly.

: 89, 82,

: citizen science, data repatriation, decolonization, digitization, historical collections

Innovation leading to new ways of knowing in Australian botanical collections and the Atlas of Living Australia

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Proposed Symposium Title: Innovation leading to new ways of knowing in Australian botanical collections and the Atlas of Living Australia

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Abstract:
Once thought of as static, collections are being reframed as resources whose potential goes beyond the physical entities held in herbaria. In Australia, novel projects are being undertaken in botanical collections, and the results can often be accessed through the Australasian Virtual Herbarium (AVH) and the Atlas of Living Australia (ALA) (https://www.ala.org.au/). The collections, AVH and the ALA together represent critical infrastructure for understanding Australia's biodiversity.

Many novel projects utilise advanced computing power, cloud-based storage, and analysis tools. For example, digitisation projects have been completed by organisations including the National Herbarium of NSW and the Australian National Herbarium, one of the CSIRO National Research Collections. These projects aim to go way beyond previous efforts in terms of sheer numbers and the scale of the operation required to deliver the result. Another activity is AusTraits, which compiles data across over 30,000 species and hundreds of traits. Collected data can be accessed on ALA species pages. Of particular interest in Australia is Indigenous knowledge recorded on herbarium sheets; unique and valuable information. Building community and collaborations to bring Indigenous knowledge and western science closer together is an active challenge for those working in Australian botany.

The Atlas of Living Australia provides a conduit for new information to be published online and made accessible. The aggregated data then provide even more opportunities for new knowledge to be generated, with tools to view, download and visualise information. Areas of future development in the ALA include work in biosecurity, including weeds and plant pests; better data about interactions, such as between plants and pollinators; and inclusion of genomic data.

Much that is new can be generated from specimens that may be old.

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: aggregated data, ALA, AVH, digitisation, extended specimen, traits