

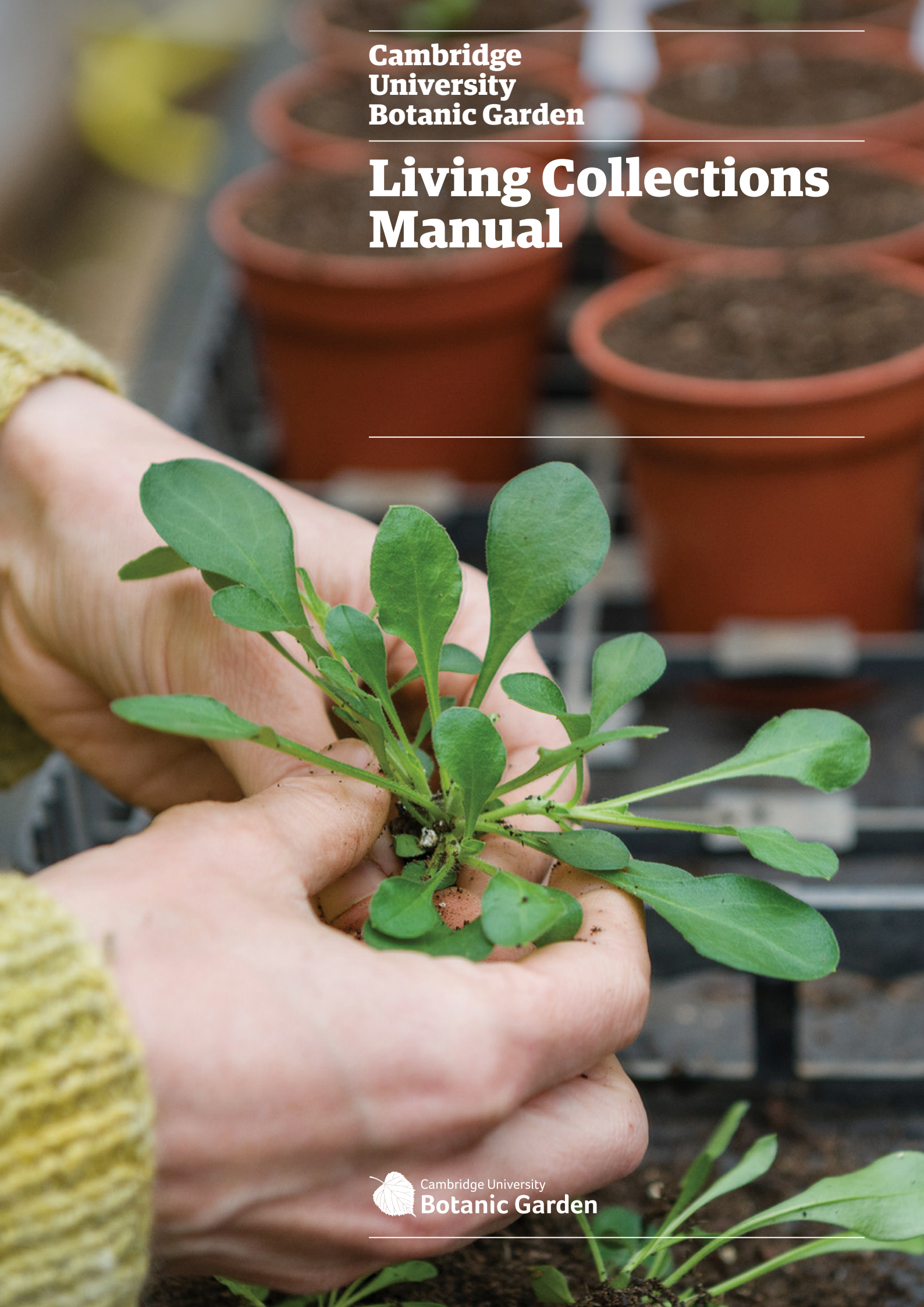
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**Cambridge  
University  
Botanic Garden**

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# **Living Collections Manual**

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# Acknowledgements

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The *Living Collections Manual* was initiated by Samuel Brockington, Curator, but has been brought to completion only through the dedication and sustained efforts of Margeaux Apple, Assistant Curator, who led its subsequent development, coordination and final production. Input for the content of the *Manual* was given through a series of discussions and meetings initially with the Curation Team and subsequently with input from all members of the Horticulture Team and 2022-2023 Trainee Programme. This document has drawn on the knowledge and expertise of these individuals and would not have been possible without each and everyone's involvement. We are grateful to Beverley Glover, Director for supporting and funding this initiative.

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# **Living Collections Manual**

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# Foreword

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The *Living Collections Manual* codifies the procedures that govern the curation and care of Cambridge University Botanic Garden's (CUBG) Living Collections. It serves as a comprehensive reference for current and future staff, outlining the decision-making frameworks that guide the management of the collection.

This manual reflects the aspirations of the horticulture and curation team to maintain the highest standards of documentation at CUBG. Given the close integration of horticultural practice and curatorial oversight, clearly communicating policies and procedures is essential to ensuring the integrity of our Living Collections records.

Created to promote continuity and a shared understanding of our work, this document also provides a valuable opportunity to review, consolidate, and refine our best practices. It is intended as a practical guide for all staff involved in managing the Living Collections, supporting smooth transitions in data stewardship and encouraging continual improvement. This is a living document; as we continue to scrutinize and improve our work, we will reflect those changes in updated versions of this document.

Though operational in scope, the manual is aspirational in spirit. It represents the culmination of decades of collective experience, years of planning, months of discussion, and days of editing.

We hope this manual will also benefit the broader botanical garden community – serving as a resource for comparing curatorial practices and sparking meaningful conversations that advance our shared mission.



**Samuel Brockington**  
Curator, CUBG

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20240379-A  
*Melaleuca spathulata*  
Myrtaceae  
Endemic to Western Australia

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# 1 Sourcing Material

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The plants that make up the Living Collections at CUBG are acquired to fulfil the institutional goals of supporting research and conservation, as well as educating and inspiring people about plants. Decisions around the sourcing of plant material drive the ethos and legacy of our Living Collections. The horticultural and curatorial staff that play a role in sourcing decisions consider the legal responsibilities and associated risks of acquiring plant material, as well as the institutional goals tied to our collection.



## 1.1

### Legal Responsibilities

We seek to curate a globally diverse collection. In order to successfully do so, all CUBG staff are reminded that genetic resources (i.e. plant material) must be obtained according to national and international laws, including, but not limited to:

- [Convention on International Trade in Endangered Species of Wild Fauna and Flora](#)<sup>1</sup>
- [Convention on Biological Diversity](#) and supporting legislation, i.e. [Nagoya Protocol](#) on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity<sup>2,3</sup>
- *International Treaty on Plant Genetic Resources (ITPGR)*<sup>4</sup>
- *Guidance from the UK Government on Invasive non-native (alien) plants*<sup>5</sup>

In addition, CUBG emphasises that national regulations may take precedence over international conventions and protocols. It is therefore necessary to take particular care and appropriate due diligence when sourcing genetic resources directly from the country of origin, taking note of any nation-specific regulations. CUBG cannot accession into its collections genetic resources that have been collected without appropriate due diligence.

## 1.2

### Institutional Priorities

The [Living Collections Strategy](#) launched in 2020 informs eight acquisition strands for bringing new material into our collections.<sup>6</sup> CUBG staff sourcing new material consider the following eight strands prior to acquisitions:

- Early diverging lineages
- Wild-collected taxa
- Missing families
- Threatened species
- Species representation
- Temperate hotspots
- Plant-human interface
- Native flora

## 1.3

### Types of Sources

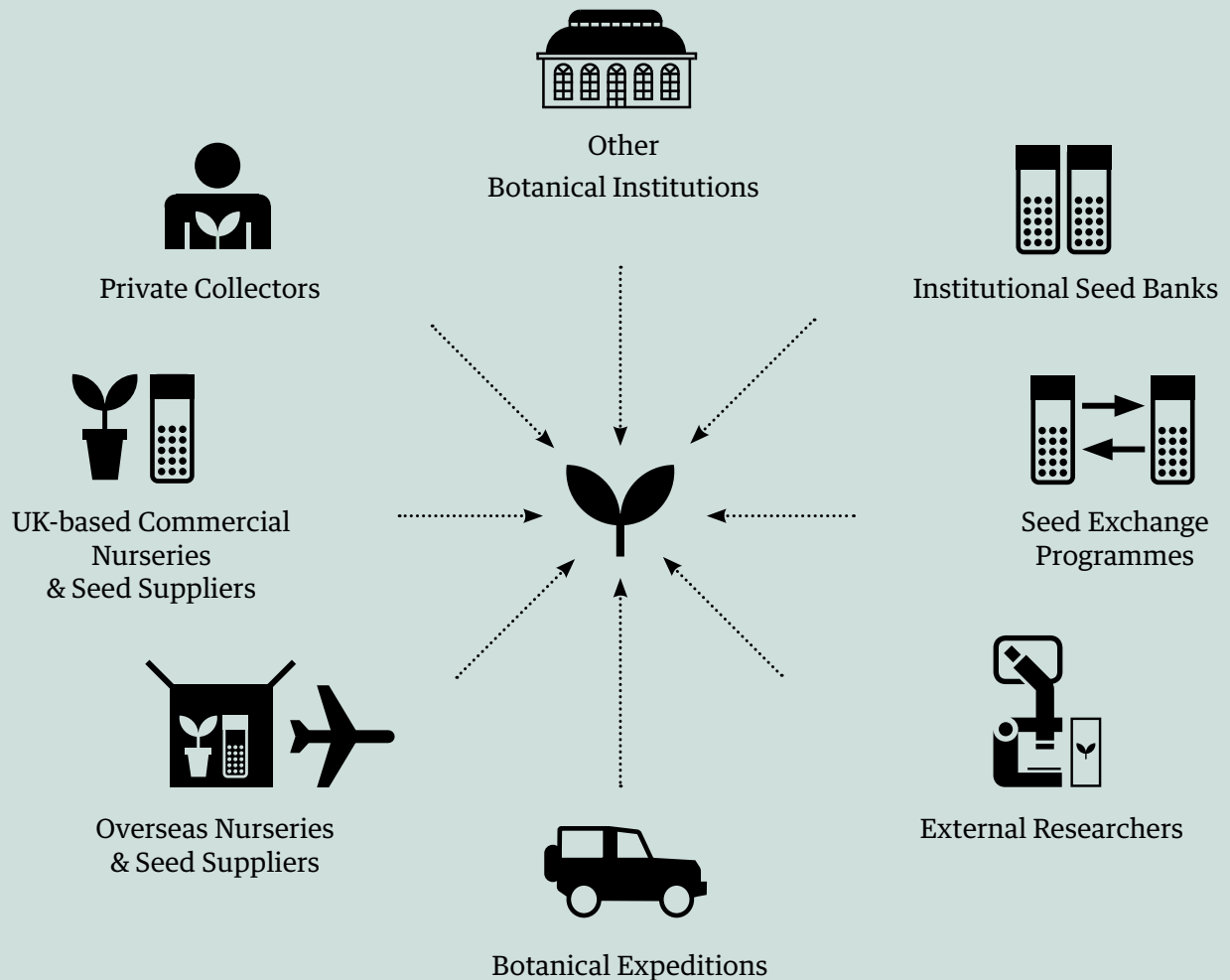
CUBG acquires genetic resources from sources including:

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**Sourcing Material**


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Gifts and bequests are accepted into the Living Collections on a case-by-case basis. Such acquisitions are subject to careful consideration and CUBG reserves the right to accept or decline such acquisitions.

## 1.4

### Prioritising Sources – Opportunities & Risks

Opportunities offered in the sourcing of new material include adding taxonomic and geographic diversity to our collection, improving the quality of the existing collection through provenance, collaborating with the wider botanic community, supporting local plant nurseries, and safeguarding threatened biodiversity. Sources of genetic material come with different levels of taxonomic verification and different levels of risk in terms of their potential to, intentionally or unintentionally, contravene national or international law. These different sources also pose different risks in terms of biosecurity.

Because of these opportunity and risk factors, CUBG prioritises certain sources over others. Considerations and procedures for the various sources are outlined on the next two pages.

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## Sourcing Material

## Sources

**Other Botanical Institutions and Expeditions**  
**Institutional Seed Banks**  
**Seed Exchange Programmes**

**Considerations** CUBG prioritises these sources because we share non-commercial incentives for the acquisition and sharing of genetic resources, and as a community, have demonstrated long-term adherence to the Convention on Biological Diversity. These sources have greater levels of associated taxonomic activity, and consequently often have a higher quality of taxonomic annotation than other sources of genetic material. Wild-collected material, especially from overseas, can pose greater challenges in terms of mitigating for pests and diseases and invasive species. CUBG staff are encouraged to collaborate with UK botanic gardens that have quarantine facilities in place to allow for proper biosecurity measures as needed. CUBG staff follow protocols to mitigate biosecurity risks and are encouraged to collaborate with UK botanic gardens that have quarantine facilities in place to allow for proper biosecurity measures as needed.

**Procedure** These institutions should only release material to CUBG with a Material Transfer Agreement (MTA). It is essential that CUBG retains a copy of the MTA under which genetic resources were originally obtained, and that this MTA is linked to the genetic material in our database. Regardless of our expectation that the material has been collected legally, it is still important to collect as much information about the collection of the specimens as possible, at the point of acquisition (see Section 4).

## Sources

**UK-based Commercial Nurseries**  
**UK-based Seed Suppliers**

**Considerations** Added due diligence is required when sourcing from UK commercial nurseries and seed suppliers due to commercial incentives to acquire genetic resources that may negatively affect the legal acquisition process or pose a pest and diseases risk.

UK-based commercial nurseries are prioritised over overseas nurseries because they are subject to oversight by UK regulatory bodies, with regulations and processes that are familiar. CUBG values working with local nurseries and regards these relationships as an opportunity to engage with community members and

**Procedures** It is necessary to secure written assurance that the institution is compliant with international agreements, conventions, protocols and do not pose a biosecurity risk for CUBG. For all material sourced from UK nurseries, it is the responsibility of CUBG staff to inquire about the original source of the material to be supplied and consult the curation team as needed. Written assurance should answer the following question:

- Has the material to be supplied been propagated on-site or has it been sourced from a third party? If the latter, please supply their details and geographic location.

## Sourcing Material

<p>support this long-standing trade and associated expertise.</p>	<p>It is the responsibility of the Head of Horticulture to review the responses before authorising any purchase and share provenance concerns with the curation team. All material sourced from within the UK is subject to Plant Passport requirements.</p>
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### Sources

#### International Commercial Nurseries and/or Seed Suppliers

#### External Researchers

#### Private Collectors

<p><b>Considerations</b> In the case of overseas suppliers, it can be particularly challenging to ascertain the quality of the institution and the material under consideration. Sourcing from these suppliers increases biosecurity risks. External researchers and private collectors may be under considerable pressure to acquire material, less aware of legal requirements around the acquisition of material and may not follow due process. In these instances, exceptional levels of due diligence are required to ensure that CUBG does not unintentionally violate national or international law.</p>	<p><b>Procedures</b> With overseas suppliers, external researchers, and private collectors, we seek written assurance that:</p> <ol style="list-style-type: none"> <li>1) The genetic material was collected in accordance with all national and international laws in force at the time of collection.</li> <li>2) The genetic material was obtained with Prior Informed Consent from the country of origin.</li> <li>3) Accessioning the genetic material does not violate any mutually agreed terms as defined by the country of origin.</li> <li>4) The researcher's proposed usage of the accessioned material does not violate any associated mutually agreed terms.</li> </ol>
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**Sourcing Material**

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**Sourcing Material**

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**Key Points**

- **CUBG cannot accession into its collections genetic resources that have been obtained without appropriate due diligence with respect to national and international laws.**

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- **CUBG staff considers the institutional priorities when acquiring new material.**

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- **CUBG acquires genetic resources from a variety of sources and recognises the opportunities and risks associated with each source type.**

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- **Varying levels of due diligence and documentation are required depending on the source.**

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- **See Flowchart 2 for a visual representation of this process.**



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## 2

# Collecting Expeditions

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The quality of plant material in the Living Collections is fundamentally shaped by its provenance and associated documentation. Wild-collected accessions, primarily derived through collecting expeditions, hold the highest value because they capture genetic diversity from natural populations and are accompanied by verifiable location, habitat, and collector records. These attributes make them uniquely informative for scientific research and indispensable for *ex situ* conservation and species and ecological restoration initiatives. Maintaining wild-origin plants within a botanic garden also deepens and expands taxonomic and horticultural scope and knowledge. For these, and many other reasons, securing and cultivating wild-collected material remains our highest priority for the Living Collections.



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**Collecting Expeditions**

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**2.1****Enriching Collections**

CUBG organises and participates in expeditions to collect plant material of wild origin and improve the quality of our Living Collections. The genetic variation present in a cultivated population is inevitably only a portion of the original genetic diversity found in the source population of a given taxon. This variation subsequently declines with each generation that the plants are in cultivation, as genetic drift, hybridisation, unintentional selection and inbreeding reduce the diversity. Therefore it is important to replenish genetic diversity through newly-acquired, wild-source seed from the larger gene pool. Along with the genetic variability, the quality and accuracy of documentation deteriorates over time, leading to collections of unknown, or at least uncertain provenance.



**Collecting Expeditions**

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**Collecting Expeditions**

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**2.2****Prioritising**

Excellent collections quality is a key goal for CUBG. Each horticultural section has the goal of increasing the quality of their collections as defined in the *CUBG Living Collections Strategy 2020-2030*.<sup>6</sup> However, collecting wild material through expeditions is a costly activity. Limited funding and constraints on staff time require that collecting expeditions be prioritised by the extent to which they satisfy the criteria below:

- New living material is added to the Living Collections.
- Specific goals and strategic targets as defined as part of the CUBG Living Collections Strategy 2020-2030 are met.
- The collecting trip has the potential to make an impact across different horticultural sections.
- The collecting team has a robust verification plan that will ensure that all material is taxonomically verified to a high standard.
- Collected material will be supported by the collection of high-quality herbarium specimens to be vouchered in the Cambridge University Herbarium, CGE (see Section 12).
- The expedition is organised with partners who have similar institutional goals and our collaborative work benefits both institutions and the conservation of targeted taxa.
- The material is accompanied by thorough collections data.

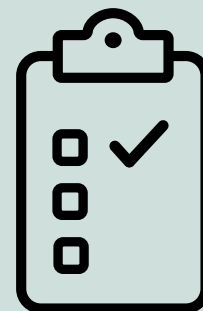
**2.3****Planning**

Expeditions are planned as a collaborative effort between the Expedition Botanist, relevant members of CUBG staff, and partner institutions. The success of an expedition relies heavily



## Collecting Expeditions

on planning. Understanding the nature of each taxon and having clear goals for material collected ensures best practices during expeditions, minimising impact on the plants *in situ*. Collaboration at this stage is crucial, as is the use of reference materials available. See Flowchart 3 for an overview of expedition execution.



### Expedition Planning Checklist

- Define clear goals** of the expedition. This involves determining the region and specific taxa to be collected justified following are the prioritising criteria (see Section 2.2).
- Select specific localities** at the optimal time to be visited to maximise collection outputs.
- Contact local institutions** to establish in-country partners. This may mean drafting a Memorandum of Understanding to ensure mutual benefits and Nagoya compliance.
- Forecast the budget** well in advance and ensure that every attempt is made to secure matching external funding for the trip.
- Request collecting permits** Know that this could be an extremely long process depending on the country to be visited, ranging from a couple of months to a year.
- Prepare a trip itinerary** that is as precise as possible but leaving some flexibility to react in case of unexpected circumstances, e.g., flight delays, bad weather.
- Procure and prepare collecting equipment** as well as first aid supplies and personal gear.
- Prepare risk assessments and travel insurance.**
- Book transport and accommodations.**
- Consider and prepare quarantine and phytosanitary procedures** in anticipation for all imported material.

## Collecting Expeditions

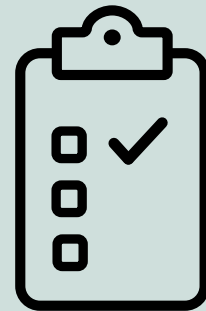
### 2.4

### Execution

Whilst in the field making a collection, the collectors follow the procedures outlined in this section. Often, expeditions are conducted by a group of collectors. The leader of the expedition coordinates which members of the expedition will conduct which tasks each day.

#### Record Keeping

Following a cut test, once a population has been determined fit for collection, the data in the Record Keeping Checklist is collected. Without this data, wild-collected material holds virtually no collection value. Care is taken to ensure that the data and the plant material is never separated.



#### Record Keeping Checklist

- Collection number:** a unique number attributed to all material collected from the same plant. This number should be used to label photos, records, living material, and herbarium vouchers.
- Taxon:** this may be vague and verified later. If the species name is not known, the genus, family or local common name can be used.
- Plant description,** especially those morphological details that are not captured through a herbarium voucher, e.g., measurements, colours, fragrance, or exudates.
- List of collectors**  
This is a list of all team members present, not necessarily just the people collecting.
- Collection date**
- Location information** e.g., country, political divisions, locality and approach route, GPS coordinates, altitude
- Contextual information:** e.g., habitat, associated taxa, substrate characteristics (pH, moisture content, soil colour)
- Type of plant material taken,** e.g., seed, cutting, seedling, herbarium specimen, DNA sample.
- Population and sample sizes,** i.e., an estimate of the size of the population and how many plants were sampled from.
- Ethnobotanical or other uses as informed by in-country partners.**

**Collecting Expeditions**

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**Collecting Expeditions**

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**Photographing**

Before any collection is taken from a given plant, it should be carefully photographed. The first photo should be that of the collection number. Subsequent photos should illustrate the environment where the plant grows, and the plant itself; its habit, stem, bark, branches, leaves, flowers, and fruits. Macro photos should be taken of details such as stipules, lenticels, flower and fruit structures.

**Collecting Material**

After photographing and recording morphological information, the collectors can proceed to take living plant material. This material could be in the form of seeds, seedlings, or cuttings of mature plants, depending on the limits of the permit.

For any collecting taking place, ethical guidelines and best practices are adhered to in order to minimise impact to the plants and environment. In order to ensure genetically representative propagules suitable for plant reintroductions and reduce long-term impacts on plant populations, it is practice to adhere to the following guidelines derived from recommendations by Guerrant et al., 2013.<sup>8</sup>

- Collect no more than 10% of any individual plant's reproductive output in any year.
  - Collect no more than 20% of the total mature seeds available in a population.
  - For species with < 50 known populations, collect from as many populations as possible.
  - For populations with < 50 plants, collect from all known individuals.
  - For populations with > 50 plants, collect from ~10% of the plants or at least 50 individuals if ~10% is not possible.
  - Collect randomly from a diverse selection of plants regardless if
-

## Collecting Expeditions

- characteristics are rare or common (do not select for only the plants with the largest blooms, unique colours, etc).
- Collect as broadly (in an area) as possible to ensure the most diverse selection of material.

### Herbarium Vouchering

Collecting herbarium vouchers is good practice to allow current and future staff and researchers access to plant material. When collecting outside of the UK, discuss if duplicate vouchers should be collected for local herbaria. If the expedition includes multiple partners, the number of vouchers should be established ahead of time per each institutions' requirements.

Herbarium specimens, or vouchers, where practical, should include all the present organs of the plant to represent as best as possible its morphology. Any part that cannot be collected should be described in the records. The parts and the morphological description should allow a specialist to visualise the morphology of the plant. Some guidelines on how to make herbarium specimens can be found in the Herbarium section (Section 12) of this document and in the *Guide to Collecting Herbarium Specimens in the Field*.<sup>9</sup> It is advisable to fasten jewellery tags with the collection number written in pencil to the specimen in addition to writing this information on the newspaper sheet within which the specimen is pressed.



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**Collecting Expeditions**

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**Evenings and Non-collecting Days**

In the evenings and during days when not actively collecting, the collectors should process and organise the collected material, review the data, verify the identity of the plant and get ready for the next collecting activity. Time has to be used wisely to make the best of it in terms of collections and data quality. This implies starting the collecting early in the mornings and finishing at sunset.

**2.5****Post-Trip****Before returning:**

- Prepare living material for the trip back to CUBG. In instances where germplasm needs to be shipped, pack to ensure minimal damage during transit and inform nursery staff at CUBG. Ideally, seed is packed into carry on luggage for safety and to avoid exposure to extreme temperatures of aeroplane holds.
- Prepare herbarium specimens. Co-ordinate with in-country partners as necessary for the drying and shipping of the material at a later date. Determine if any of the herbarium material is subject to further DEFRA legislation.
- Have all necessary documentation in order and, when necessary, notify airport of arrival.

**Upon return:**

- Organise the living plant material and liaise with horticulture staff as to next steps for propagation.
  - Clean seed and follow quarantine, drying and chaff disposal protocol before adding to the seed bank.
  - Clean and verify the records (digitise them if not done during the trip), before submitting them to the Plant Records Officer for accessioning. Photos should also be organised and linked to the collections in the database.
  - Print labels for the herbarium specimens (see Section 12) and add them to the queue for mounting.
  - Prepare reports for external funding institutions when necessary.
  - Send thanks to and keep all collaborators up to date with final reports.
  - Present major results of the expedition to the CUBG staff during staff meetings.
  - Communicate what has been achieved from the trip to staff, Friends of the Garden, and members of the public.
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**Collecting Expeditions**

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**Key Points**

- **Wild-collected material is the highest priority for CUBG.**  
.....
- **Collection expeditions are prioritised based on the relevance to the *Living Collections Strategy 2020-2030*.**  
.....
- **Collection expedition success is heavily dependent on the thoroughness of pre-trip planning.**  
.....
- **Protocols are followed in the field and during trip follow up that ensure the highest quality of documentation and the greatest opportunity for successful propagation.**  
.....
- **See Flowchart 3 for a visual representation of this process.**

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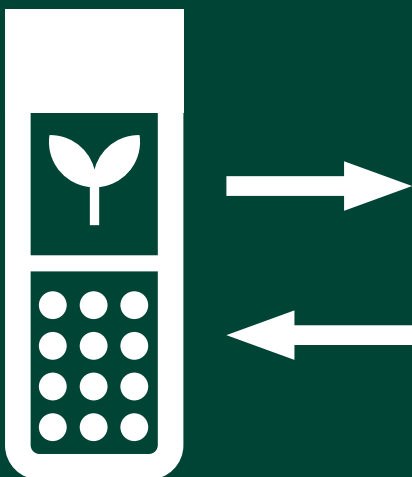
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# 3 Seed Sourcing & Sharing

Seed exchanges are a long-standing system by which botanic gardens share diverse genetic material. Seed exchange enables institutions to request and distribute seed responsibly, expanding access to taxa that may otherwise be difficult to source commercially or through fieldwork. For Living Collections, a variety of seed sources provide a practical route to increase taxonomic breadth, secure rare or underrepresented species, and maintain historically important taxa. Participation in seed exchange also fosters professional exchange, as curators, horticulturists, and seed bank staff share knowledge on propagation, documentation, and sourcing. Used carefully and transparently, seed sourcing and exchange programmes can complement wild collecting by broadening diversity and strengthening collaboration across the botanic garden community.



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**Seed Sourcing & Sharing**

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**3.1*****Index Seminum***

*Index Seminum* is an exchange of seed between botanical institutions around the world. It has existed for several hundred years as an informal network and is one of the main ways in which botanical institutions share plant material. Participating gardens publish catalogues of available seed for use in display, education, research and conservation.

**Incoming *Index Seminum***

CUBG receives many offerings each year. Traditionally these have been received in paper form, but the majority are now received in a digital format or as a link to a website.

The curation team monitors incoming Indices Semina, filters, and collates them into a shared spreadsheet that the horticulture team annotates with requests. Head of Horticulture is consulted and institutional priorities considered. The curation team places all orders and, upon receipt, accessions the seed and distributes to respective horticulture team members.

**Outgoing *Index Seminum***

CUBG's *Index Seminum* is published annually and is available to other botanical institutions under mutually agreed terms.

At the beginning of the year the Plant Records Officer generates a list of available seed in the seed bank in collaboration with the Head of Horticulture. The list of seed is loaded onto the BGCI *Index Seminum* portal and an email sent to participating gardens with a link to the BGCI's website.

On receipt of completed requests, seed is packaged, labelled, and mailed to the recipient along with relevant accession information. Prior to sending, the plant health and importing requirement for each receiving country must be checked and suitable documentation obtained. All transfers are documented in IrisBG and reported in CUBG's Annual Report.



**Seed Sourcing & Sharing**

## 3.2

## Additional Resources

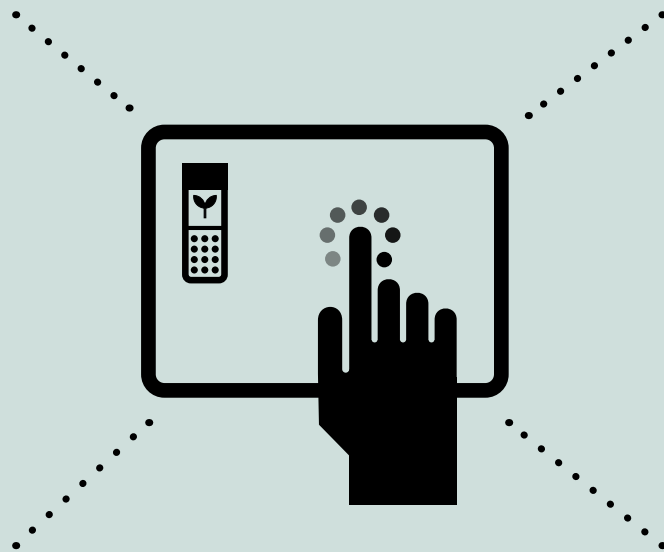
In addition to *Index Seminum*, there are other resources available to CUBG staff year-round. The Millennium Seed Bank (MSB), ENSCOBASE, and the USDA Department of Agriculture are a few examples of high-quality seed banks which offer seed for *ex situ* collections on an *ad hoc* basis. While ordering seed from these sources may entail a more involved process, the potential added value to the Living Collections cannot be understated.

### Millennium Seed Bank

The Millennium Seed Bank (MSB) is the world's largest wild plant seed bank, holding seed of over 39,000 species, including nearly all the UK's native plant species.<sup>10,11</sup> The online ordering system allows botanic gardens to request seed from MSB. The ordering system is intuitive, and you can search by taxonomy or geography. Some seed in their collection has restricted access. Staff members can register for an individual login and engage with this platform.

### ENSCOBASE

ENSCOBASE is a virtual seed bank co-ordinated by ENSCONET, a collaborative network of European institutions engaged in native seed conservation in Europe.<sup>12</sup> It is similar in nature to MSB but differs in that it is a search portal for all the European institutional seed banks. The database offers good search functionality and data access via downloadable spreadsheets.



### USDA NPGS

The U.S. Department of Agriculture's National Plant Germplasm System (NPGS) is a collaborative effort to safeguard the genetic diversity of agriculturally important plants.<sup>13</sup>

Seed is available for research or breeding purposes from a network of US gene banks and can be requested through their online portal.

### Individual Botanic Gardens

Some botanic gardens maintain year-round seed banks. Seed can be requested through online portals or individual communication. Additionally, functionality in BGCI's Plant Search allows for requests to be sent directly to gardens that have a taxon of interest in their collection. Beyond these examples, there are plenty of opportunities for receiving and sharing seed throughout the botanic garden network on an *ad hoc* basis.

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**Seed Sourcing & Sharing**

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**Key Points**

- **Seed sharing is a high-quality and cost-effective way of diversifying the Living Collections.**

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- ***Index Seminum* is an annual seed sharing programme through which CUBG sources material and offers material.**

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- **Institutional seed banks offer year-round opportunities to source high-quality material.**



CORNUS DRUMMONDII C.A. Mey.  
CAMBRIDGE UNIVERSITY BOTANIC GARDEN E. NORTH AM  
CORNACEAE

ENTRY NUMBER AND PROVENANCE	DEPT	DATE AND PLACE OF PLANTING IN GARDEN AND GRID NO.	NOTES
93/87 Guelph	0	R9, 1989	coll. Ontario, Elgin
309/89 Guelph	0		

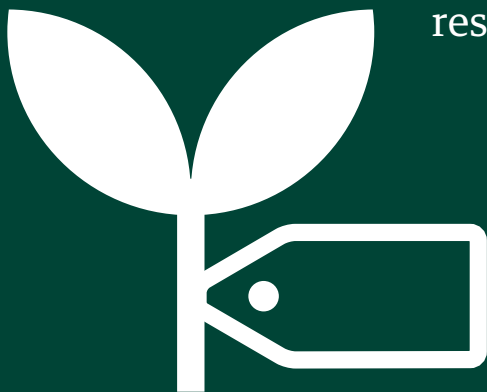
UNIVERSITY BOTANIC GARDEN  
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# 4 Accessioning Living Material

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Accessioning is the act of formally incorporating plant material into the Living Collections, ensuring that each individual plant is linked to a durable record of provenance, taxonomic identity, and subsequent management history. The accession number serves as the key link that connects living plants to their associated data, allowing the collection to exist as a coherent and accessible databased resource. In contrast, unaccessioned material lacks this documentation and traceability, limiting its long-term value and preventing it from contributing fully to the different aspects of our mission. Rigorous accessioning therefore serves to preserve the integrity of the Living Collections, supporting transparency in collection development, and enabling future use for research, conservation, and learning.



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**Accessioning Living Material**

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**4.1****Accession Numbers**

As of 2025, the Living Collections is made up of approximately 12,500 accessions. These accessions represent individual plants or groups of plants that satisfy the following criteria:

- Are of the same taxon.
- Are of the same propagule type.
- Were received from the same source.
- Were received at the same time.

Example: 20173224 is the accession for seed that resulted from successful in-house propagation of *Amorphophallus titanum* in 2017. All resulting plants fall under this same accession.

The accession number itself holds information. The accession number consists of eight digits; the first four digits represent the year the plant material was accessioned, and the last four the sequential item number in that year.

For example:

20173224



Year accessioned      3224th accession of the year

Plants that are found in the Living Collections which have lost their accession number and cannot be assigned to an existing accession are accessioned into the year they are found. These plants are given a provenance of uncertain (U) and flagged as Uncertain source, e.g., 20210310 *Cyclamen persicum* which was found without an accession number in 2021.

Where multiple accessions of the same taxon are planted in the same bed and become indistinguishable over time, a new accession is created that captures the inclusion of these accessions under this umbrella accession. If the accessions are of the same provenance (i.e. both garden origin) the new accession will retain this provenance. Where the accessions are of different provenances the new accession is assigned of uncertain provenance. For this reason, it is discouraged that accessions of the same or very similar taxa (especially wild origin, herbaceous taxa) are planted in close proximity.

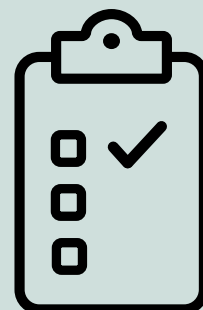
Plants that predate accessioning, such as old trees, were historically given artificial accession numbers starting with 1000, e.g. 10005838 *Cedrus libani*. See Appendix A for more information.

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## 4.2

### Accession Information

Regardless of the source from which the plant material is acquired, the information associated with the plant material helps determine the value for current and future use and contributes to a high-quality Living Collections. Plant material should always be accompanied by as much information as possible, which is recorded at the time of acquisition and shared with the Plant Records Officer. Retrospectively filling in missing data can be very difficult or often impossible. All plant records are stored in the botanical garden database, IrisBG.<sup>15</sup> See Flowchart 4 for accessioning decision-making process.



#### Information required for all accessions

- Botanical name of plant material as supplied by source.**
- How the plant material is received,** e.g., as seed, cuttings, or whole plant.
- Number of individuals received,** provide exact numbers when feasible, approximate in all other cases.
- Source of the plant material** i.e., the name and contact information of the nursery, botanic garden, collector/collection expedition, etc. from which the plant material was received.
- Provenance** – wild (W), garden origin (G), indirect wild origin (Z), or uncertain (U).
- Date received.**
- The horticulturist and garden section responsible for the acquisition.**
- Restrictions** (see Restrictions Section).
- IPEN** (International Plant Exchange Number) as received or assigned by CUBG.

## 4.3

### Provenance

Provenance refers to the place of origin of an accession and falls into four categories – **garden, wild, indirect, or uncertain**. Depending on the provenance of the plant material, the data stored beyond the compulsory data will vary. The fields requiring completion will depend on the nature of the plant material, its source, and the completeness of information provided. In all instances, all information available must be recorded.

#### Garden Origin

Garden origin (G) plant material is defined as plant material known to be derived from plant materials in cultivation. Sexually derived propagules from garden origin plant material (G) are given a new accession number and considered of garden origin. Vegetatively derived propagules from trees or large shrubs of garden origin are given a new accession number and maintain the provenance of the parent plant.



#### *Additional data for garden origin plants:*

- A copy of receipts or equivalent documentation.
- If derived from accessioned material, the accession number of the parent accession(s).
- If derived from accessioned material, genetic variability, i.e., whether the seed was taken from one plant or more.
- Plant Passport number, where applicable.
- Any additional relevant information.



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**Accessioning Living Material**

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**Wild Origin**

Wild origin (W) plant material is defined as plant material known to be sourced directly from wild-occurring populations. Wild origin material is often the most valuable material in a collection. If the exact locality of where a plant is from is known and recorded, informed decisions can be made based on the performance of these accessions with respect to local climatic conditions to inform future acquisitions. This information may also be of relevance to complementary *in situ* conservation efforts and collections management.

Vegetatively derived plant material from wild origin plants in a garden setting would also here be defined as of wild origin. Sexually derived propagules from wild origin plant material (W) are given a new accession number and considered of indirect garden origin (Z). All associated collection details should be shared with the Plant Records Officer and stored within the accession record.

***Additional data for wild origin plants:***

- Date of collection – as precise as possible, preferably to the day.
  - Collector's name.
  - Collector's number (where applicable).
  - Expedition name/code (where applicable).
  - Country where plant material was collected, with administrative divisions if possible.
  - Locality – a descriptive account with latitude and longitude where possible, preferably from GPS.
  - Genetic variability i.e. the sampling method used, for example whether the seed was taken from one plant, or from more than one plant.
  - Altitude (m) at which the plant material was collected.
  - Habitat or environment from which the plant material was collected.
  - Associated plants – a listing of other taxa growing nearby.
  - Photographs of the parent plant and/or habitat.
  - MTAs, permits, and other associated collections documentation.
  - If derived from accessioned material, the accession number of the parent accession.
-

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**Accessioning Living Material**

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**Indirect Wild Origin**

Indirect wild origin (Z) plant material is defined as plant material discernibly derived from wild-collected accession. Tracking indirect wild origin plants in the collection is a way to understand the sustainability of wild-collected accessions in the Living Collections.

Sexually derived propagated material from a wild origin (W) plant growing in the Living Collections would be given a new accession number and be designated of indirect wild origin (Z). Unless derived through controlled pollination, sexually derived material from an indirect wild origin plant (Z) would be given a new accession number and designated of garden origin (G). Vegetatively propagated material derived from an accession of indirect wild origin (Z) would also be here defined as indirect wild origin (Z).

***Additional data for indirect wild origin plants:***

- If derived from accessioned material, the accession number of the parent accession(s).
- If derived from accessioned material, the genetic variability, i.e., the sampling method used, for example whether the seed was taken from one plant, or from more than one plant.

**Uncertain Origin**

Uncertain origin (U) plant material is defined as those plant materials which lack associated provenance data. For example, older plants that predate accession records or those plants who have been separated from their accession number are accessioned as of uncertain provenance. Data is naturally scant for plant material of uncertain provenance.

***Additional data for uncertain origin plants:***

- Circumstances surrounding accessioning, e.g., “found during audit 2022”.

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**Accessioning Living Material**


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**4.4****Re-accessioning**

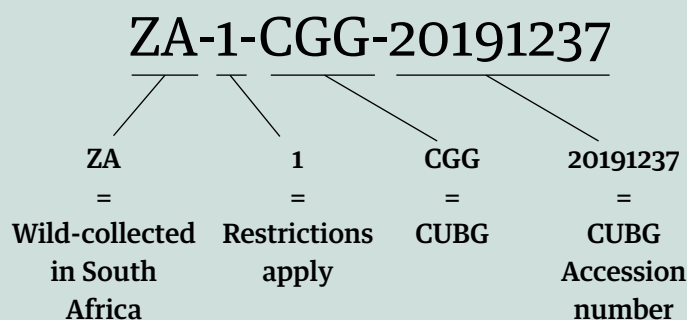
Re-accessioning is the process whereby a new accession number is allocated to plant material that has at some stage already been accessioned at CUBG. There are four circumstances when this is done:

- As a result of vegetative propagation of a tree or large shrub. All other vegetative propagated plant material does not require re-accessioning unless there is a specific reason for doing so. For example, splitting an herbaceous plant would not require a new accession record.
- As a result of sexual propagation – including seed and spores collected from plants in the Living Collections.
- Where the material has lost its accession number and that number cannot be accurately identified from existing records or existing records.
- Where batches of plant material originally accessioned under a single number are later determined to be a mixture of different taxa. See Appendix A for explanation into historic accessioning procedures and batch numbers.

**4.5****IPEN Numbers**

IPEN numbers (International Plant Exchange Network) allow plants to be traced back to their original source.<sup>16</sup> The numbers consist of a two-letter county code (for wild origin material) or XX for garden origin material, a number ‘0’ for not restricted or ‘1’ for restricted, a code for the source garden and the source garden accession number.

Example:



This number will remain with the plant regardless of how it is propagated or to whom it is shared, and will follow the mother line when propagated via seed. For example, plants grown on from seed from the original 20191237 accession will be given a new accession number but will retain the above parent IPEN number.

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## 4.6

### Restrictions

Restriction flags are used as a flag and filter for any restrictions on making public or distributing plant material. The flags consist of two-colour blocks. The first section of the block is for Usage and second Making Public. Usage relates to distributing plant material and Making Public relates to making it public knowledge that we hold a plant. Restrictions are subject to change over time and justification for restrictions may be recorded in the accession record. Restrictions are stored in the Details tab of the Accession table in IrisBG.

Restrictions occur in instances where we may not wish to make public or distribute plant material that is in the Living Collections as part of an active research project. Additionally, members of the horticultural staff may request restrictions on an accession. The general presumption is that most plant material will be unlimited (two green blocks), where we are able to distribute and to make public that we hold the plant material. The only plant material we would normally prohibit is plant material sourced for and actively being used for research or wild-collected plant material with restrictive agreements.

**No Limit (Green, Green)** Plant material can be distributed and made public. Most plant material will fall into this group.

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**Shielded (Green, Red)** We can hold, use and distribute to other gardens. We would not make public that we hold the plant material. This restriction is applicable for some rare and highly collectable taxa which may be targeted for theft.

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**Limited (Yellow, Green)** Plant material we are able to distribute and make public that is subject to agreement with supplier. This restriction is applicable where plant material is subject to the Nagoya Protocol, Material Transfer Agreements or other relevant conventions.

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**Shielded 2 (Red, Green)** We are not allowed to distribute plant material due to the agreement with the source, but we can make public that we hold the plant material. This restriction is applicable where wild-collected plant material is collected under a restrictive permit or plant material is held under specific licenses.

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**Prohibited (Red, Red)** We are not allowed to share the plant material or make public that we hold the plant material, e.g., sensitive research plant material.

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**Accessioning Living Material**

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**Key Points**

- **All plant material that is acquired for the purpose of being a part of the Living Collections is issued an accession number.**  
.....
  - **An accession number is a unique value that holds all recorded information about any given plant material.**  
.....
  - **For all plant material considered part of the Living Collections, it is vital that as much information as possible should be recorded at the time of acquisition and shared with the Plant Records Officer.**  
.....
  - **Certain compulsory data is required for all accessions, however additional data will vary based on the provenance of the accession.**  
.....
  - **Restrictions dictate the degree to which we can distribute and make public accessions in our collection and are subject to change over time.**  
.....
  - **See Flowchart 4 for a visual representation of this process.**
-

Saxifragaceae  
20091034\*D



*Saxifraga berica*

Endemic to Italy  
Vulnerable

W

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# 5 Nomenclature

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“If the names are unknown knowledge of the things also perishes...”

Carolus Linnaeus

Botanical nomenclature is a set of rules that determine the correct naming of plant taxa. *The International Code of Nomenclature for algae, fungi, and plants* (ICN) governs the names in Latin for those life forms.<sup>17</sup> *The International Code of Nomenclature for Cultivated Plants* (ICNCP) governs the names formed for taxa of plants whose origin or selection is primarily due to intentional human activity, e.g., cultivars.<sup>18</sup> Accurate, continuously curated nomenclature allows for efficient use of the Living Collections. At CUBG, we strive to reflect the most up-to-date, valid nomenclature in our records.



## 5.1

### Management of Plant Names

In 2020, the decision was made to standardise botanical nomenclature and distribution information based on Plants of the World Online (POWO).<sup>19</sup> Based on this decision, all taxa are updated to POWO standards, with the exception of some key lineages whose taxonomy has been historically or is currently studied at CUBG.

When accessioning new material, one must first consider the taxonomy of the accession. The name as recorded by the source is checked against POWO. This search will reveal whether the name is 1) accepted, 2) a synonym or 3) cannot be found in POWO, is "unplaced" or an artificial hybrid. If the taxon already has a record associated with it in the Taxa table in IrisBG, the Plant Records Officer need only confirm that the nomenclatural status of the taxon is accepted.

- 1) If the name is accepted**, then a record for the taxon can be created in the database or would not need to be updated if it already exists (see Section 5.2).
- 2) If the name is a synonym, and the accepted name is indicated in POWO**, then the accepted name should be used instead of the synonym name. If the synonym name already exists in the database, the accepted name should be created, and a link to the synonym should be established in the database (see Section 5.2). Regardless of the accepted name, the name the plant material was received under is stored indefinitely in the database in the Accessions Details table.
- 3) Names that are not found in POWO, or that are synonyms according to POWO** but with no indication on their accepted names, are searched in other nomenclature databases. The name might be found with different spelling in other sources than POWO. In that case, search POWO again with the new spelling. If not found in POWO, apply the information from other sources and reference them in the database.

## 5.2

### Creating a Taxon Record in IrisBG

Plant names and taxonomic information are stored in the Taxa table in IrisBG. This crucial table underpins all other records in the plant records database. Where a name is not currently in the database, a new Taxa record will need creating. Below is a list of the required information for populating a Taxa record. When sourced from a reliable reference, more information may be added.

#### *Required information:*

**Name status** Most names will be 'Accepted name'. Where an existing name in the database is found to be a synonym, a record with the accepted name must first be created and then the synonym record created and linked to the accepted record. Within IrisBG it is not possible to record a name as a synonym without first attaching a valid accepted name. Where the status of a name

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**Nomenclature**

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is unclear, the name status should remain as 'Accepted name' and under the Details tab change the Provisional field to 'Provisional'.

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**Genus and species** The genus and specific epithet are recorded in separate fields in the database, Generic information is stored in the Taxonomic groups table. Where a genus is novel to the database a new Genus record is created. Great care should be taken to ensure new genera records are valid and correct. Specific epithets are subject to spelling errors and care should be taken to ensure such errors are avoided. For hybrid names, e.g., *Abutilon x hybridum* enter "x hybridum" in the species field. If parentage on a hybrid is known, this information can be populated in the Parentage comments section.

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**LSID** LSID (Life Sciences Identifier) checks the species against the International Plant Names Index (IPNI).<sup>16</sup> This is a list of all published plant names (note: this list will contain many names which are not accepted). Where multiple name records are found use the record with the authority that matches the name looked up or the earliest published name. Not all taxa have an LSID. Note, where no results occur, this could indicate a data entry error in the form of a spelling error.

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**Author** To whom the naming rights are ascribed. Where LSID are available, this section will be auto-completed when checked via the LSID function. Care should be taken to make sure the authority supplied by LSID matches the authority of the species information found.

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**Infraspecific Information** Where appropriate add infraspecific taxa details e.g., subspecies, varieties, and/or forma.

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**Cultivar** Cultivar names are non-Latinized, fancy names written as free text. Cultivar names should be enclosed in single quotes and the first letter of each word in the name must be capitalized. Where a name is hyphenated any letter after the hyphenation is not capitalised.

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**Common name(s)** Where common names are known and relevant they are recorded. The first letter of each word in the common name should be capitalized. Where more than one name is recorded the one to be used on labels should be ranked '1'.

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**Life form** This is the habit which best defines the taxon (e.g., tree, herbaceous perennial).

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**Distribution** The distribution field is used to record the geographic range of the taxon. This data is used on plant labels and is populated using CUBG's Species Distribution Code and organised based on the BRU code system.<sup>20</sup> Where a taxon is a cultivar or artificial hybrid, the distribution is recorded as Garden origin, with the exception of those cultivars that are of known wild origin.

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**IUCN Red List** Add IUCN Red List information where available.<sup>23</sup>

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**Nomenclature**

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This information is updated for all taxa on a routine basis by the Plant Records Officer.

**National red list** This information, where available is gathered through the most up-to-date version of the Vascular Plant Red List for England or relevant country's threatened species list.<sup>24</sup>

**CITES** Add CITES information where available.<sup>25</sup>

**References** Cite all references used to populate the record in the References tab of the Taxa table. For web links, it is useful to record the date the site was visited in the Comments section.

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**Nomenclature**

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**Key Points**

- **At CUBG, we strive to reflect the most up-to-date, valid nomenclature in our records.**

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- **All taxa are updated to POWO standards, with the exception of some key lineages whose taxonomy has been historically or is currently studied at CUBG.**

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- **Plant names and taxonomic information are stored in the Taxa table in IrisBG. This crucial table underpins all other records in the plant records database.**

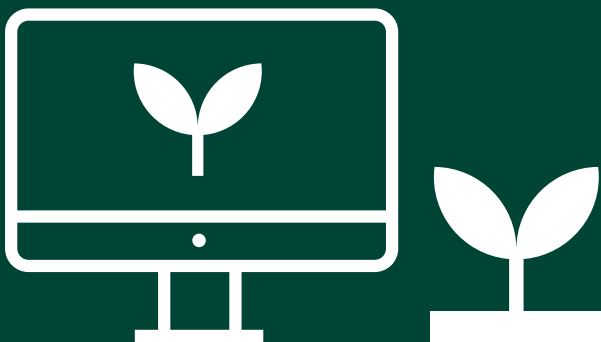


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# 6 Creating Planting Records

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The accession record links the plant material to data captured at point of receipt. Planting records contain the information on plants as they exist or existed in the Living Collections. In their most basic form, these records store the location and status of every plant. The location refers to where in the garden the plant or group of plants is and the status refers to the most recent action associated with the plant(s). From the time a plant enters the collection, Living Collections records are updated by members of the horticulture and curation teams. Living Collections records are never deleted. When a plant is no longer part of the collection, i.e. it dies or is de-accessioned, the record reflects this status and is stored indefinitely. Living Collections records are captured in the Items Tab in IrisBG.



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**Creating Planting Records**

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**6.1****Creating Planting Records**

The Plant Records Officer creates the Living Collections record upon receipt of plant material once the plant material is accessioned. The Plant Records Officer assigns the initial qualifier(s) and date, prints labels (see Section 9), records the nursery location, and updates the status to “Planted”. This information is passed to the horticulturist responsible for the plant(s).

The policy and procedure laid out in this section informs the most pertinent information to capture at the time of planting. Whenever any of this information changes, the record is updated (see Section 8).

If an accession holds multiple plants, all plants that are not trees will be grouped in one qualifier by the Plant Records Officer. It is the responsibility of the horticulturist planting the material to assign qualifiers to plants/plant groupings planted in different locations and order new labels once qualifiers are assigned.

***Required information:***

**Location of Planting** This captures where the plant or group of plants is planted.

This information is stored in the Location code field in IrisBG.

Staff and volunteers refer to a CUBG map with bed codes before or during the planting process. If a group of plants is planted in more than one bed a separate qualifier is created for the plants in separate beds. A single qualifier cannot exist in two beds.

If a planting extends from one bed to a neighbouring bed with no discernable boundary, the bed in which the mass is most abundant is determined and the planting assigned to this location. A note can be made in the location reference field and/or comments to document this.

Within a bed, the area in which the plant or group of plants has been planted is recorded and captured within the Location reference field. This information will tell you where in the bed the plants are with respect to cardinal directions e.g., north side or central.

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**Planting Date** This captures the day the plant(s) went in the ground. For plants staying in pots, the planting date may be captured by the Plant Records Officer.

This information is stored in the Date field.

In the event that a group of plants are planted over the course of several days, e.g., mass bulb plantings, planting dates reflect the day planting began.

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**Staff** This captures the person doing the planting.

This information is stored in the Person field.

If there are multiple individuals involved in the planting, it is a good practice to record one individual in the Person field and all others in the Comments field.

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**Number of Plants** This captures the exact number of plants planted. As a planting of multiple plants becomes established and

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**Creating Planting Records**

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indistinguishable, the number of plants may be updated to “mass”.

This information is stored in the No. spec. (number of specimens) field.

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**Label Requests** This captures the request for labels. A label request captures the type of label being requested and the number of labels.

Horticulturists request engraved labels in anticipation of plants being planted and in instances where new qualifiers are created. Printed labels are requested and printed for plants in propagation and for most potted plants. It is good practice to write a dated comment that implies the date a label was requested and who requested it.

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**Status** This captures the fact that the plant or group of plants has been planted. This information is stored in the Status field. The status “Planted” indicates a plant coming into the garden as well as a plant being planted. When a whole plant comes into the garden, the Plant Records Officer creates a Living Collections record with the status “Planted”. When the plant is planted into the garden, the status remains “Planted” and the Location, Date, Person fields are updated along with any other relevant fields.

Note: if one were to divide, for example an *Epimedium*, and plant the divisions in a separate bed, a new qualifier would be assigned to the divisions.

- The group divided **from** would have a status update to “Divided” and the Date & Person fields updated. A note in the Comments field is created to reflect this action, i.e. “26/10/2022 MSA: divisions taken, planted in NW6-2, qualifier C”.
- The newly **divided** group is given a new qualifier and updated to “Planted” or “Moved” with accompanying pertinent information. The qualifier from which divisions came is captured in the Item Reference field of the new qualifier.

**Additional information:**

**Condition** This captures the condition of the plant at the time of planting.

This information is stored in the Condition section. See Section 8.3 to find out more about assigning condition.

Conditions assigned at initial plantings are done so judiciously as a newly planted plant is an unestablished plant. This field may be left blank or populated based on qualifying characteristics and best judgement. Comments can be added to the Comments field that give context to a condition assessment, i.e. “26/10/22 MSA: stem-girdling roots at time of planting”.

## 6.2

### The Use of Qualifiers

#### Assigning Qualifiers

Qualifiers (also referred to as “items”) are used to record and track the plants, germplasm and herbarium specimens that make up

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**Creating Planting Records**

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a single accession.<sup>26</sup> Qualifiers are an alphabetical letter attached to the end of an accession number following an asterisk. Always assign the first available alphabetical qualifier and create subsequent qualifiers sequentially.

20020098\*A

Acc. number      Qualifier

For each new planting, a new qualifier is created. Qualifiers can be used to record groups of plants or individuals within an accession. All trees and some shrubs are individually qualified. Certain scenarios, e.g., hedge/border plantings, warrant a grouping of multiple trees/large shrubs under one qualifier. In these cases, it is still important to record the initial number planted.

Herbaceous material can have more than one plant in the same qualifier when plants of the same accession are in the same bed, as defined by individual location codes. Multiple qualifiers are assigned when herbaceous perennials of the same accession are planted in multiple locations.



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## Creating Planting Records

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Considerations as to which taxa exist in a bed are taken before adding new plants to the bed. Unless the accessions can be sure to stay distinguishable over time, staff should refrain from planting different accessions of the same taxa or very similar taxa of herbaceous perennials or suckering woody plants in the same bed.

If a tree or large shrub is vegetatively repropagated or seeds/spores collected of any plant, these propagules would require a new accession.

### **The Process**

All plants received as plants are assigned a qualifier by the Plant Records Officer once they are accessioned into the collection. Upon receipt, the first location for any established plant material will be the nursery and the status will be set to “Planted”. See Section 7 for procedure on plants received as propagules. Horticulture staff is responsible for labelling plants and updating the records once planted. For all woody plants, an engraved label is ordered and placed with the plant in anticipation of it being planted out in the Living Collections.

### **Key Points**

- **Planting records contain the information on plants as they exist or existed in the Living Collections.**
  - **Living Collections records are created by the Plant Records Officer upon receipt and required fields are populated by staff members responsible for the plant material.**
  - **Qualifiers are used to record and track the plants, germplasm and herbarium specimens that make up a single accession and can be used to track individual plants or groups of plants of the same accession.**
  - **Unless the accessions can be sure to stay distinguishable over time, staff should refrain from planting different accessions of the same taxa or very similar taxa of herbaceous perennials or suckering woody in the same bed.**
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# 7 Creating Propagation Records

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CUBG acts as steward of the plants in the Living Collections. An integral aspect of this responsibility is the practice of propagation. Propagation is the process of producing plants via sexual or asexual propagules. It allows for the preservation and perpetuation of not just the plants themselves, but their genetic integrity and diversity.<sup>27</sup> It ensures against loss in any Living Collections and is means through which the sharing of plant material to other botanical institutions is made possible.



## 7.1

### Sourcing Propagation Material

#### **Internally Sourced Propagation Material**

The establishment of propagation priorities is as important as the outcome of propagation. The horticulture and curation staff work together to monitor and evaluate the collections to assess for propagation needs, with special attention given to those plants considered valuable due to conservation, research, education and/or display value. Propagation material collected from accessioned plants in the Living Collections are handled in one of two ways:

- 1) If vegetatively-derived propagation material is taken, e.g., cuttings, the propagation material is assigned to the accession number of the parent plant and given a new qualifier. However, if vegetative propagations are taken from a tree or large shrub, a new accession is created for the propagation material.
- 2) If sexually-derived propagation material is taken, e.g., seed, a new accession is created for the propagation material. See Section 4 for assigning provenance and information to capture during collection.

#### **Externally Sourced Propagation Material**

Propagation material received from external sources is accessioned by the Plant Records Officer upon receipt. Once an accession is assigned, the propagation record is created by the Plant Records Officer and it is the responsibility of the horticultural staff to populate the record as the plant moves through the propagation process.

For in-house grafting, the understock is documented in the accession record of the “top accession.” As much information as possible is captured about the taxon and provenance of the understock material.

## 7.2

### Creating the Propagation Record

The propagation records are used to track the propagation processes at CUBG. These records are stored in the database as a type of planting record but differ from other planting records in that the plant material is not yet an established, whole plant and is yet for public display. In their most basic form, propagation records store the propagations underway and track the outcome of each propagation attempt.

Members of staff initiating the propagation process create the propagation records of accessioned material at the time of propagation. The policy and procedure laid out in this section informs the most pertinent information to capture at the time of propagation and the steps taken once a propagation is complete, successful, or not.

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**Creating Propagation Records**

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**Required information:**

**Location** In most cases, this will be in the nursery areas. This information is stored in the Location code field.

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**Status** Plants undergoing propagation are stored as Planting records in the database and the status is Propagation. Under this status, plants are neither considered existing plants in the Living Collections nor non-existing. Instead, plants with this status maintain a “procedure” status. This information is stored in the Status field. Once the propagation procedure is completed the status is updated. If the propagation was successful, the status is updated to Planted.

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**Date** The day the material is set out for propagation, e.g., seed sown or cuttings stuck. For vegetatively-derived material collected from CUBG, where the date collected differs from the date of propagation, record the date of propagation in the Date field and the date collected in the Comments field. For sexually-derived material or vegetative propagations from trees in the Living Collections the accession record will reflect the date the seed was collected or cuttings taken.

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**Staff** This captures the person doing the propagating. This information is stored in the Person field.

---

**Printed Label Request** To be stuck in substrate of pots. Handwritten labels are discouraged.

---

**Propagule** Type of plant material, e.g., seed, cuttings. This information is stored in the Propagule field.

---

**Number of Propagules** The initial number of propagules is captured in the Number of Propagules field and in the Number of Specimens field. This number may change as propagules fail. In the event of number changes, the Number of Specimens field is updated to reflect the current number while the Number of Propagules field is not updated. This number represents the initial number of propagules.

In the event where multiple propagules are split among multiple pots/containers, the number of propagules (not pots) is recorded as the Number of Propagules and/or Number of Specimens. The number of pots is recorded in the Comments field and/or the Container field.

**Additional information**

The following information is useful in understanding the successes/shortcomings of various propagation techniques on different taxa. Understanding the conditions that resulted in the success or failure of a propagation attempt streamlines future attempts and adds to horticultural knowledge.

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**Creating Propagation Records**

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**Treatment** The methods of propagation used.

**Environment** The temperature, humidity, and other environment-related conditions applied to the propagules.

**Medium** What the propagules are being grown in, e.g., coir and perlite, and at what ratios.

**Container** The size and type of container used. This information can be useful during auditing.

**Comments** These give context to the propagation procedures. Any additional relevant information can be stored in this field.

### 7.3

### The Use of Qualifiers

For each propagation attempt, a new qualifier is created. The first available alphabetical qualifier is assigned and subsequent qualifiers created sequentially. When a propagule moves through the process and results in an established plant, the plant will retain the same qualifier as it had when it was a propagule\*. For herbaceous and woody material, all propagules are grouped under the same qualifier during the propagation process unless different propagation methods are being used.

### 7.4

### Completing the Propagation Record

#### Propagation Success

If propagation results in established plant(s), the status is updated to “Planted” and thus the item is recognized as an existing plant in the database. The Planted status date for this qualifier will reflect the date the plant established i.e., the day the plant was “pricked out” and potted as an established plant.

If the propagation attempts are successful, new qualifiers are made when herbaceous material is planted out in more than one area and when multiple trees are established. When multiple trees are established, each tree is individually qualified. In both cases, newly created qualifiers are linked to the original qualifier through the Item Reference field and each qualifier is updated to reflect the number of individuals within that individual qualifier.

If a process that yields success for propagating a specific taxon is followed or established, the details of these processes is stored in the Propagation field of the Details tab in the Taxa table. By storing this information here, future staff members can easily search on propagation information and become more efficient and informed.

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**Creating Propagation Records**

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**Propagation Failure**

Recording propagation failures is as important as recording successes. This information contributes to horticultural knowledge and can save effort in future propagations of the same or similar taxa. If a propagation is unsuccessful the status is updated “Dead” and any notes that indicate factors in failure are to be recorded in the Failure and or Failure comments sections.

**Key Points**

- **Propagation is the process of producing plants through sexual or asexual means. It allows for the preservation and perpetuation of not just the plants themselves, but their genetic integrity and diversity.**
  - **The horticulture and curation teams work together to monitor and evaluate the collections to assess for propagation needs, with special attention given to those plants considered valuable based on various criteria e.g., conservation value.**
  - **Propagation records are stored in the database as a type of planting record but differ from other planting records in that the plant material is not established, whole plants and is yet for public display.**
  - **Required fields in the database are populated with the understanding that this information can contribute to horticultural knowledge and maximize time and resources in future propagation attempts.**
  - **See Flowchart 5 for a visual representation of this process.**
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# 8

# Auditing the Living Collections

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Auditing is the process through which the Living Collections are kept up to date. Through this process we get a holistic understanding of the Living Collections – including what plants make up the Living Collections, the condition of plants, deaths, survival rates, phenological data, and growth rates. It is also an opportunity to verify the taxonomy of the Living Collections, as well as to order new labels or reposition existing ones.



## 8.1

### **Types of Audits**

Updating records is a fundamental and irreplaceable process. The goal at any given time is to have all individual records updated within the last four years for any given accession in the Living Collections. Horticulture and curation staff members continuously interact with and observe the Living Collections. The recording of these interactions is a key aspect of collections management. In addition, CUBG engages in various forms of structured audits outlined below.

#### **Targeted Audits**

Targeted audits involve assessing all plants recorded in a given area and are carried out on a rotating basis. A targeted audit of an area begins with a list of all the plants that are recorded in the database as existing in a given location. Auditors systematically move from one side of the bed to another recording observations and checking off plants as they are inspected. When the auditors have made their way entirely through a bed, the final step is to check for plants that are on the list but have not yet been audited. It could be the case that a plant was overlooked, and a second glance reveals it is still in the bed. Alternatively, the plant could be dormant and need revisiting. Or it could be the case that the plant should be observable but after consideration is deemed “Not Found”.

A targeted audit of a taxonomic group may be undertaken for verification purposes or, due to the ephemeral nature of the group, is only able to be audited during a small window of time. For this latter situation, plants that have not been audited in 4 years or more are targeted.

#### **Tree Surveys**

All trees are subject to a formal inspection and tree survey by an external contractor. This surveyor must be qualified at Professional Tree Inspection level or higher, and credentials to be checked. Formal tree surveys take place at an interval of no longer than three years. These trained professionals evaluate the condition of each tree, take measurements of height, spread and diameter at breast height (DBH) and provide management recommendations. Head of Horticulture and Team Leader for Garden Landscapes develop a tree works schedule based on the recommendations of the report.

#### **In-House Tree Assessments**

The CUBG Trees and Shrubs team conduct in-house assessments on a regular basis and following high wind events and weather-related Garden closures. Informal, incidental day-to-day checks of trees by members of staff or volunteers may be conducted and recorded in IrisBG. Conditions recorded by members of staff or volunteers in IrisBG are not to be regarded as tree health and safety assessments but rather for the context of internal records only. Any person observing a hazard or defect to a tree during an informal check must report this to Head of Horticulture, Team Leader for Garden Landscapes and/or a CUBG Arborist. See CUBG’s Tree Survey Policy for more information.

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## 8.2

### Tools for Auditing

Audits are carried out using handhelds, tablets, and/or pencil and paper. Handheld mobile devices and tablets allow staff to look up and edit collection data while in the garden. These devices reduce time spent at the computer doing manual data entry and increase the interactions between staff and the records, allowing for more updates to be done on a more regular basis.

In addition to tablets and/or handhelds, employing paper records is useful, particularly during targeted audits, as its use allows one to record plants that may not be on the inventory, make notes about which plants to return to at a later date, and review electronically recorded information for potential data entry errors.

## 8.3

### Updating Records

A lot of information can be captured during an audit. This information gives us a snapshot of the composition of the Living Collections and informs horticultural and curatorial decisions. The value of this information lies in its accuracy and consistency. With the introduction of mobile devices for auditing comes a potential influx of records data. While an increased amount of records is a benefit to the Living Collections, potential problems to mitigate are introduced error and inconsistencies in the database. Accuracy can be diluted by recording assumptions, e.g., “I cannot find this plant, I will record it as ‘Dead’”, rather than observations, e.g., “I cannot find this plant, I will record it as ‘Not Found’”. Consistency is diluted by various users of a database imposing their own interpretations on the database. To reduce these inconsistencies and empower staff to contribute to the recording process, this section gives guidance on interpreting and contributing to the fields most commonly update during an audit.

#### Status

The status in its basic utility indicates whether the plant(s) in a given record are considered alive or not. Some status designation are utilized more than others and below is a definition for the most relevant statuses to use during an auditing event. All other status definitions and their appropriate uses are listed in Appendix B. Green text indicates existing plants in the Living Collections. Red text indicates the plant no longer exists in the Living Collections and will **not** show up on database-generated lists of existing plants.

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**Inspected** This status is the default status used when updating records. This status indicates a qualified staff member or volunteer has observed and scrutinized the plant(s) and, with respect to that plant or group of plants, has considered most of the relevant fields outlined in this section.

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**Number changed** This status is used when a change is made to the number of plants in the qualifier, e.g., if one plant dies or a plant grouping can no longer be individually counted and henceforth considered a mass.

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**Auditing the Living Collections**

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**Re-mapped** This status is used when maps have been updated and old beds have become defunct, or boundaries changed.

The plants have not been moved but the location has changed.

This status is also used to correct erroneous locations recorded in the database. For example, *Crataegus pinnatifida* was noted to be in NW9 but during the audit the plant was found in SW9. The status was updated to Re-mapped and a note about the previous error added to the Comments field.

---

**Dead** This status is used when there is certainty that a plant is dead, e.g., the lifeless remains are present. As there is no value of assumptions in the records, when a plant is unable to locate and remains are not present, default to the status “Not Found”.

---

**Not Found** This status is used when a plant that should be visible at the time of auditing is not found, i.e. presumed to be dead or removed. If a plant is presumed dormant, this status is not used and the record for this plant is not updated at that time. It becomes the responsibility of the staff undertaking the audit to return at the appropriate time of year for this accession.

For example, during an audit of the Woodland Garden in July 2022, *Trillium albidum* accession items were not updated. Because there was no way to practically comment on the condition or presence of the plants at that time, these areas were returned to in April and the individual records updated when the plants were no longer dormant. *Trillium albidum* not seen in April had their record updated to Not Found.

---

**Consolidated** This status is used when two qualifiers of the same accession are planted in the same bed and become indistinguishable over time or it is deemed unnecessary to maintain two separate qualifiers, the two qualifiers can be consolidated into one. Typically, the qualifier with alphabetic priority is maintained.

In the event where different accessions of the same taxon grow indistinguishable over time, a new accession is created and assigned to the planting (see Section 4). The prior accession qualifiers are Consolidated in the records and a note included in the Comment section of each qualifier to explain, e.g., “20/05/94 MSA: indistinguishable from 19680001\*A, consolidated under new accession 20220054\*A”.

---

### **Condition**

Condition assessments allow for an understanding of the health and vitality of the plants in the Living Collections. Conditions are updated for all plants during auditing. Currently the database is programmed to carry over the previously recorded condition. Condition is updated if the plant/plant grouping no longer fits the criteria of the previously recorded condition.

Condition assessment criteria are the areas of consideration listed below. These conditions are assessed in terms relative to the environment at CUBG and not relative to the context of the plants in their natural habitat.

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**Auditing the Living Collections**

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- Relative growth.
- Overall appearance and vitality.
- Presence/indication of pests/pathogens.
- Evidence/observation of the plant's ability to undergo its phenological cycle.

**Excellent** – this condition is indicative of a plant/plant grouping excelling in all condition criteria.

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**Good** – this condition is indicative of a healthy plant/plant grouping. Perhaps there is one “defect” notable, but overall, the plant is doing well with respect to all condition criteria. Example: The plant is healthy and robust but crowded by a neighbouring plant.

---

**Fair** – this condition is indicative of a plant/plant grouping with more than one defect with regards to the condition criteria. One would expect this plant to be alive during the next audit cycle (i.e., in 4 years' time), albeit with notable defects. When on the fence, the difference between a plant in fair and good condition can be determined by asking the question “would I bring someone out to see this plant?”.

---

**Poor** – this condition is indicative of a plant/plant grouping with many notable defects with regards to the condition criteria. The plant is not healthy and would not be expected to be alive during the next audit cycle. If of considerable value to the collection, this plant is prioritised for propagation.

---

**Critical** – this condition is indicative of a plant/plant grouping that is nearly dead. There is little if any opportunity for propagation and it is to be considered for removal/replacement.

---

**Normal** – while this condition exists as an option in IrisBG it is discouraged from being used.

**Number of specimens**

This indicates how many plants within an item and is important to track changes over time. During auditing, this number is useful informing how many plants the auditor is looking for. When plants are planted, the exact number is recorded. Over time, when a group of plants form a mass and it no longer becomes practical to count individual plants, the number is updated to “mass”. Alternatively, if a former “mass” dwindles to a few, countable plants, the number can be updated to reflect this change.

**Date**

The day the update was made.

**Person**

Person conducting audit.

**Label Requests**

Request labels as necessary where labels are missing, broken, or outdated (see Section 9).

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**Auditing the Living Collections**

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**Comments**

The Comment field is used to elaborate on the condition, note the current phenology, e.g., full bloom, abundant fruit, or add context to any other observations of a plant/plant grouping.

When adding comments in the Comment field, the date of the comment and the initials of the commentor should precede the comment, e.g., “20/05/1994 MSA: start of bloom – 1st flower”. Currently the database defaults to carry over the comment from the previous audit. Previous comments are manually removed from the current record if no longer relevant. This cuts down on confusion caused by outdated comments. Rest assured, by doing so the comment is not outright deleted, instead it is stored in the database under the prior record.

**Location reference**

This field informs where in the bed the plants are with regard to cardinal direction. Prior to starting a targeted audit, it is useful to “pace off the bed”, walking due north/south and east/west to establish quadrants to the bed for location reference context.

The notation used may vary, e.g. “NW” “northwest” and “NW side” would all be in reference to the north western quadrant of the bed. Any context to the location can be added to the Location Sub-Reference field. For example, where there are three qualifiers of the same accession of tree grouped together in the NW, in the Location Sub-Reference field of each qualifier identify the north plant, central plant and south plant. This will reduce confusion in the future and aid in collections management should labels go missing.

The Location Sub-Reference field is also used to make reference to fixed features of the landscape. For example, in the Location Reference field you might note “central” and in the Location Sub-Reference field note “west of water feature”.



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**Auditing the Living Collections**

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**Key Points**

- **Auditing is the process through which the Living Collections are kept up to date.**  
.....
  - **The goal at any given time is to have all individual records updated within the last four years for any given accession in the Living Collections.**  
.....
  - **There are various audits that are conducted at CUBG, each plays an important role in collections management.**  
.....
  - **The status in its basic utility indicates whether the plant(s) in a given record are considered alive or not.**  
.....
  - **Condition assessments allow for an understanding of the health and vitality of the plants in the Living Collections and are assessed in terms relative to the environment at CUBG and not relative to the context of the plants in their natural habitat.**  
.....
  - **Information captured during audits allows for a holistic understanding of the Living Collections and consistency and accuracy of the information captured establishes data integrity and allows for robust analysis of the Living Collections.**  
.....
  - **See Flowchart 6 for a visual representation of this process.**
-



Cupr  
100

Cupr  
100

Bet  
20

Cela  
198

Actinidiaceae  
19540354\*A

Rosaceae  
10005895\*A

Cotoneaster x watereri

Garden origin

G



# 9 Labelling

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Plant labels are the link between the accession information held in the plant records database and the plants in the Living Collections. They are also one of the main methods for conveying information about the plants to the public. It is therefore crucial for the curation and use of the Living Collections that all plants are correctly labelled.



## Labelling

### 9.1

## Types of Labels

There are two types of labels used by CUBG:

- engraved labels.
- printed labels.

### Engraved labels

These labels are used for all plants in public areas of the garden and function as both records labels and display labels. These labels are printed in-house by curation staff. Engraved labels are requested by populating the Label-Type-2 fields in IrisBG.

Engraved labels include the following information:

- Accession number and qualifier.
- Family.
- Botanical Name.
- Common Name where applicable, with all words capitalized.
- QR code, which allows for quick records access, currently for internal use only.
- Geographical distribution.
- Provenance represented by code G, Z, W, or U.
- IUCN status where applicable, Threatened status and higher.
- Memorials, sponsorships or other special plant attributes, where applicable.

**Figure 1**  
Engraved label example.



Engraved labels are available in three sizes:

- Large (LGE/LGEH) 100mm x 75 mm.
- Medium (MED/MEDH) 75mm x 50mm.
- Small (SML) 35mm x 60mm.

## Labelling

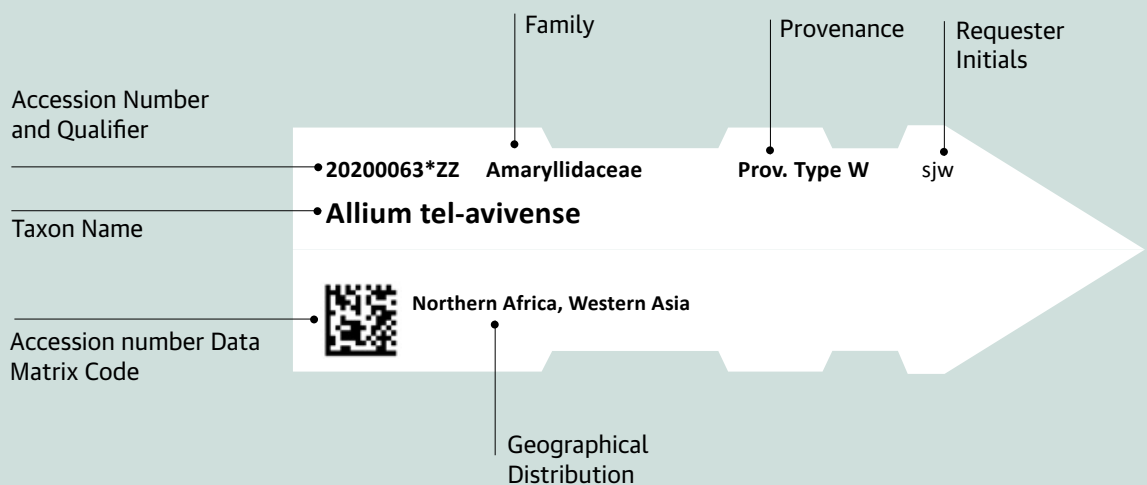
The large and the medium can be displayed on a label stand, hanging from a branch or screwed into the trunk of a tree using stainless steel screws. Hanging labels should be fastened loosely around branches, never on the main bole of a tree/shrub, and adjusted to allow for growth. The size and type of display are specified by the requester.

Commemorative labels are labels that reflect plants dedicated as Memorial or Sponsorship plants. These plants are typically trees and their engraved labels capture the above information as well as dedication information. Commemorative labels are printed in black and gold.

### Printed Labels

These labels are used for all plants upon entering CUBG. When the plant material is first accessioned, printed labels are created by the Plant Records Officer. Horticulturists can generate their own printed labels as required. Printed labels are requested using the Label-Type-1 fields in IrisBG. Printed labels include all the information that is included on the engraved labels. These labels function as records labels but not display labels.

**Figure 2**  
Printed label example.



Printed labels are available in two forms:

- **Pot labels** for sticking in the substrate of a pot.
- **Stick-on barcode labels** for use on woody plant material. These labels have a longer lifespan than pot labels.

## Labelling

### 9.2

### Garden Label Policy

- All plants or mass plantings in public areas of CUBG must have an engraved label.
- The Plant Records Officer orders printed labels for all newly accessioned plants.
- The Horticulture team order engraved labels for all plantings before they are planted out in public areas. Printed labels can be discretely kept with the plants when warranted.
- The Horticulture team orders printed labels when propagating or as required. Handwritten labels are discouraged from use due to potential introduced error.
- All trees and shrubs in the nursery and in public areas have both an engraved label and a stick-on barcode label.
- Where a plant is an annual or biennial an engraved label with the term ‘Annual’ or ‘Biennial’ in lieu of the accession number may be placed with the plant so long as a printed label is placed with the plant or attached to the engraved label and the database reflects the current accession and qualifiers on display.

#### Below:

A sample of labels used currently and historically at CUBG.



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**Labelling**

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**Key Points**

- **At CUBG, we strive to have accurate and up-to-date labels on all plantings.**

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  - **There are two types of labels, engraved labels and printed labels.**

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  - **All plantings in public areas require an engraved label, while all plantings in reserves require at least a printed label.**

---
  - **It is the responsibility of horticulturists and curation staff to request labels as needed.**
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# 10 Mapping

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Maps are an essential function of any botanic garden. They are useful for visitor and staff orientation, for planning purposes, historical context, and for ensuring high quality collections management. In a collection's context, accurate maps mean that if a plant loses its label, we can identify which accession and individual qualifier they belong to. Accurate maps mean high value accessions of wild-collected provenance or conservation value plants are stewarded and tracked appropriately. Accurate maps inherently add value to the collection through the abovementioned ways. They also present opportunities to document, analyse, and enrich our collections. Once established, accurate maps underpin analysis on topics such as collections management and quality, microclimates, canopy cover, collections capacity, topography and distribution of soil types.



## Mapping

### 10.1

### Mapping the Site



CUBG uses a postcode style system to denote areas of the garden. The garden is divided into four broad areas based on cardinal direction, NW, NE, SW, SE, which are then sub-divided into areas based on features of the garden with each area given a unique code, see Figure 4. Each bed in an area is then given a code comprised of the area it is in and a bed number. Each glasshouse range uses the same location code with each area within the glasshouse given a unique code with an additional number on the end to designate a specific bed location, see Figure 5.

This system ensures that every location in the garden is defined, and no plant is without a location. Maps of the garden are produced using ArcGIS software from aerial photographs and projected using the WGS84 geographic co-ordinate system.<sup>28</sup>

#### Figure 3 (below)

The systematics beds are in the SW (Southwest) area of the garden and are divided into five areas, SW5, SW6, SW7, SW8, SW9.

#### Figure 4 (opposite top)

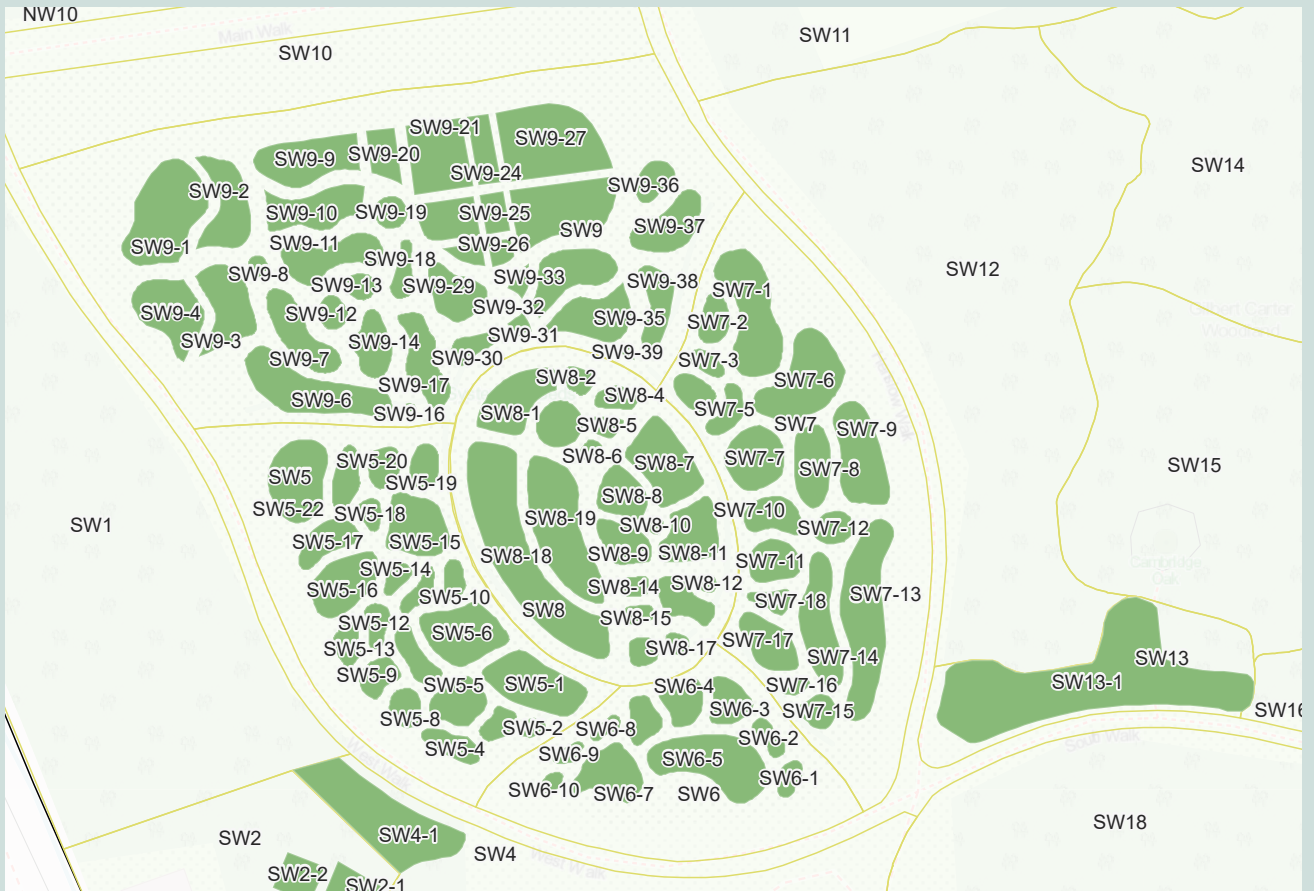
Within each of these areas individual beds are given unique location codes reflecting the location area. Seen above, within area SW9 the Fabaceae bed location codes are SW9-1, SW9-2, SW9-3 and SW9-4.

#### Figure 5 (opposite bottom)

The public glasshouse code is NW15. The Continents Apart house has the code NW15-1 with each bed being given an additional unique code e.g., NW15-1.1, NW15-1.2.



Mapping



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**Mapping**

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**10.2****Mapping the Plants**

Accurate mapping in the Living Collections acts as an insurance policy should labels go missing. Without precise location information, the ability to confidently match accession information with an unlabelled plant is jeopardized. All trees and large shrubs are mapped using a GPS device or by selecting a location from up-to-date air photographs georeferenced to WGS84. Latitude and longitude coordinates are captured at the time of planting or within a year of planting.

**Trees**

Each tree is individually mapped. As it is policy that all trees are individually qualified, in the event where mapping uncovers instances where trees have been lumped together into one qualifier item, we will endeavour to individually qualify each individual and map accordingly.

**Large shrubs/small trees**

Where large shrubs are planted en masse and qualified under the same accession we will determine if the planting warrants individual qualifying. If it does, the policy set out for trees will be applied. An example of where individually qualifying is warranted is if the plants in question are not in a bed but in a large area and individually mapping will allow for ease of location.

If individual qualifying is not warranted, we will follow the below policy:

- Where the planting is an indistinguishable mass (e.g. a hedge, clump-forming) a GPS point will be taken in the approximate centre of the mass.
- Where the planting is made up of individuals that are distinguishable but do not warrant individually qualifying, a GPS point will be taken from the centre of the southernmost plant in the grouping.

**Herbaceous perennials**

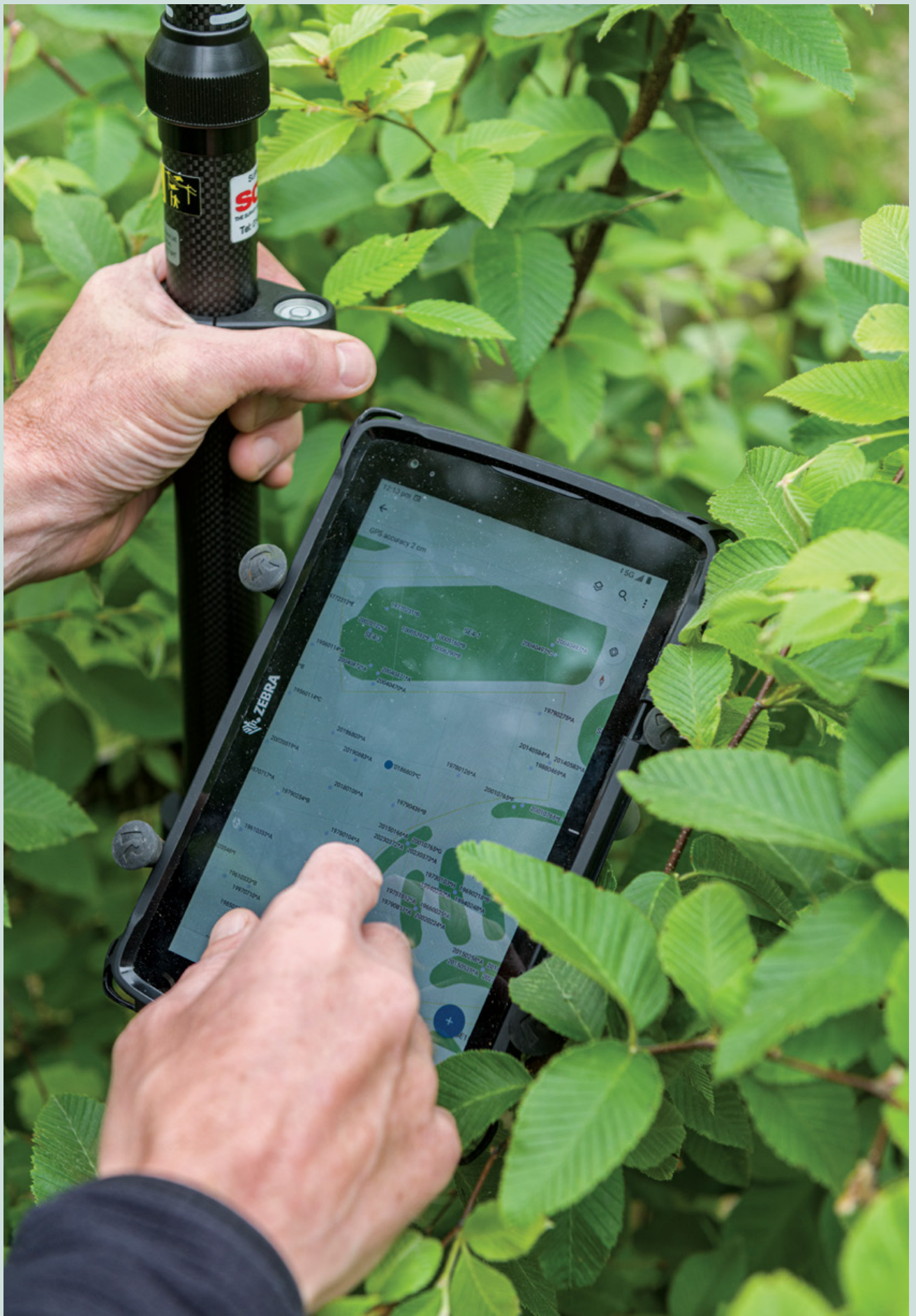
Mapping of herbaceous perennials may be warranted in certain scenarios. For example, when one individual is planted or when the accession is of conservation value.

Polygons cannot be stored in IrisBG but can be stored in ArcGIS. For areas such as Systematic Beds and Eco Mound where we may want to track herbaceous plantings to ensure integrity over time or to track population changes we will employ polygons in ArcGIS and GPS points associated with the accession item in IrisBG will be taken from the centre of the mass.

**10.3****Version History**

Version histories will be stored as layers in ArcGIS. Each version history will be named according to the year it was produced and reflect the layout of the beds at the time of the layer created.

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**Mapping**

Mapping



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**Mapping**

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Once the map is updated PDFs will be made for the full map, each quadrant (e.g. NW, SW, NE, SE), and section maps. These PDFs will be stored in a central location for access by all staff members. Hard copies will be stored in the Plant Record Officer's office.

**10.4****Recording Locations in IrisBG**

Within IrisBG, areas and bed codes are stored in the Locations table. Both active and inactive location codes are stored along with the horticultural section to which the location belongs, a description of the location, and GPS coordinates for a central point in the area or bed. Each accession item is then recorded within a location.

All plantings are required to have a location recorded in IrisBG. Location information on any given planting is stored in the Items tab of the Accession table. The Garden location code corresponding to the plant or plant grouping's current location is entered into the Location field in Items. GPS point location for individual trees and large shrubs is stored in the Latitude and Longitude Coordinates fields.

**Key Points**

- **Accurate and precise maps of beds, plants, and features are required for the efficient management of the Living Collections.**
  - **GPS locations of plantings acts as an insurance policy against label loss in the collection and allow for high quality stewardship of conservation collections.**
  - **Version histories of maps are stored for historical context in digital and hard copy form.**
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# 11 Verifications

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One of the primary functions of the Living Collections is to provide a reference source of accurately named plants for taxonomists, horticulturists, teachers, and researchers alike. The term verification denotes the continual and on-going process of identifying and accurately naming the plants held in the Living Collections. This may involve the confirmation of an existing name, i.e., the name that the material came in with, the changing of an existing name (verified or not) to another name, or the determination of the plant's identification if it is unknown. Verification also involves checking that the name selected is accepted according to the wider botanical community.



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**Verifications**

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**11.1****Priorities for Verification**

Ideally all plants in the Living Collections should be verified. However, the scope for routine verification is limited by resource constraints and the size of the Living Collections. Out of necessity, priorities must be established. The list below defines the types of plants that are prioritised for verification, although not necessarily in that order.

- Plants whose identity is unknown. These can be completely unidentified, or to the levels of family or genus.
- Plants to be used for research purposes.
- Plants of conservation importance.
- Plants suspected of being wrongly named.
- Plants of known wild origin.
- Plants in which CUBG has a particular education interest.
- Plants that will comprise part of a prominent display or outreach initiative.

**11.2****The Verification Process**

Once a verification priority has been established, the plant is visited in its location at CUBG. It is important that the plant to be verified is in a reproductive state. Photos are taken following the Photographing protocol (see Section 2). When possible and if appropriate, the plant is then taken to a place where verification is possible given literature and internet access. If moving the plant is not adequate, e.g., trees, morphological data is recorded.

Verification is done using various sources as outlined below. Many of these sources are insufficient in themselves, but may provide useful guidance:

- Using Google Images is a preliminary step that functions to contrast the morphology of the supposed taxon and that of the accession. Artificial intelligence provided by Google Images algorithms can offer interesting clues towards the identification of a plant.
- If the locality of the accession is recorded in the database, floras of the region can be consulted. The Global Biodiversity Information Facility (GBIF) is also used, by searching all the plants of a given genus occurring in a given locality and, when available, associated images.<sup>21</sup> Although this method can be useful, it can also be misleading since not all of the records in that database are accurate. Therefore, results obtained from GBIF have to be verified in other sources.
- Nomenclatural and taxonomic databases are checked. These include reputable sources such as Tropicos, Plants of The World Online, physical herbarium specimens, the Jstor repository of herbarium type images, and the Biodiversity Heritage Library.<sup>19,22,29,30</sup> Checking these resources can be useful to find

**Opposite page:**

The process of collecting a herbarium specimen.

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**Verifications**



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Verifications

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## Verifications

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accurate images of the plants and bibliographic references, e.g., dichotomous keys or monographs.

- Recent taxonomic revisions, often published as books, are searched in the Cory Library or online. These types of resources are often the most reliable ones and should be used whenever possible.
- Where available, correspond with an expert.

Once a verification has been made, the verification is documented by updating the Determination fields in the Accessions Details table of IrisBG, specifying the individual responsible for verification, their level of expertise, e.g., a general taxonomist or specialist, the date of verification, and the reference(s) used for the verification. Any images taken during the process are uploaded to the database. Finally, if not already done, an herbarium voucher is collected.

### Key Points

- **The term verification denotes the continual and on-going process of identifying and accurately naming the genetic resources held in the Living Collections.**
  - **Plants to be verified are prioritised by curation staff members based on relevant criteria.**
  - **Verifications are backed by in depth research using available resources.**
  - **Verifications are recorded in the plant records database and formerly documented with an herbarium voucher.**
  - **See Flowchart 7 for a visual representation of this process.**
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# 12 Herbarium

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Herbaria are repositories of pressed and dried material that are records of organisms growing at a particular location on a particular date. Herbarium specimens function as sources of biological material for many purposes, including taxonomic verification and DNA extraction. University of Cambridge manages two herbaria: the Cambridge University Botanic Garden Herbarium (CGG) and the Cambridge University Herbarium (CGE). This section is concerned with the management of CUBG's herbarium (CGG). This collection is stored, along with CGE, in the basement of Sainsbury Laboratory.



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**Herbarium**

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For any Living Collections, it is a useful practice to document the collection as herbarium vouchers. Doing so allows future staff members and/or researchers access to plant material that may no longer be alive, assists in verifying the collection, and presents a snapshot of the Living Collections. At CUBG, we prioritize vouchering plants that have been used in research and plants whose identity has been verified by CUBG staff. Prioritising plants used in research ensures researchers can reference herbarium records in publications. Material verified by CUBG staff is prioritised for vouchering as it serves as the formal documentation of the verification process. Herbarium vouchers collected by CUBG staff while on expedition are deposited into CGE and the records retained in IrisBG.

Procedures used by CUBG staff and affiliates to collect, record, press, and mount specimens follow those standard procedures outlined by *The Herbarium Handbook* and RBGE's *Guide to Collecting Herbarium Specimens in the Field*.<sup>9,31</sup> See Flowchart 3 for standard vouchering procedures followed by CUBG staff and volunteers.

## 12.1

### Herbarium Records in IrisBG

Herbarium records are stored in the Items Tab of IrisBG. This information is used to make the herbarium specimen label and acts as a reference database for enquires. Examples of herbarium specimen labels of wild-collected material and garden origin can be seen in Figures 6 & 7, respectively. The following fields are required for complete herbarium specimen records.

**Item Type** Herbarium. The qualifier assigned can be H or sequential next letter.

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**Item Status**

**Seen:** indicates a specimen has been seen and fully curated.

**Missing:** indicates a specimen that is documented in the database but cannot be found in the physical herbarium.

**Curation needed:** indicates a specimen with an outstanding issue, e.g. label or barcode missing, image missing, repairs or taxonomic review required.

**Not mounted:** herbarium specimen that is awaiting to be mounted.

**On loan:** specimen loaned to another collection.

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**Date** This is the date that the voucher was collected.

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**Number Specimens** Indicates how many sheets a specimen is mounted on e.g. sheet 1 of 3. Each sheet is barcoded and imaged individually.

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**Person** The individual who collected the voucher.

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**Location** CGG or CGE (organised by sublocation).

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**Herbarium**

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**Label Request** This information is stored across three fields of the Label type-2 field-section. Herb01 is used for CGE material and Herb02 for CGG material.

**Item Reference** This indicates the qualifier from which the voucher of this accession was taken.

**Conservation Number** The unique barcode number affixed to the voucher is stored here.

**Comment** Information about the plant that is not evident in the voucher, e.g., height, DBH, fragrances, colours, exudates, overall condition. The accession number and qualifier from which material was collected, written as “Specimen of: XXXXXXXXX\*X”. The bed code from where the material was collected, written as “Bed Location: XXX-X”.



## Herbarium

	Taxon Name	Author	Accession Number	Herbarium Collection Code
	Cambridge University <b>Botanic Garden</b>		Acc Num: <b>20150029</b>	CGG
	<b><i>Amborella trichopada</i></b>	<b>Baill.</b>		<b>Amborellaceae</b> • Family
Plant description	Male plant; in bloom, shedding pollen; good condition • Specimen id: 20150029*A Bed location: NW26-2			
Collector & Collection Date	• <b>Apple, Margeaux 2022-10-21</b>			

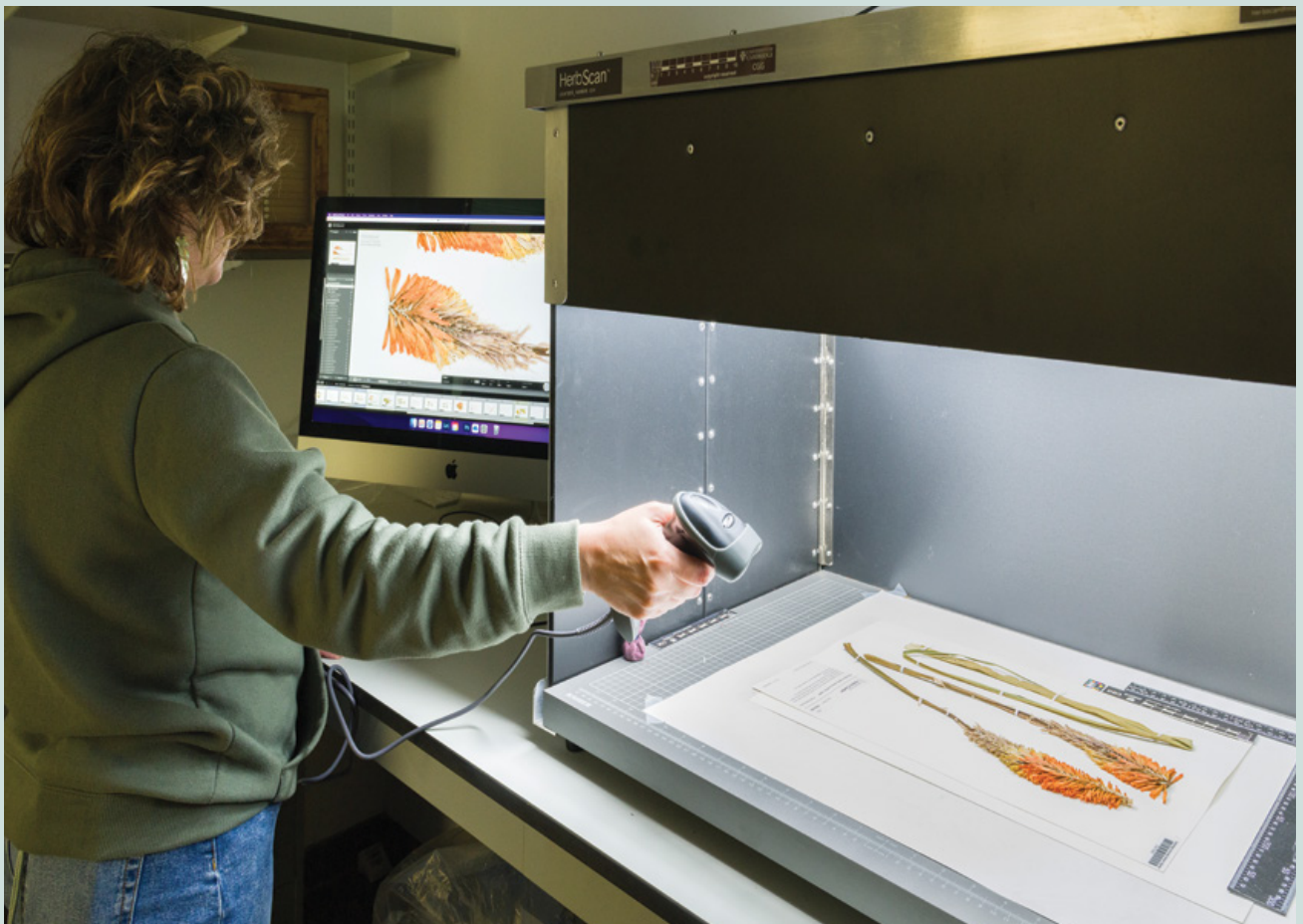
**Figure 6 (above)**

Herbarium labels for garden collected material, left, and fields pulled from in IrisBG for associated information.

	Genus	Species	Author	Accession Number	Herbarium Collection Code
	Cambridge University <b>Botanic Garden</b>			Acc Num: <b>20220331</b>	CGE
	<b><i>Tulipa fosteriana</i></b>		<b>W. Irving</b>		<b>Liliaceae</b> • Family
Locality	Kyrgyz Republic, Batken District. Found on stony south facing slope in foothills of mountans south of Baul village. 39.73073°   69.937° 2186m •				Habitat description
					Altitude
Plant description	Large leaves near the bottom of stem that holds a large bright red flower with a black centre. Whole plant approximately 15-20cm in height.				GPS Coordinates
	<b>Wilson, B 2019-04-14</b>				<b>BDW19</b>
	Collector	Collection Date			Collector Code

**Figure 7 (above)**

Herbarium labels for wild-collected material, left, and fields pulled from in IrisBG for associated information.

**Herbarium**

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**Herbarium**

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**12.2****Adding Specimens to the Herbarium**

Once pressed specimens are fully dried, all material entering the herbarium is placed in sealed bags and frozen for 72 hours at  $-30^{\circ}\text{C}$  to prevent the introduction of pests and/or molds into the collection. Specimens are then thawed overnight, whilst still bagged. All dried specimens should have their collection data uploaded to the database to allow for the further curation of the specimens and printing of labels.

**12.3****Mounting**

CUBG staff follow standard mounting procedures, using archival quality materials. Specimens may be strapped or glued to mounting sheets depending on the nature of the plant that is being mounted. Loose material and/or excess reproductive structures are placed in capsules that are themselves fastened to the mounting sheet. It is good practice to include empty capsules on mounting sheets for future users to insert material sampled from the voucher. Care is taken to ensure plant material is mounted with enough room from the edge of mounting sheets to avoid damage. Additionally, plant material is mounted to leave space for labels in the bottom right and barcodes in the upper right. Currently, acid-free, self adhesive, archival quality laser labels (102 x 85mm) are used for CGG vouchers.



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**Herbarium**

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**12.4****Imaging**

Fully curated herbarium specimens have a five-digit CGG barcode attached at the top right of each sheet. Sheets are imaged using a digital SLR camera inside a HerbScan herbarium light box and are staged with a scale bar and colour chart. Images are captured in a camera raw format then colour balanced and cropped using Adobe Lightroom Classic. Images are archived in a TIFF format and JPG files are hosted for local use. All files are stored on CUBG's servers and linked via the Images tab of IrisBG.

**12.5****Storage**

CGG specimen genus folders list the family, genus and region of the specimens enclosed inside. These specimens are laid into the CGG compactor units alphabetically by family, genus, and species.

Wild-collected CGG specimens are laid into CGE in separate CGG folders, according to the geographic divisions of 'Great Britain and Ireland', 'Flora Europaea' and 'World' collections.

- Within each of these divisions, specimens are arranged taxonomically by family, genus, and species.
- Within the World collection, genera are further subdivided into geographic sections before separation into species.

**Key Points**

- **University of Cambridge manages two herbaria: the Cambridge University Botanic Garden Herbarium (CGG) and the Cambridge University Herbarium (CGE).**
  - **CUBG prioritises the vouchering of those plants in the Living Collections that have been used in research and those that have been verified by CUBG staff.**
  - **CUBG follow standard collection & mounting procedures for all vouchers.**
  - **Labels for vouchers are derived from information stored in the plant records database.**
  - **See Flowchart 8 for a visual representation of this process.**
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Germplasm

SD



Store dt. 08 MAR 12

PJA

Narcissus

Cambridge BG  
Germplasm Bank

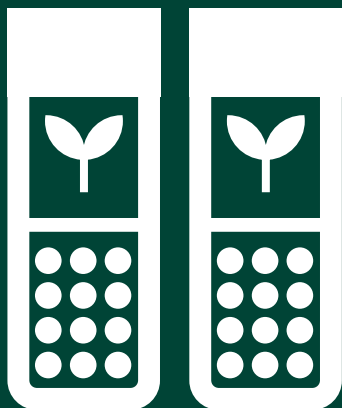
020

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# 13 Seed Bank

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CUBG maintains a medium-term seed bank. The seed bank complements the Living Collections by providing in-house stock of orthodox seed. This seed is available for future use in the Living Collections, for conservation, research, and for sharing with other botanical institutions. Seed for storage comes from seed collected from accessioned plants in the Living Collections and from seed from wild collecting or horticultural sources. All seed lots in the bank are accessioned. For seed received from external sources, seed is accessioned by the Plant Records Officer upon receipt (see Section 4).



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**Seed Bank**

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**13.1****Prioritising**

The establishment of seed collection priorities is an important step in insuring against loss in the Living Collections and expanding the *ex situ* capacity of CUBG. The horticulture and curation staff work together to monitor and evaluate the collections to assess for seed collecting opportunities, with special attention given to those plants considered valuable based on various criteria, e.g., conservation value. Priorities are also established for annual and biennial taxa in the collection to reduce the need for regular collection/seed orders and perpetuate the ornamental value of the collection.

At the beginning of each growing season, horticulture and curation staff members collaborate to create a target list of accessions/taxa for collection in the coming season. Feasibility of cross pollination, collection timing, and other topics are discussed during the planning process.

**13.2****Collecting**

To ensure the best quality, seed should be collected on dry days when the seed is mature. Care should be taken to ensure seed is ready for collection as immature seed will not be fully formed and will have a reduced viability. Some seed will continue to mature after collection. It is important to understand the nature of the seed prior to collecting to maximize outcome.

When collecting, collect as much seed as possible to reduce the need for subsequent collections. Seed is collected in cotton or plain brown paper bags. Envelopes and folded paper are not suitable as they do not allow sufficient air movement or moisture to escape. A tag must be placed in each bag with the accession number of the mother plant, plant name, collection date, collector(s), and sample size.

In special circumstances, controlled pollination may be practiced to guarantee desired collection outcomes. Controlled pollination is the process in which the pollen from a selected plant is deliberately transferred from one plant or flower to the stigma of another while all other pollen is restricted. This practice, when successful, produces progeny of known parentage and potentially improves seed set. Controlled pollination is practiced in breeding schemes but also in *ex situ* collections where plants are prone to hybridization and there may be a desire to perpetuate lineages.

**13.3****Processing**

After collection, seed with associated collection information is placed on silica in sealed plastic containers for four weeks, at a relative humidity (RH) of approximately 15%.

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**Seed Bank**

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**13.4****Storing Seed**

Once seed has gone through sufficient drying process, seed is put into clean glass jars and labelled with associated accession information. A label with the storage number is adhered to the cap. Since seed is exposed to air when jarring, once the seed is jarred, jars are returned to silica containers for a short duration to return to 15% RH before being sealed and stored in refrigerators at 5 degrees Celsius. Jars are stored in sequential order by storage number.

**13.5****Accessioning**

For seed collected from the Living Collections, once the seed has been processed the accession record for the seed is created by the Plant Records Officer using information recorded during collection by members of staff or volunteers. See Section 4 for the information required for the accession record.

**Regarding provenance**

All seed collected in CUBG must be newly accessioned as it will (in most cases) be genetically distinct from the parent plant(s). The parent plant(s) accession record should be linked to the new accession using the Parentage tab in IrisBG. Where seed is from controlled pollination both the mother and father plant accession numbers should be recorded. In any case, the contact/origin of the accession is recorded as “CUBG” for this accession.

Seed from a wild source mother accession (W) has its provenance recorded as indirect wild origin (Z) and the mother collection details copied into the new accession record, in the Locality and/or Collection sections of the Details tab.

Seed from mother plants with provenance ‘Z’ is recorded as ‘G’ (garden origin). Seed from mother plants with provenance ‘G’ or ‘U’ (uncertain origin) will be recorded as ‘G’.

**13.6****Creating the Seed Bank Record**

The accession record links the seed to data captured at point of receipt/collection. The collection record informs about the availability, quantity, and location of each seed lot in the seed bank. Below is the most pertinent information to capture in the collection record in the Items table of IrisBG.

**Type** This differentiates seed bank records from other types of records, e.g., plantings, propagations. The type Seed is used exclusively for seed in the seed bank. Seed undergoing propagation would be categorized as a Planting with a status of Propagation in the database (see Section 7).

**Location** This refers to the general location, the seed bank. In IrisBG, SEB3 is the location code designated for seed bank fridges. SEB3L is the location designated for large jars in the seed bank.

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**Seed Bank**

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**Storage number** The storage number is a sequential number used to locate seed in the seed bank.

**Status** The status indicates whether there is currently seed 'In store' or if there is no longer seed available, 'Empty'. The status <25 indicates seed lots with less than 25 seeds and flags these seed lots as in low quantity.

**No. specimens** The amount of seed is recorded in jars or seeds. For example, half a jar of seed would be recorded as "0.5 jars" while 30 seeds would be recorded as "30". When seed is removed from the bank the amount remaining is updated with the remaining quantity. When the seed stock is fully exhausted the amount is changed to 0 and Status changed to 'Empty'.

**Label Request** Label type BMSB, "Barcode Label – Seed Bank", is requested during seed processing in preparation for storage.

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**Seed Bank**

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**13.7****Using Seed from the Seed Bank**

To find seed in the seed bank check the Items table or generate a list of available seed from the database. Where possible always use the oldest seed in the bank. When removing jars from the fridge, leave the jars to sit unopened for 30 minutes to minimise condensation events. When opening jars to remove seed try to minimise the amount of time the jars are open and ideally only open jars on dry days. Seeds are dried back down to 15% relative humidity following any exposure to ambient conditions. Make sure lids are placed back on tightly and any unused seed is placed back in the bank in its correct location. After seed has been removed from the bank, the number of specimens field in the Items table is updated with the amount of seed/jars remaining. Where all the seed is used put a zero in this field and update the status to 'Empty'.

**Key Points**

- **CUBG maintains a medium-term seedbank for seed collected from the Living Collections, collected in the wild, or received from horticultural sources.**
  - **Seed is collected from the Living Collections based on priorities established by horticulture and curation staff.**
  - **All seed is subject to a drying period and stored in sealed and labelled glass jars at 5 degrees Celsius.**
  - **All seed is accessioned. Those seeds collected from the Living Collections are given a new accession and linked to the parent accession in the database.**
  - **See Flowchart 9 for a visual representation of this process.**
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# 14 Facilitating Research & Exchanges

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As a university botanic garden, one of CUBG's primary objectives is to support world-class research. As a member of the botanic garden community, we strive to share plant material to bolster research, learning, and *ex situ* conservation worldwide. This section outlines the policies and procedures that guide how access to the collection is provided and to whom. Research requests concerning the use of experimental glasshouse and plot facilities are facilitated by nursery staff and are not addressed in this document.



## 14.1

### Receiving Requests

All requests are vetted by members of the curation team with input, as deemed necessary, from horticulture and other departments. When granting use of the Living Collections it is important to understand the nature of the request, and identity of the requester, to ensure that the request is in keeping with the mission and values of CUBG. It is also important to ensure the request falls within the remit of the Nagoya Protocol and that supplying plant material does not contravene national or international legislation. Requests may be fulfilled through access to plant material and/or access to the site. For all requests that we are able to facilitate, CUBG does not charge a fee for the plant material or any associated costs for shipping or phytosanitary.

## 14.2

### Types of Requests

**Research** – material and/or access is provided to support a specific research project.

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**Amenity** – material is provided to another botanical institution.

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**Education** – material is provided to support learning programmes, e.g., material used in CUBG Educational Courses or where teaching material is provided to educational institutions.

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**Landscape** – access to the environment or to the associated biodiversity at CUBG that supports a specific research project, e.g., monitoring bird songs, or collection soil samples.

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**Commercial** – material and/or access is provided to support commercial activity, e.g., collecting plant material for use in the making of special edition gins by local gin makers.

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**Private** – material and/or access is provided to support National Plant Collections or other private collectors.

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**Index Seminum** – material is provided through the seed exchange programme *Index Seminum*. See Section 3 for more information.

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**Conservation** – material provided supports reintroduction programmes or other distinctly conservation driven projects.

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## 14.3

### Receiving Requests

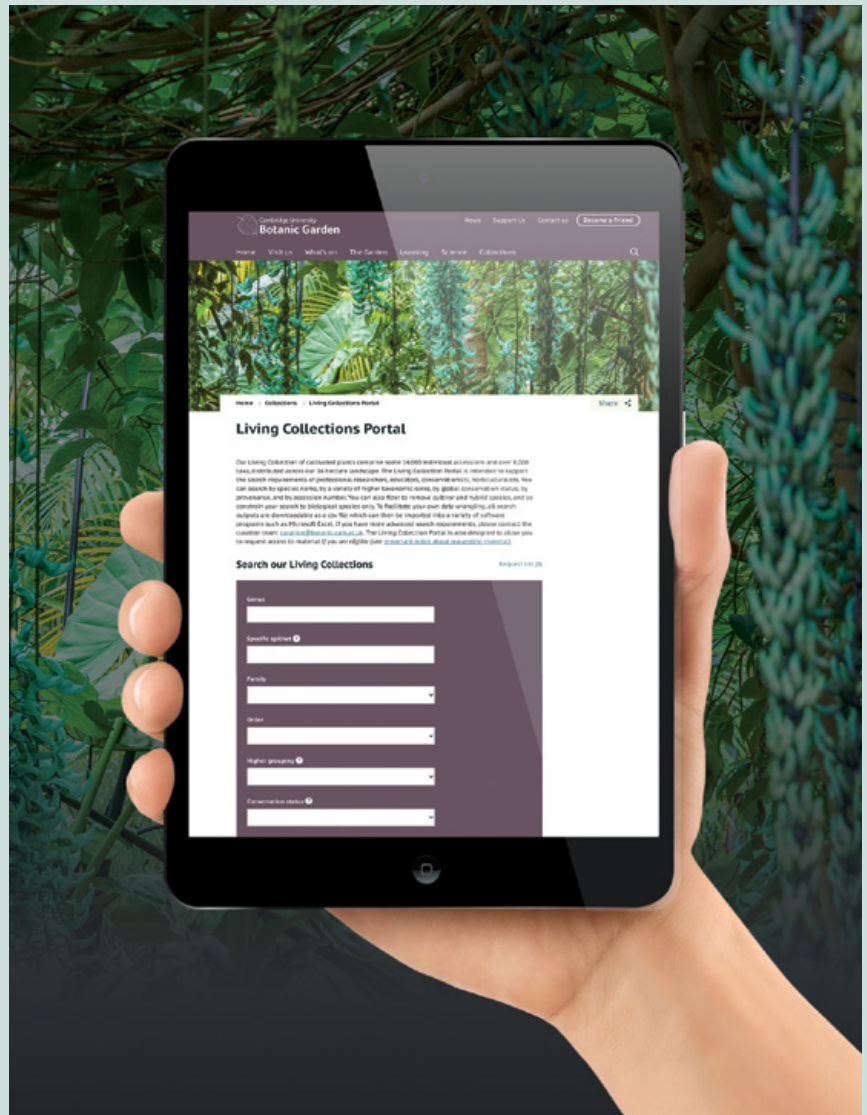
Requests are received through the Living Collections Portal, BGCI Plant Search, or directly to the curation email: [curation@botanic.cam.ac.uk](mailto:curation@botanic.cam.ac.uk).

We strive to respond to all requests, whether fulfillable or not, within a week.

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## Facilitating Research & Exchanges

**Right:**  
Living Collections Portal.



### 14.4

## Plant Material Request

Plant material requests include requests for seed, cuttings, dried or fresh plant material. Research requests are a useful opportunity to explore the diversity of the collection, to update records in the database, and to consider potential propagations or acquisition strategies. The first step is to check if we have the material requested and if material is shareable (see Section 4.6). This involves checking the database and then verifying whether the material is present in the Living Collections or seed bank. If the material is unavailable the requester is notified and the request logged as unfulfilled.

If the material is available for sharing, the requester is notified and sent a Request Form (see Appendix C). Upon receipt of completed Request Form, the request is vetted for legitimacy. If approved, the IrisBG Exchange record is created and material collected. Depending on what the material is and where it is being sent, procedures vary (see Flowchart 10).

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**Facilitating Research & Exchanges**


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Once necessary collection steps have been taken and materials are ready to be transferred, the requester is sent a Material Transfer Agreement (MTA) (see Appendix D). No material is sent or given until the MTA is reviewed and signed by the requester. Upon receipt of a signed MTA, CUBG staff member adds signatory, retains a copy and shares a copy with the requester.

Once the material has been posted or an on-site requester has been granted a permit or picked up their material, the exchange is closed out in IrisBG. The closing date is the date referred to as the exchange date. Once material is sent, requesters are notified and an export containing the accession information of the shared material is sent via email to requester.

## 14.5

### Permitting Process

Requests may require a permit for unaccompanied onsite access to the site and/or the Living Collections. Requests that require permits fall into two broad categories:

1. Access to the environment that supports the Living Collections and/or the associated biodiversity.
2. Access to the Living Collections that does not require staff supervision.

Permits follow much the same process as material requests. It is important to keep open communication with Head of Horticulture, Visitor Services, and relevant horticulturists when vetting onsite requests and give updates as required. Researchers are required to have a hard or digital copy of their permit while onsite and a researcher lanyard issued by the curation team. If a researcher is collecting material from the Living Collections, they are required to fill out a Plant Material Supply Form (see Appendix F).

## 14.6

### Recording Requests

In order to comply with UK Compliance Measures on the Nagoya Protocol, we keep records on all exchanges for at least 20 years.<sup>3</sup> In addition to the digital records described below, the request form, MTA, and any other pertinent documentation associated with fulfilled requests are kept in hard copy form.

#### Opposite page:

Collecting and preparing material for a researcher.

#### Recording Exchanges in IrisBG

The Exchanges table of IrisBG is used to log all exchanges. The following fields are required when creating an exchange record.

**Category** Most exchanges will be considered outgoing.

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**Exchange Number** This unique identifier is automatically generated by the database.

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**Contact** Contact information for the primary requester. Most importantly, requester's name, institution, city (stored in Address 3 field in IrisBG) & country.

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**Facilitating Research & Exchanges**



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**Facilitating Research & Exchanges**

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**Status** The status indicates whether the exchange has been completed or is open, i.e., pending.

**Type of Request** See types of requests listed above.

**Material** Indicates the type of material being supplied, e.g., seed, access.

**Comments** The description of the research or project the request supports as provided by requester in the Request Form is copied and pasted here.

**Notes** Dated notes that show the progress of the request are logged by curation staff.

**Items** A list of the accessions and/or items provided in the request. In addition to the accession information, the amount of material and type of material can be included in this section. If the requester is requesting access (i.e., most Landscape requests) the placeholder accession 00005000\*A is used.

**Attachments** Most completed requests should have a copy of the Request Form, the permit (where applicable), and a signed copy of the MTA.

### **Recording Exchanges in Excel**

An external Excel spreadsheet is kept in a shared Teams folder. Storing the data here in addition to in IrisBG allows for efficient reporting and analysis of exchange activities. Both fulfilled and unfulfilled requests are captured in the Excel spreadsheet. Appendix E shows the standard fields populated in the Excel spreadsheet.

## **14.7**

### **Follow Up**

Plant material used by researchers is prioritised for vouchering at CUBG. This allows researchers to reference herbarium records in publications. Vouchers may be collected at the time the material is collected for research or later depending on presence of reproductive materials and/or on time constraints. More information on the herbarium can be found in Section 12.

Researchers are reached out to via email annually to prompt sharing of publications resulting from shared material. Publications resulting from supported research are added to CUBG's website on an annual basis.

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**Facilitating Research & Exchanges**

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**Key Points**

- **As a member of the botanic garden community, we strive to share plant material to bolster research, learning, and *ex situ* conservation worldwide.**

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  - **CUBG receives many types of requests and vets the nature of the request to ensure that the request is in keeping with the mission and values of CUBG, that the request falls within the remit of the Nagoya Protocol and supplying plant material does not contravene national or international legislation.**

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  - **No material is sent or given until a Material Transfer Agreement is reviewed and signed by the requester.**

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  - **Onsite access requires a permit.**

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  - **Records of all exchanges are stored in IrisBG, Excel, and in hard copy and retained for at least 20 years in order to comply with UK Compliance Measures on the Nagoya Protocol.**

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  - **See Flowchart 10 for a visual representation of this process.**
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# 15 De-accessioning

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CUBG experiences plant loss within the Living Collections, with the average life span of a plant being less than 10 years.<sup>6</sup> In addition to this natural turnover, plants may be de-accessioned. The term de-accessioning refers to the evaluation and procedure for intentionally removing an existing plant from the Living Collections. De-accessioning can be urgent and mandatory, or a discretionary institutional decision. This section, along with Flowchart 11, is intended to inform the decision-making process behind de-accessioning and ensure that where de-accessioning is deemed necessary, thorough evaluation is taken to ensure de-accessioning does not diminish the value of the Living Collections.



## 15.1

### De-accessioning Justifications

There are many justifications for de-accessioning, and it is important to understand the context in which a plant is considered for de-accessioning. The urgency of de-accessioning depends on the risk posed by the plant. If the plant is a danger to staff and/or the public, poses a threat to other accessions within the Living Collections, or is symptomatic of or susceptible to a given pest or disease, there is a required urgency for de-accessioning. In addition to these health and safety risks, invasive or aggressive plants or those being grown in contravention of national or international law pose a legal or environmental risk that demands urgent intervention. These plants in the Living Collections that pose health and safety, environmental, or legal risks are highest priority for de-accessioning and in most cases will be de-accessioned regardless of the outcomes of the due diligence procedure (see Flowchart 11).

When urgency is not a factor, justification for de-accessioning is based on horticultural or curatorial standards, as well as use factors (e.g., research, learning). The following are some examples of justifications that would set in motion a de-accession decision making process which may or may not result in the de-accessioning of the plant(s).

- The area in which the plant(s) exist in the Living Collections is being redeveloped.
- The plant is not climatically suited for our garden and/or requires excessive horticultural or resource intervention.
- The plant is deemed an inadequate use of resources because it is disproportionately redundant within the Living Collections, or with respect to collections held elsewhere.
- The plant is in poor condition or fails to meet aesthetic standards and, although it poses no immediate health or safety risk, its long-term viability and horticultural value are compromised.

## 15.2

### Due Diligence Procedure

Once a plant has been flagged for de-accessioning, a level of due diligence is required to avoid hasty de-accessioning of potentially valuable or important plant material. Flowchart 11 shows the due diligence process that may identify factors which would either support de-accessioning the plant(s) or prompt reconsideration. The flowchart is not a hierarchy of decisions; instead, it is a multi-access flowchart that considers the variables that may influence de-accessioning and contributes to an informed management decision.

Using the criteria shown in Flowchart 11, we developed an informatics tool, *ditchR*, that gathers information on the different variables to facilitate the process and allow staff members to make an informed decision regarding whether to see through de-accessioning.

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**De-accessioning**

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**De-accessioning**

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The use of this tool should always be coupled with visual inspection of the plant material to be de-accessioned and other plants of the same taxon held in the collection, as well as communication between teams (e.g., curation, horticulture and learning). The procedure may also require further inquiries into accession-level restrictions or verifications of unknown or uncertain plant identities.

Depending on the flags raised against de-accessioning by *ditchR*, one may appropriately de-accession the material, reconsider de-accessioning altogether, or take actions that could improve justification for de-accessioning. For example, if the tool warns against de-accessioning because the plant is used on a learning trail, the staff member could discuss with the learning team alternative options that could be used to fill the same educational role.

**15.3****Final Actions**

De-accessioning may be unavoidable or even actively desired, but this does not always mean disposing of the plant(s). Offering the plant(s) or plant material derived from the plant(s) to another botanic garden or National Collection holder that has an interest in the group is an option for the de-accession outcome. Particularly in the case of redundant or surplus plants, this may offer a good opportunity to contribute to botanical meta-collections and act as an insurance policy against loss. In the event of de-accessioning, the records associated with de-accessioned plant(s) are retained permanently.

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**De-accessioning**

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**Key Points**

- **De-accessioning refers to the evaluation and procedure for deliberately removing an existing plant from the Living Collections.**

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  - **There are many justifications for de-accessioning, and it is important to understand the context in which a plant is considered for de-accessioning to inform urgency and outcomes.**

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  - **Members of staff can use the in-house informatics tool, *ditchR*, to carry out due diligence and inform decision making.**

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  - **Plant(s) or plant material derived from the plant(s) may be bequeathed to another botanic garden or National Collection holder.**

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  - **See Flowchart 11 for a visual representation of the due diligence process.**
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MINUTE  
BOOK

1954

1956

1944

1954

MINUTE  
BOOK

1957

1960

MINUTE  
BOOK

67/0

378/

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# Appendix A

## Historic Accession Numbers

### Batch Accession Numbers

In some instances prior to 1978, the practice of "batch accessions" was utilized at CUBG where all plants received from a single source at the same time, regardless if there were multiple taxa, were given the same accession number. In 1999, CUBG adopted the plant records database BG-BASE. BG-BASE required that a single accession could not contain multiple taxa and thus these batch accessions needed reconciling. To do so, the original accession number was conserved and an additional digit added to the end of each new accession to make them unique. For example, accession 19520284 contained multiple wild-collected accessions of *Betula pubescens* var. *pubescens*, *Betula pendula* subsp. *pendula* and *Alnus glutinosa*. Each of these was assigned a new accession number 195202841, 195202842 etc. to make the numbers unique.

With the move to IrisBG in 2017 how accession numbers were handled in the database changed again. Within the database, accession numbers are stored in two fields in the Details tab of the Accessions table – Acc. Year and Acc. No. The Acc. No. field stores the number as a 4-digit integer and does not recognise leading zeros. In the example above, the batch accession numbers 195202841 now changes to 19522841 in the database. Changes to the accession numbers are recorded in the current database using the Batch acc.no. attribute field in the Accessions Details tab and the Cons. field.

### Accession without Accession Numbers

The move to BG-BASE in 1999 forced all plant to have an accession number. Plants that predate accessioning, such as old trees, or plants that lost their accession number, were given an accession number starting 0000. These plants were checked to establish if a valid accession number could be identified and where not, an artificial accession number starting with 1000 was assigned. This practice is no longer in use but many accessions still in existence retain these accession numbers.

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## Appendix B

### Explanation of all status types in IrisBG and their appropriate uses

Key to colour coding:

**Green text** – indicates existing plants in the Living Collections.

**Red text** – indicates the plant no longer exists in the Living Collections and will not show up on database-generated lists of existing plants.

**Yellow text** – indicates an unknown status and will not show up on database-generated lists of existing plants.

**Blue text** – indicates plants in a procedural state and will not show up on a database-generated list of existing plants. This colour status is reserved for propagations.

**Planted** – The status indicates a plant coming into the garden as well as a plant being planted. When a whole plant comes into the garden, the Plant Records Officer creates a record with the status “Planted”. When the plant is planted into the garden, the status remains “Planted” and the Location, Date, Person fields are updated along with any other relevant fields. See Section 6 for more detail.

**Inspected** – This status is the default status used when updating records. This status indicates a qualified staff member or volunteer has observed and scrutinized the plant(s) and, with respect to that plant or group of plants, has considered most of the relevant fields outlined in Section 8.3.

**Seen** – This status is regarded as interchangeable with “Inspected”, however “Inspected” is the preferred status when conducting an audit.

**Moved** – This status is used when a plant or entire plant grouping has been moved from one location to another. In addition to the status update, the Date & Person fields are updated and a note is made in the Comments field reflecting this action, e.g., “20/05/94: moved from NW6-2, qualifier C”. If part of the plant grouping of massed herbaceous material is moved, see “Divided” status.

**Number changed** – This status is used when a change is made to the number of plants in the qualifier, e.g., if one plant dies or a plant grouping can no longer be individually counted and henceforth considered a mass.

**Divided** – This status is used when dividing massed herbaceous material. The group divided **from** would have a status update to “Divided” and the Date & Person fields updated. A note in the Comments field reflects this action, e.g., “20/05/94: divisions taken, planted in NW6-2, qualifier C”.

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**Appendices: Appendix B**

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The newly **divided** group is given a new qualifier and updated to “Planted” with accompanying pertinent information. The qualifier from which divisions came is captured in the Item Reference field of the new qualifier.

In the event where material is divided and divisions are planted in the same bed, the status is updated to “Divided” and a comment made to elaborate. No additional qualifier is required. If the record reflects a specific number of plants this number is updated to reflect current count.

**Repotted** – This status is used when a plant that lives in a pot is moved into a new pot. It is useful to note the size of the new pot and, when relevant, the medium used in the Comments. This information helps track a plants growth over time and knowing the size of the pot can aid during auditing. Additionally, if the plant is repotted into more than one pot, number of specimens is updated to reflect number of plants.

**Muntjac Damage** – This status is useful to flag the impact of the invasive muntjac deer damage on the Living Collections. This status is only used to indicate newly made muntjac damage. In situations where old muntjac damage persists e.g., trunk damage on a tree, this status is not utilized.

**Re-mapped** – This status is used when maps have been updated and old beds have become defunct, or boundaries changed. The plants have not been moved but the location has changed.

This status is also used to correct erroneous locations recorded in the database. For example, *Crataegus pinnatifida* was noted to be in NW9 but during the audit the plant was found in SW9. The status was updated to “Re-mapped” and a note about the previous error added to the Comments field.

**Dead** – This status is used when there is certainty that a plant is dead, e.g., the lifeless remains are present. As there is no value of assumptions in the records, when a plant is unable to locate and remains are not present, default to the status “Not Found”.

**Dead – Natural Cause** – This status is discouraged from being used. Often the cause of death includes many factors, some unknown. This status may be used in events such as lightning strikes or a pathogenic event. In most situations, where it is certain a plant is dead, the status “Dead” is used.

**Dead – Horticultural Cause** – As with the above status, this status is discouraged from use. Where applicable, it can be used judiciously when all other causes of death can be ruled out.

**Dead – Muntjac Damage** – This status is used when it is certain and evident that a plant was lost due to activities of muntjac deer.

**Not Found** – This status is used when a plant that should be visible at the time of auditing is not found, i.e. presumed to be dead or removed. If a plant is presumed dormant, this status is not used and the record for this plant is not updated at that time. It becomes the responsibility of the staff undertaking the audit to return at the appropriate time of year for this accession.

For example, during an audit of the Woodland Garden in July 2022, many *Cyclamen* species and cultivar accession items were not updated. Because there was no way to practically comment on the

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**Appendices: Appendix B**

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condition or presence of the plants at that time, these areas were returned to in September and October and the individual records updated when the plants were no longer dormant. *Cyclamen* that were not seen in September and October had their record updated to “Not Found”.

**Given away** – This status is used in the event where accessioned material has gone through the decision process of de-accessioning (see Section 15) and the plant material has been given to another botanic garden or qualified institution/individual.

**Removed** – This status is used when an accessioned plant is deliberately removed from the Living Collections, e.g., when a tree is cut down.

**Stolen** – This status is used when an accessioned plant is known to have been stolen out of the Living Collections.

**De-accessioned** – This status is discouraged from being used. As de-accessioning is a process, the outcome, i.e., “Given away” or “Removed” is reflected in the status update.

**Consolidated** – This status is used when two qualifiers of the same accession are planted in the same bed and become indistinguishable over time or it is deemed unnecessary to maintain two separate qualifiers, the two qualifiers can be consolidated into one. Typically, the qualifier with alphabetic priority is maintained.

In the event where different accession qualifiers of the same taxon grow indistinguishable over time, a new accession is created and assigned to the planting. The prior accession qualifiers are “Consolidated” in the records and a note included in the Comment section of each qualifier to explain, e.g. “20/05/94 MSA: indistinguishable from 19680001\*A, consolidated under new accession 20220054\*A”.

**Questionable** – This status is discouraged from being used.

**Unknown** – This status is discouraged from being used.

**Propagation** – This status is used when a propagule is actively being propagated. Plant material with the status “Propagated” are not recognized as existing or not existing but instead remain in a “procedural” state until the propagation process is completed. See Section 7 for more detail.

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## Appendices

# Appendix C

## CUBG Research & Exchanges Request Form

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### CUBG Research and Exchanges Request Form

The Cambridge University Botanic Garden (CUBG) operates within the legal framework of the Nagoya Protocol. In completing and returning this document the researcher agrees to act in accordance with the Nagoya Protocol, and **to acknowledge CUBG in all resulting reports and publications.**

The information you enter into this form will be used by CUBG staff to administer your request and to keep a log of it in the longer term so as to comply with UK Compliance Measures on the Nagoya Protocol. In addition, if access is granted, your name and/or affiliation may be reported as necessary to our funders and stakeholders and/or included in the published CUBG annual report. For more information about how we handle your personal information, and your rights under data protection legislation, please see <https://www.information-compliance.admin.cam.ac.uk/data-protection/general-data>

A. User Details						
Please complete as many of the fields below as you can, and where applicable						
Name						
Institution and Department						
Address						
Email						
Date						
B. Project Details						
Type of Project	<input type="checkbox"/> Research	<input type="checkbox"/> Education	<input type="checkbox"/> Conservation	<input type="checkbox"/> Horticulture	<input type="checkbox"/> National Plant Collection	<input type="checkbox"/> Biodiversity and Environment Access
Other:						
Project Title						
Project Start Date						
Project End Date						
Funding Source						
Grant Code						
Principal Investigator						

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**Appendices: Appendix C**


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page 2 of 2

Project Description						
Graduate Student Involvement?	<input type="checkbox"/> Yes			<input type="checkbox"/> No		
<b>C. Material Request (if applicable)</b>						
Material Supplied As	<input type="checkbox"/> Unrooted Cutting	<input type="checkbox"/> Rooted Cutting	<input type="checkbox"/> Silica-dried	<input type="checkbox"/> Seed	<input type="checkbox"/> Whole Plant	<input type="checkbox"/> Dry Ice
Other:						
<b>D. Access &amp; Sampling</b>						
<input type="checkbox"/> I will visit CUBG to sample material		<input type="checkbox"/> CUBG may sample material on my behalf		<input type="checkbox"/> Out of Hours Access Required		
<b>E. For CUBG Staff Use Only</b>						
Received Date				Exchange Number		

## Appendices

# Appendix D

## CUBG Non-Commercial Material Supply Agreement

page 1 of 2



### Non-Commercial Material Supply Agreement for Living Collections

The Cambridge University Botanic Gardens [‘CUBG’] operates under the legal framework of the Nagoya Protocol, and expects its partners to act in a manner consistent with the Nagoya Protocol, if applicable. This research agreement is designed to promote scientific research and exchange, whilst recognising the terms on which the CUBG acquired material. The CUBG reserves the right not to supply any plant material if such supply would be contrary to any terms attached to the material and/or to the CBD as outlined in the Nagoya Protocol if appropriate.

The CUBG will supply the material listed following this agreement [‘Material’] subject to the following terms and conditions:

1. The recipient may only use the Material, its progeny or derivatives for the common good in **scientific research, education, conservation and the development of botanic gardens**;
2. The recipient **shall not sell, distribute or use for profit or any other commercial<sup>1</sup> application** the Material, its progeny, or derivatives.
3. In case the material is subject of the Nagoya Protocol, the recipient shall **share fairly and equitably** the benefits arising from their use of the Material, its progeny or derivatives in accordance with the Nagoya Protocol.
4. The recipient shall **acknowledge CUBG**, as supplier, in all written or electronic reports and publications resulting from their use of the Material, its progeny and derivatives and shall **lodge a copy** of all such publications and reports with CUBG;
5. The recipient shall take **all appropriate and necessary measures** to import the Material in accordance with relevant laws and regulations and to contain the Material, its progeny or derivatives so as to prevent the release of invasive alien species;
6. The recipient may only **transfer** the Material, its progeny or derivatives to a bona fide third party such as a botanic garden, university or scientific institution for **non-commercial use** in the areas of scientific research, education, conservation and the development of botanic gardens. All transfers shall be subject to the terms and conditions of this agreement. The recipient shall **notify CUBG** of all such transfers and, on request, shall provide the CUBG with copies of the relevant material transfer agreement;
7. The recipient shall maintain **retrievable records** linking the Material to these terms of acquisition and to any accompanying Data provided by CUBG;
8. Unless otherwise indicated, **copyright** in all information or data [‘Data’] supplied with the Material is owned by the CUBG. You may use this Data on condition that it is used solely for scholarly, education or research purposes;
9. That it is not used for commercial purposes; and that you always acknowledge the source of the Data with the words “With the permission of the Cambridge University Botanic Gardens”;
10. The CUBG makes no **representation or warranty** of any kind, either express or implied, as to the identity, safety, merchantability or fitness for any particular purpose of the Material, its progeny or derivatives, or as to the accuracy or reliability of any Data supplied. The recipient will indemnify the CUBG from any and all liability arising from the Material, its progeny or derivatives and/or the Data and from their use or transfer, including any ecological damage. This agreement is governed by and shall be construed in accordance with English law;
11. The recipient will contact the CUBG to request **prior permission** from the CUBG or, where appropriate, from the provider of the Material to the CUBG, for any activities not covered under the terms of this agreement.

<sup>1</sup> For the purposes of this agreement, commercial application shall mean: applying for, obtaining or transferring intellectual property rights or other tangible or intangible rights by sale or licence or in any other manner; commencement of product development; conducting market research; seeking pre-market approval; and/or the sale of any resulting product.

Please return a signed copy to: Cambridge University Botanic Garden, 1 Brookside Close, Cambridge, and CB21JE, UNITED KINGDOM. E-mail: [curation@botanic.cam.ac.uk](mailto:curation@botanic.cam.ac.uk)

A. Recipient Details and Declaration (Section to be filled in by recipient of material)	
By signing below I agree to comply with the conditions outlined on page 1 of this document:	
Recipient	Cambridge University Botanic Garden, 1 Brookside Cambridge, CB2 1JE, United Kingdom
Position	
Phone Number	
E-mail	
Signature	
Date	2025-05-28

B. Nagoya Protocol Compliance (Section to be filled in by CUBG Staff)
Please complete one of the following sections, checking the box that applies.
<input type="checkbox"/> A. An EU Registered Collection
The material listed on page 2 was originally sourced from an EU Registered Collection. I attach the full compliance information provided by the EU Registered Collection.

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**Appendices: Appendix D**


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page 2 of 2

Name of Registered Collection						
B. Internationally recognised certificate of compliance						
I attach a copy of the internationally recognised certificate of compliance with the Nagoya Protocol and mutually agreed terms that relate to <b>the material listed on page 2</b> . I also attach all relevant collection/access, export and import permits.						
C. No internationally recognized certificate of compliance is available for the material listed above						
I confirm that the material listed on page 2 was accessed in compliance with the Nagoya Protocol and attach the relevant mutually agreed terms, all relevant collection/access, export and import. I have also answered the questions relating to the material on page 2						
<b>C. CUBG Staff Declaration (Section to be filled in by CUBG Staff)</b>						
By signing below I, the supplier of the material, confirm that the information provided on this form and related attachments is correct to the best of my knowledge:						
Name						
Section						
Signature						
Date	2025-05-28					
Exchange no:	1439	Date:	2025-05-28	Quantity:	1	
Material:	EXAMPLE					
Comments:	EXAMPLE					

**Items**

Item no.	Taxon name	Provenance	IPEN	Locality · Collector · Coll.no · Coll.date
00005000*A	Unknown Permit	Uncertain		•••

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 IrisBG - Collection Management

## Appendices

# Appendix E

## CUBG Standard Fields for Research Exchanges Excel Spreadsheet

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Appendix E - CUBG Standard Fields for Research &amp; Exchanges Excel Spreadsheet

<i>Field</i>	<i>Description</i>
<b>Exchange Number</b>	Auto-generated by IrisBG. Exchange records are only created in IrisBG for those requests that we can fulfil. Fulfilled and unfulfilled requests are logged in Excel.
<b>Initial Contact Date</b>	Date that the requestor first contacted CUBG
<b>Response Date</b>	Date that CUBG responded to initial request
<b>Request Fulfilled?</b>	'1' indicates the request was fulfilled; '0' indicates that the request was not fulfilled; 'pending' indicates the request is underway
<b>If no, why not?</b>	Reason that the request was not fulfilled (e.g., no response from requestor, material/taxon not available)
<b>BGCI request?</b>	'1' indicates the request was received through BGCI Plant Search; '0' indicates that the request was received through another avenue
<b>Portal Request?</b>	'1' indicates the request was received through CUBG Living Collections Portal; '0' indicates that the request was received through another avenue
<b>Fulfilment Date</b>	The date the request is considered completed (e.g., the date specimens picked up, put it post, or the permit issued). This is the date used for reporting purposes.
<b>Primary Contact</b>	The first point of contact for the request
<b>Type of Request</b>	Categories include Research, Conservation, Education, Amenity, Private, National Plant Collection Holder, Commercial, Index Seminum, Land & Bio, Herbarium Material, Education Loan
<b>Research Description</b>	The reason for the request as given by the requestor via email or found in the request form field "project description".
<b>Secondary Contact</b>	Any other relevant individuals involved in the request (e.g., Principle Investigator(s))
<b>Contact Email</b>	Email address of primary contact
<b>Student Involvement?</b>	'1' indicates student(s) are involved in the request; '0' indicates that no student is involved in the request
<b>Affiliation</b>	The organization that the requestor is affiliated with (e.g., The University of Cambridge)
<b>Department</b>	Where applicable, the specific department within the organization that the requestor is affiliated with (e.g., Plant Sciences Department)
<b>Contact's Country</b>	The country where the requestor is located

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**Appendices: Appendix E**


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<b>Contact's City</b>	The city in which the requestor is located
<b>Material Requested &amp;/or Provided</b>	A brief description of the type of material requested/provided (e.g., information, seed, cuttings, access to CUBG grounds)
<b>Plant Passport Issued</b>	The number of plant passports issued for relevant plant material being sent within the UK. 'NA' for exchanges where plant passports are not relevant
<b>No. of Taxa</b>	The number of taxa requested/provided in the exchange. 'NA' for exchanges where plant material is not requested/provided
<b>No. of Accessions</b>	The number of accessions requested/provided in the exchange. 'NA' for exchanges where accessioned plant material is not requested/provided
<b>Taxa</b>	A list of the taxa requested/provided, separated by semi-colons. 'NA' for exchanges where plant material is not requested/provided
<b>Provenance</b>	Indicates the provenance (W, Z, G, U, or mixed) of plant material shared. 'NA' for exchanges where plant material is not requested/provided
<b>On-site visit</b>	'1' indicates the requestor came to CUBG to fulfil the request; '0' indicates that the request was fulfilled without the requestor coming onsite (e.g. material was posted)
<b>Number of On-Site Visits</b>	Where onsite visits occurred, record the number of onsite visits by the requestor. 'NA' where onsite visits did not occur.
<b>Outputs made known to CUBG?</b>	'1' indicates the requestor shared publications or relevant outputs resulting from the exchange. '0' indicates that no outputs have yet been shared (default)
<b>Notes</b>	Any other relevant notes regarding the exchange

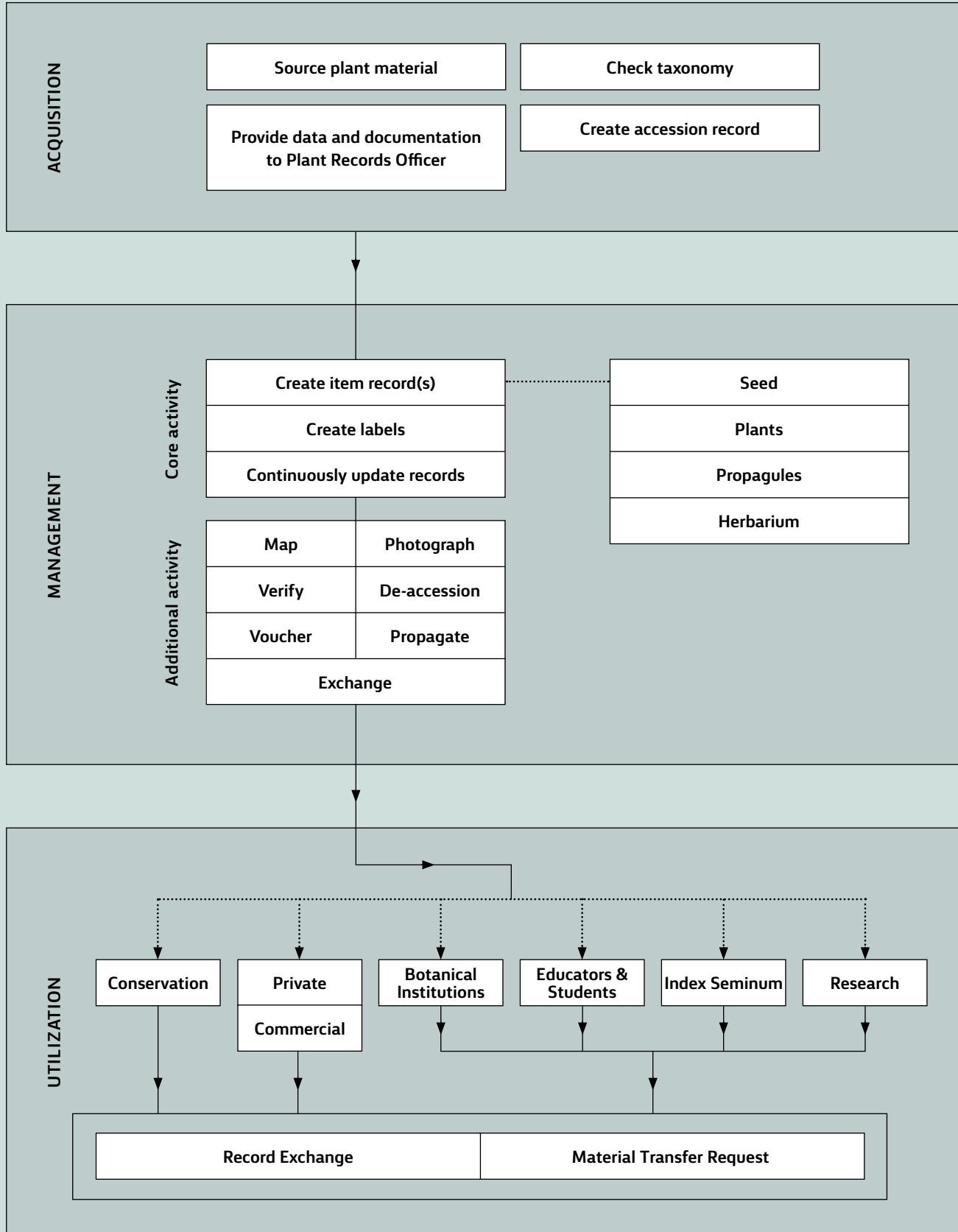


# Process Flowcharts

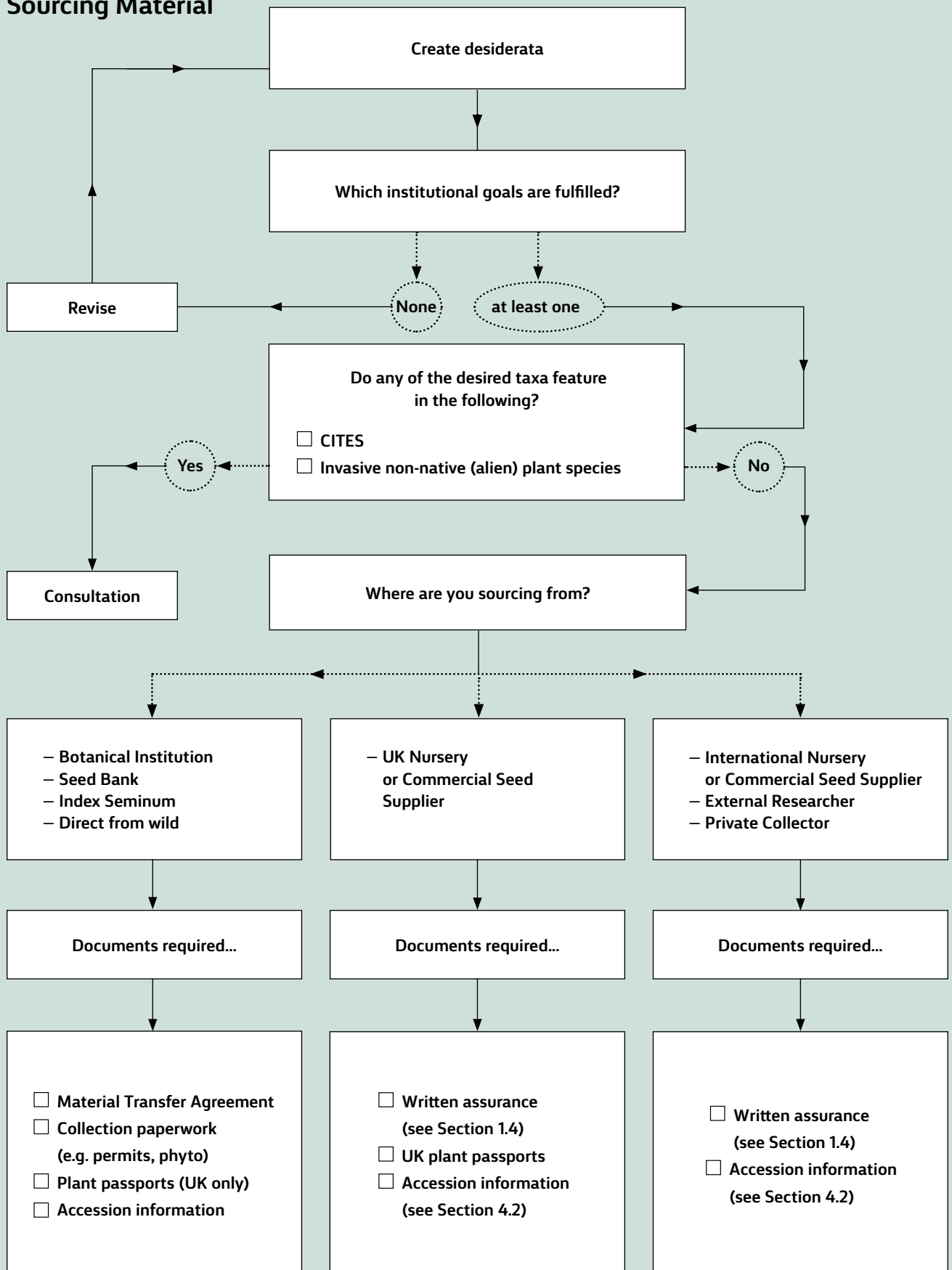
---

Process Flowcharts

Flowchart 1:  
Curatorial Processes

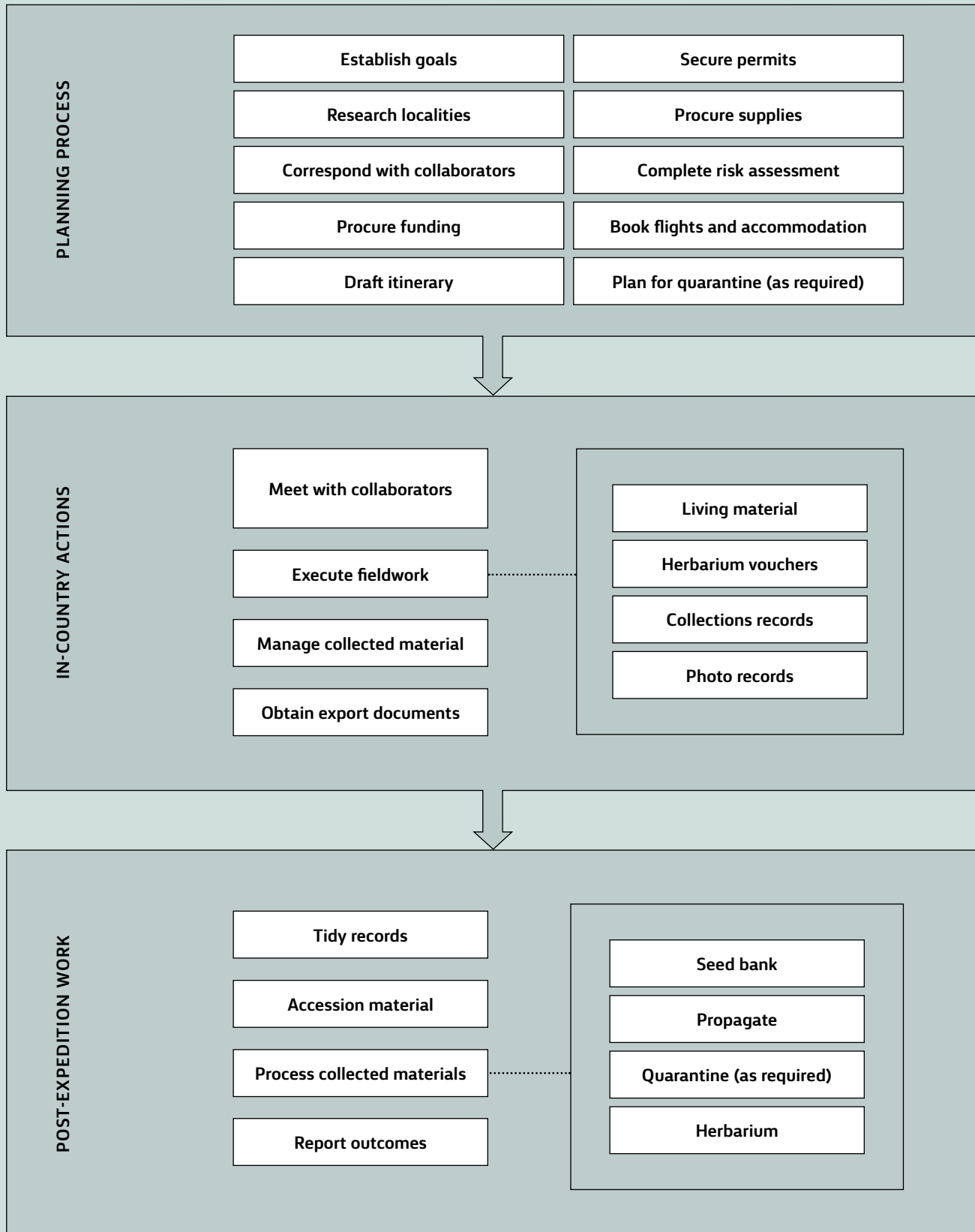


## Process Flowcharts

Flowchart 2:  
Sourcing Material

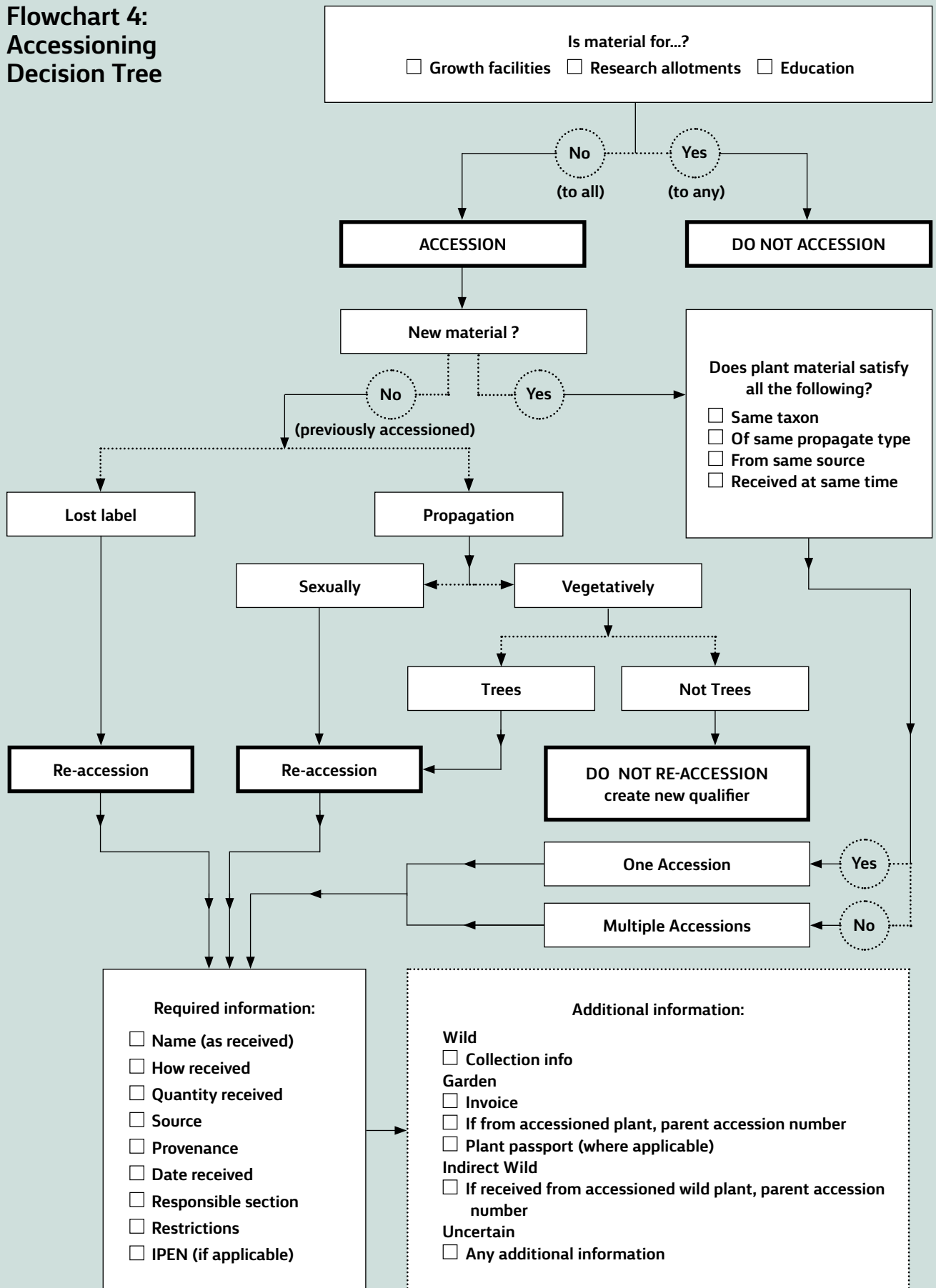
## Process Flowcharts

### Flowchart 3: Collecting Expeditions



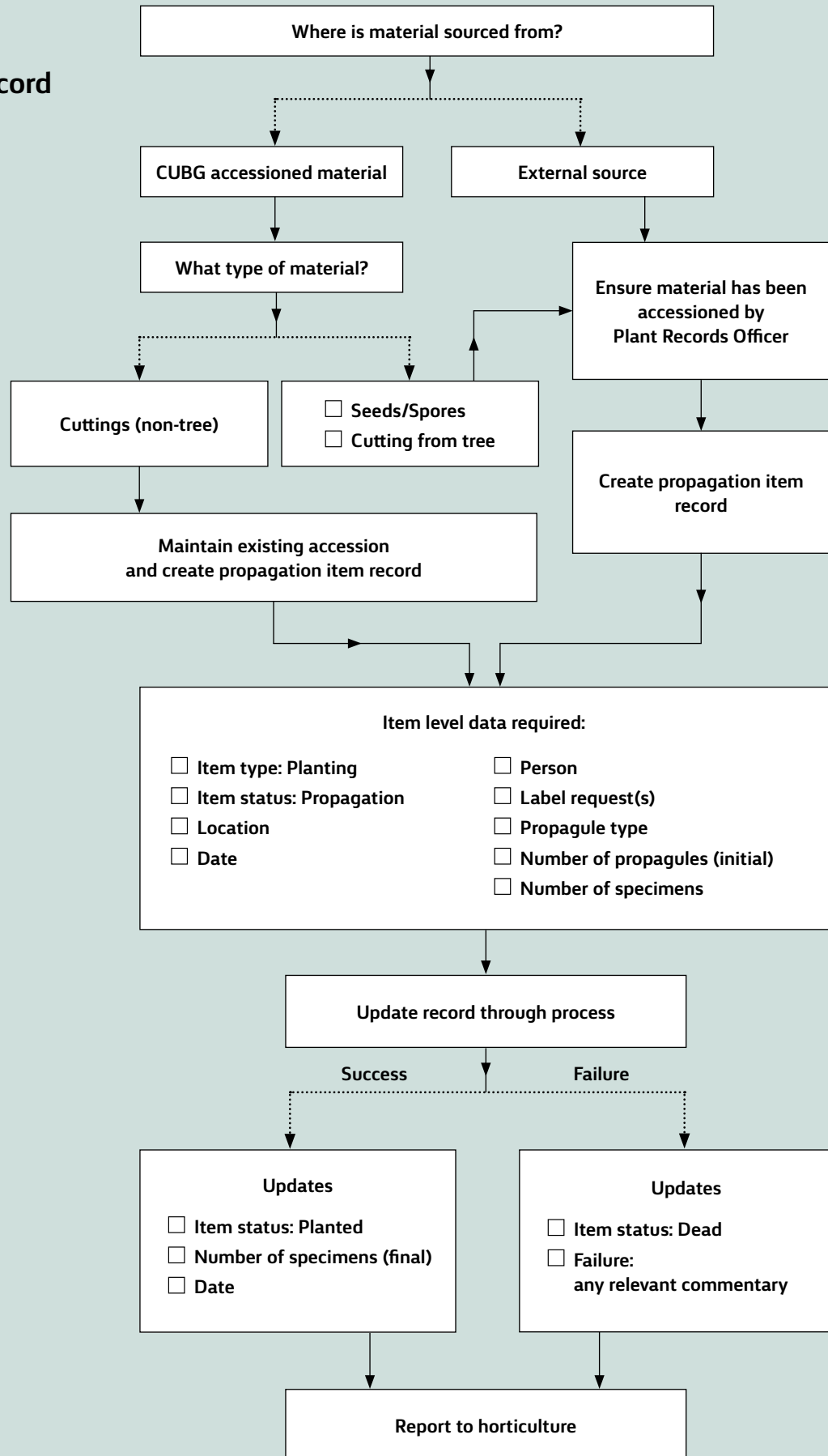
Process Flowcharts

**Flowchart 4:  
Accessioning  
Decision Tree**



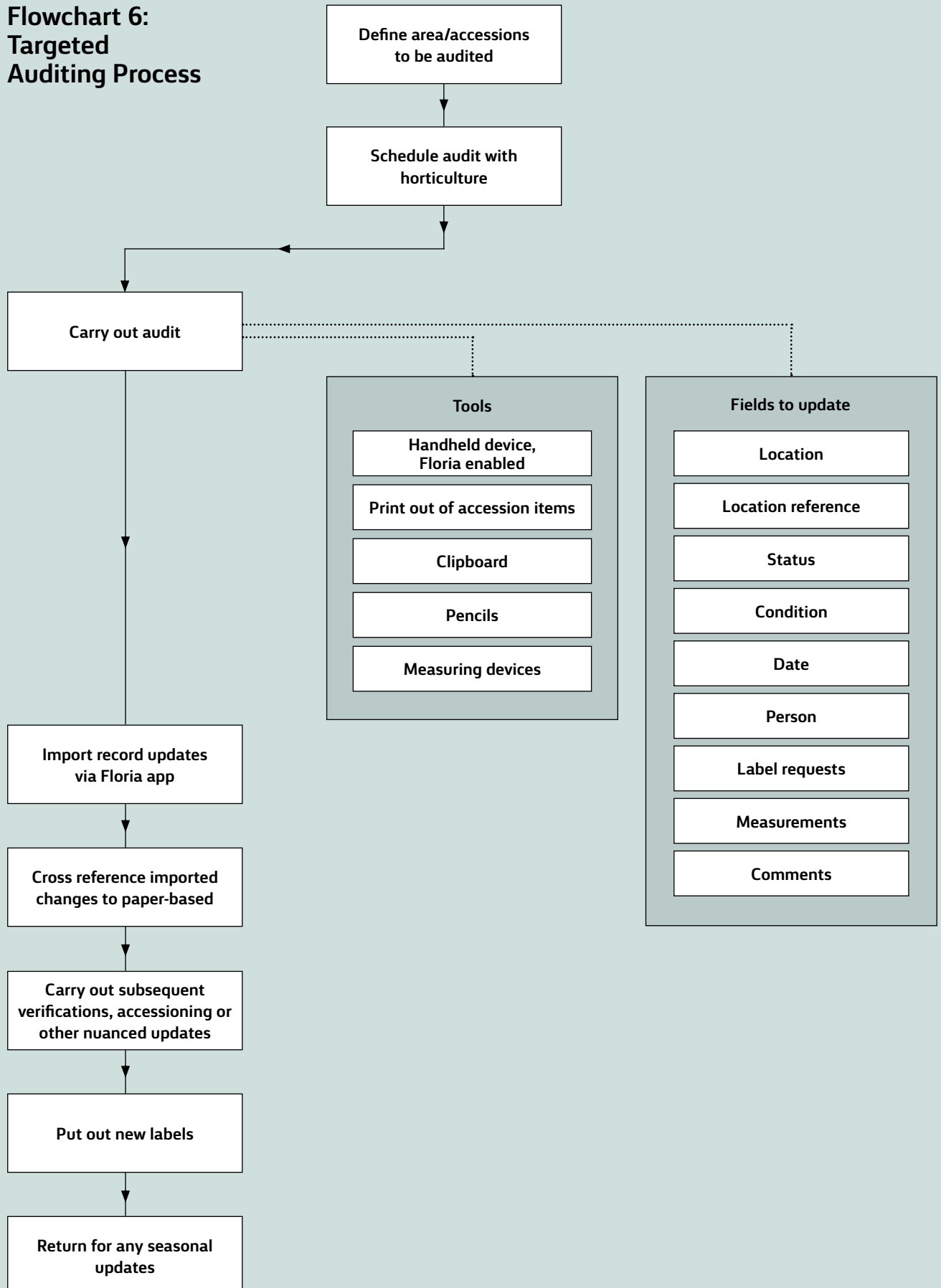
Process Flowcharts

**Flowchart 5:  
Creating  
a propagation record**

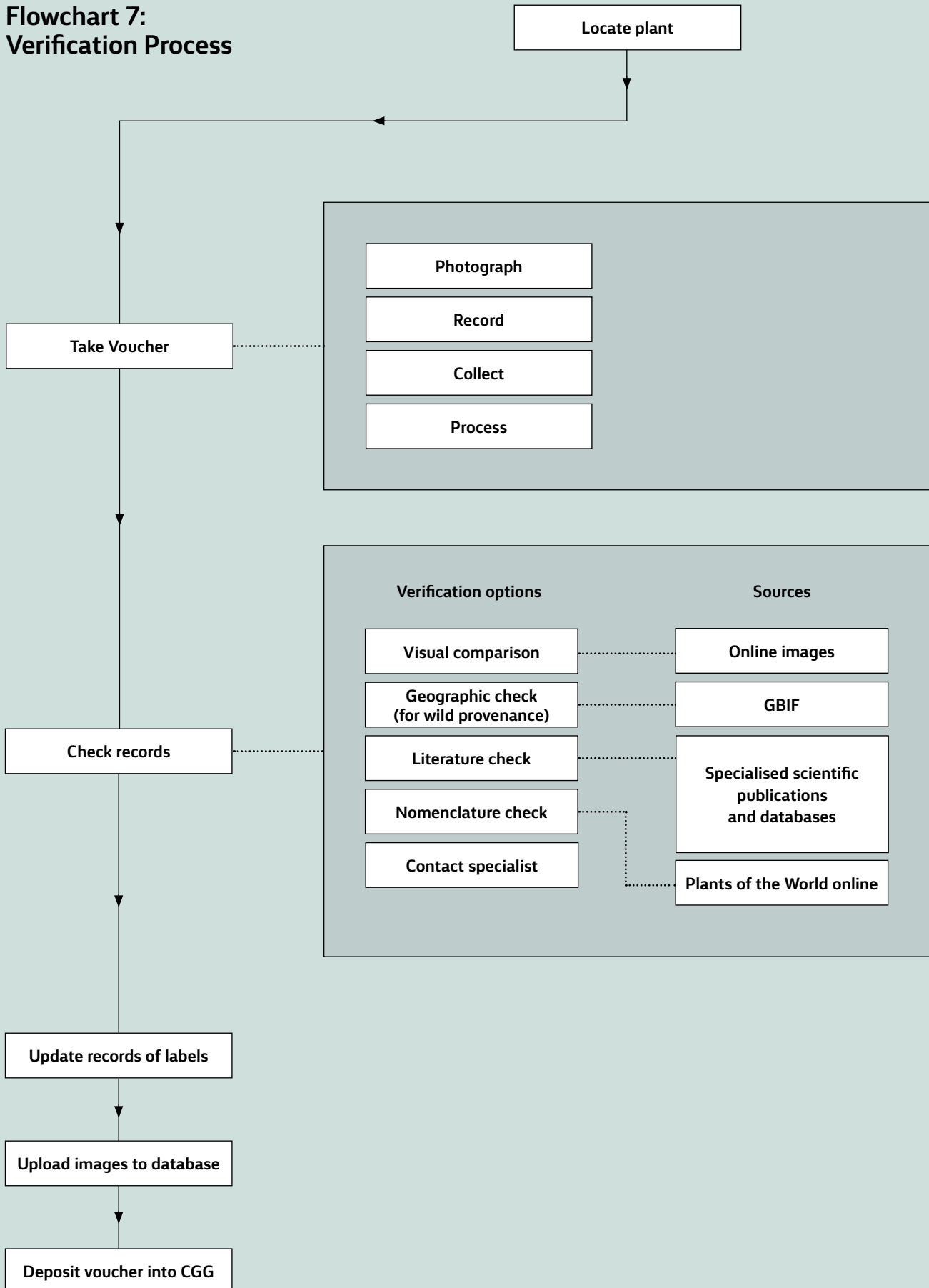


## Process Flowcharts

## Flowchart 6: Targeted Auditing Process

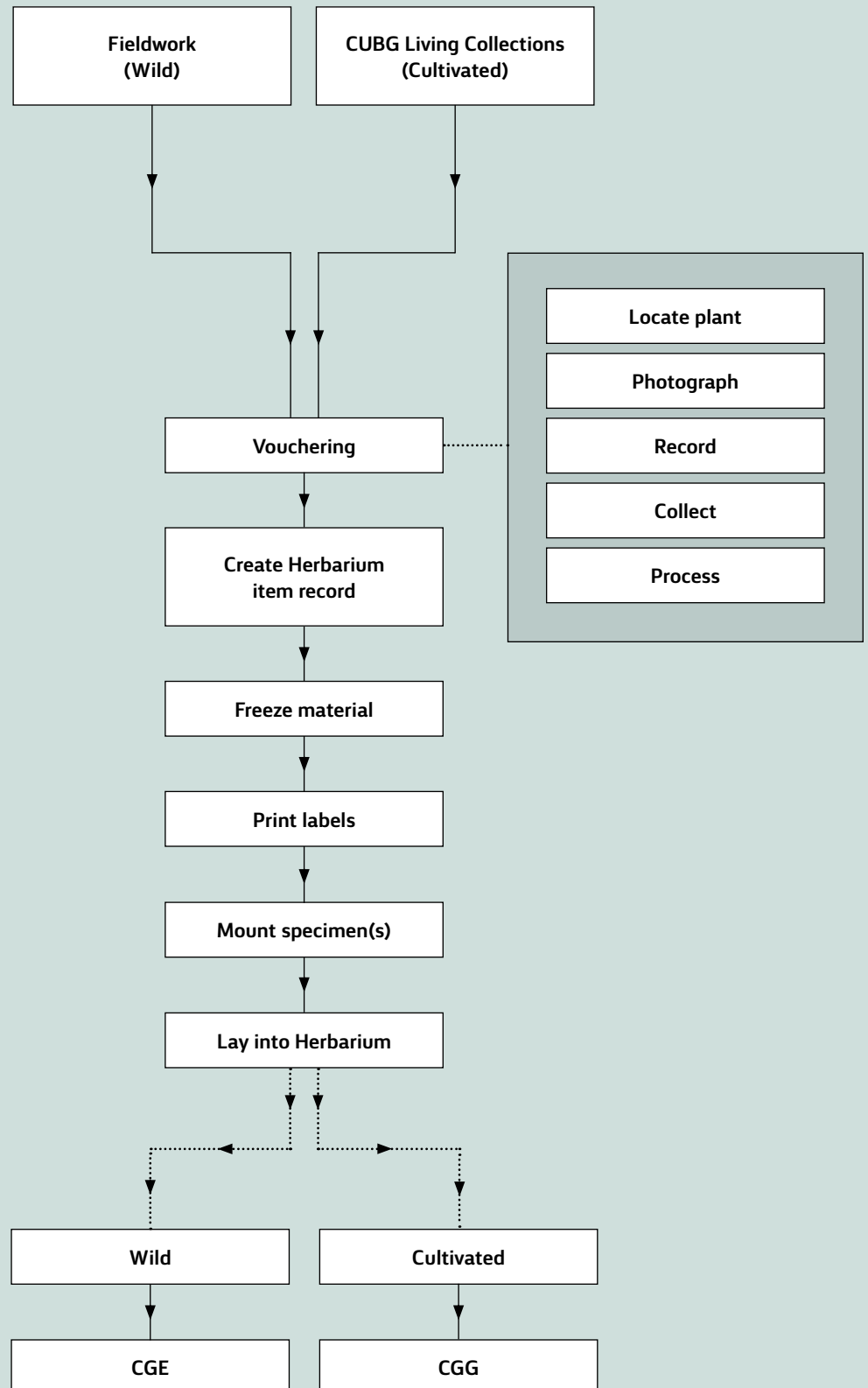


## Process Flowcharts

Flowchart 7:  
Verification Process

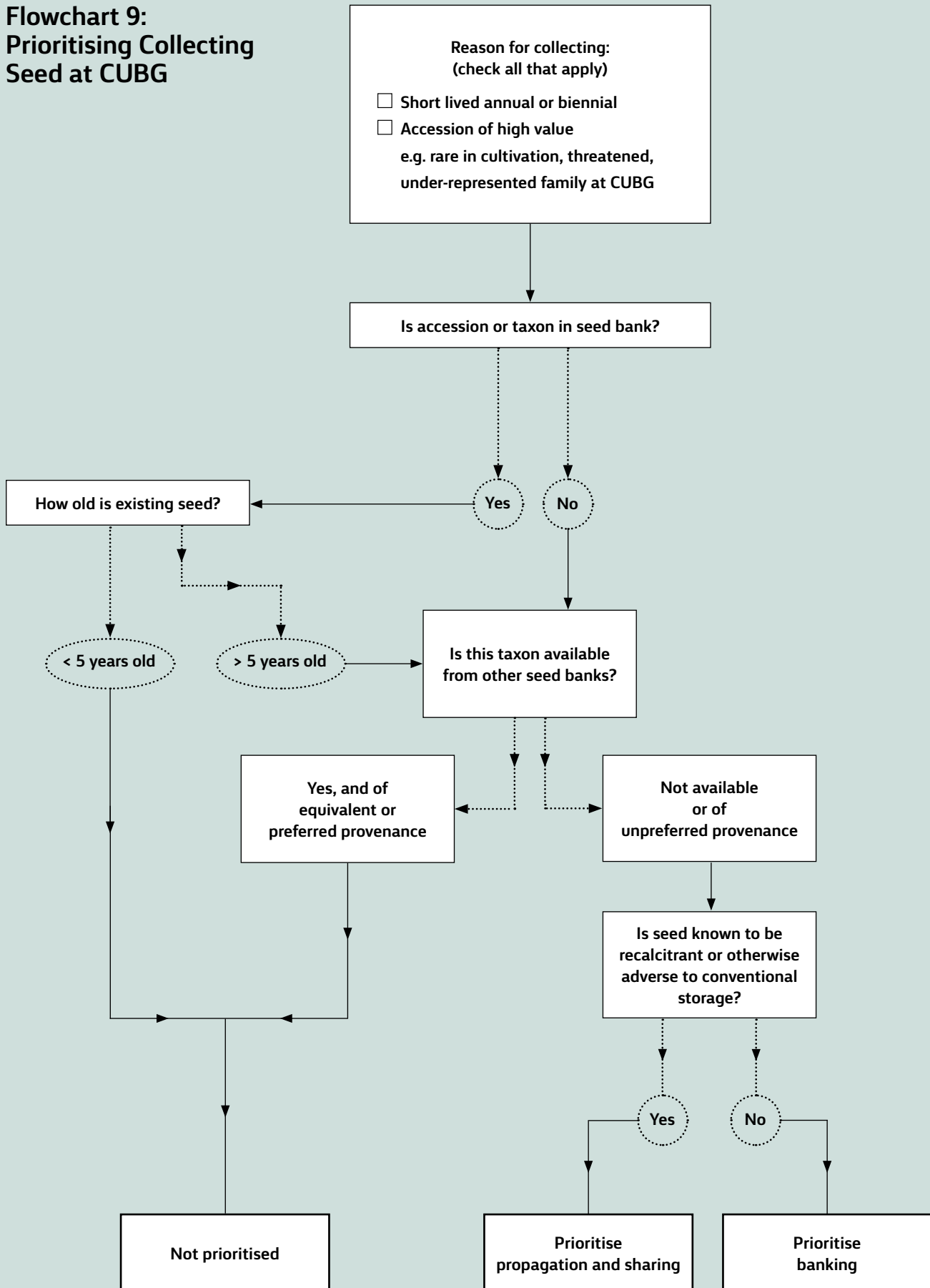
## Process Flowcharts

## Flowchart 8: Herbarium and Vouchering



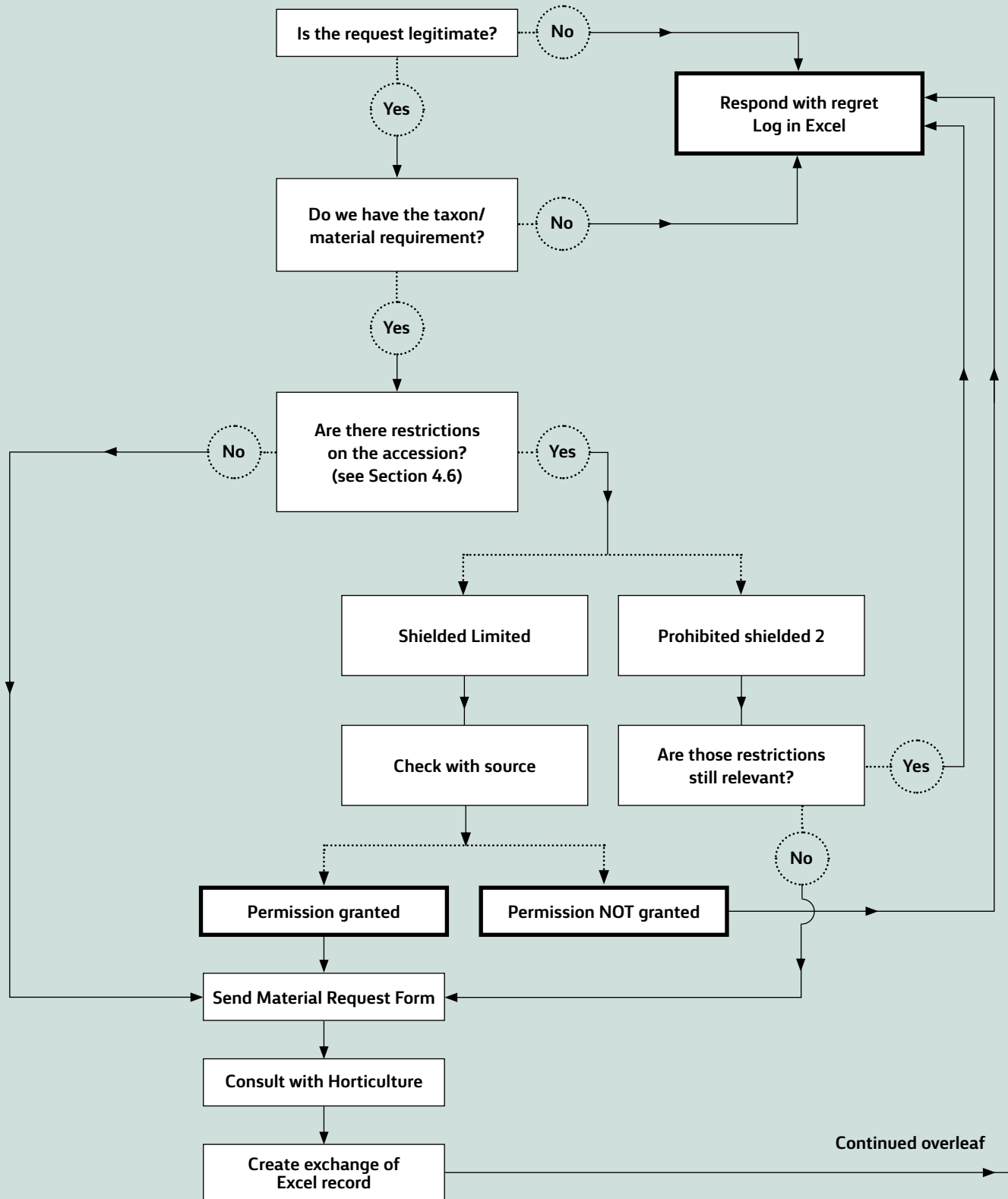
Process Flowcharts

**Flowchart 9:  
Prioritising Collecting  
Seed at CUBG**



Process Flowcharts

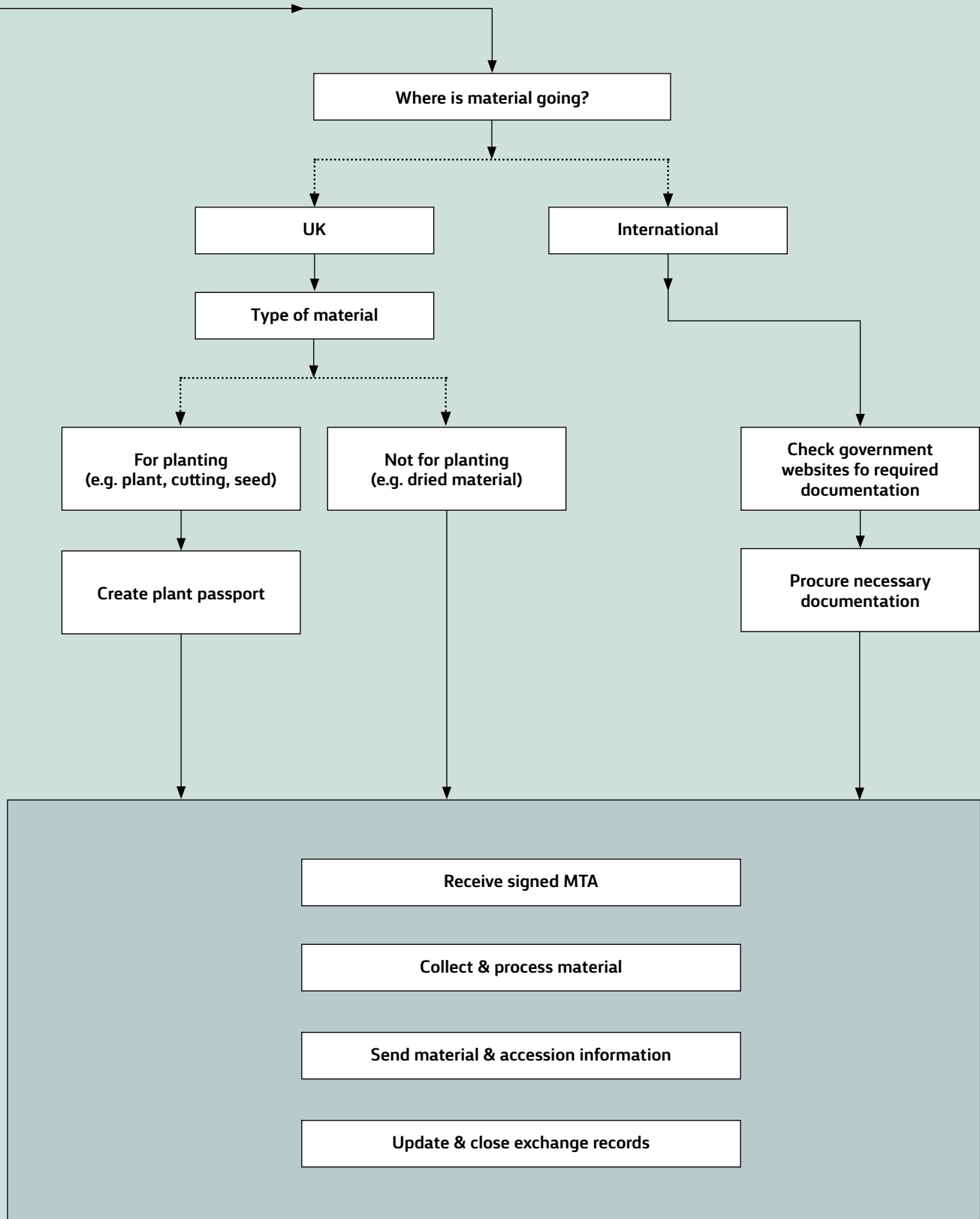
**Flowchart 10 (Part 1 of 2):  
Processing Material Requests**



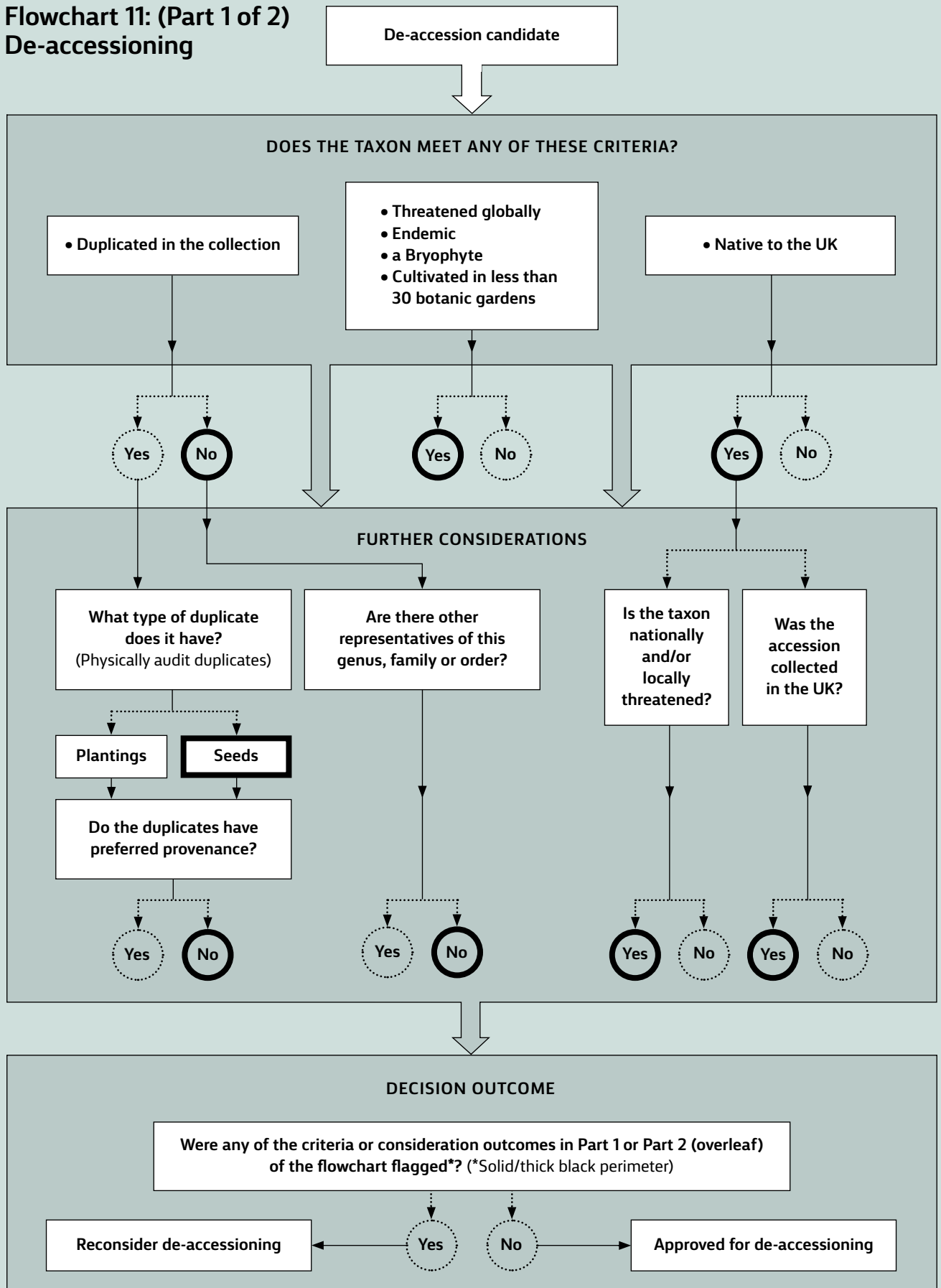
## Process Flowcharts

## Flowchart 10 (Part 2 of 2): Processing Material Requests

Continued from previous page

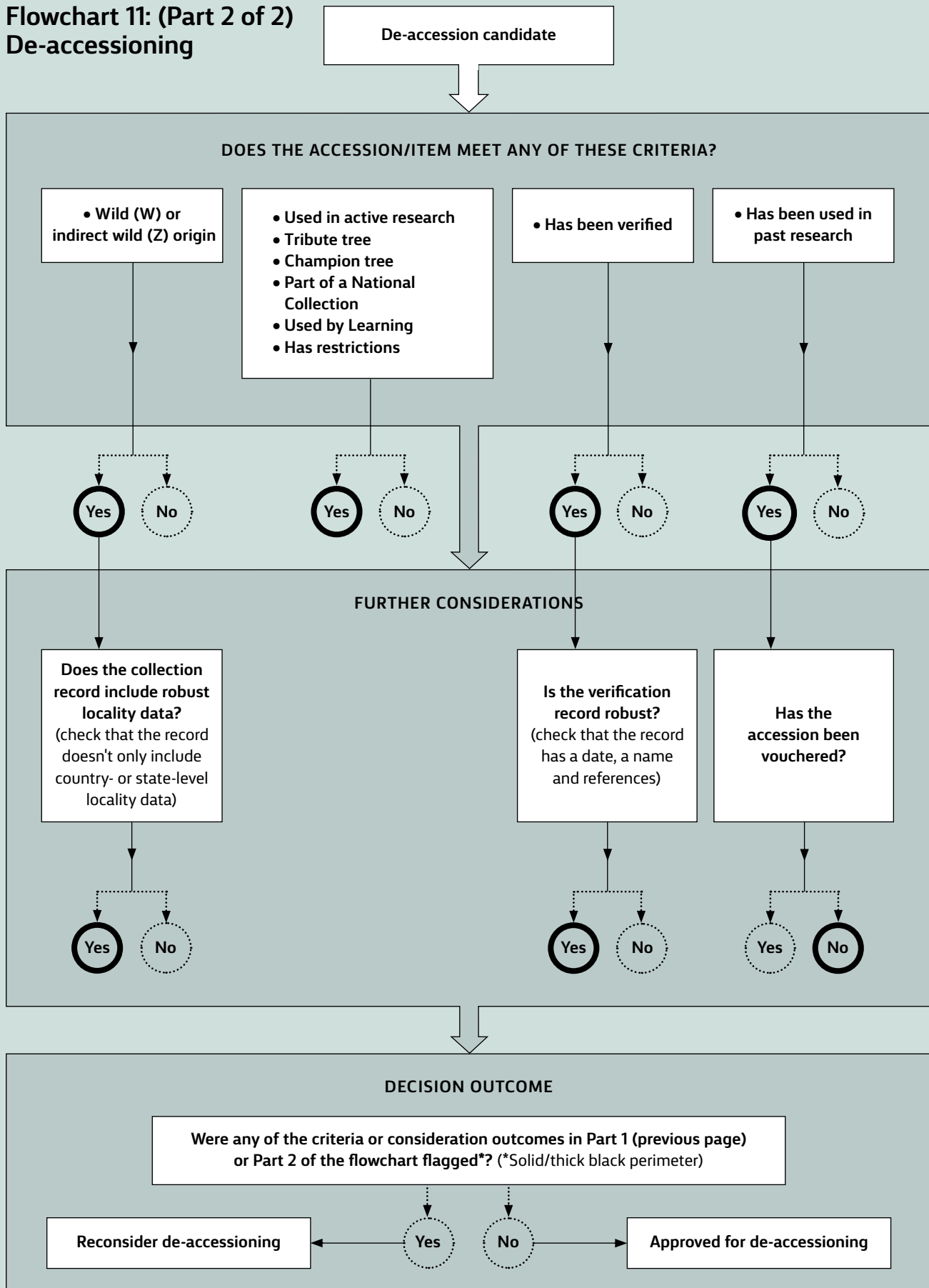


## Process Flowcharts

Flowchart 11: (Part 1 of 2)  
De-accessioning

Process Flowcharts

**Flowchart 11: (Part 2 of 2)  
De-accessioning**







Cambridge University

**Botanic Garden**

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**Cambridge University  
Botanic Garden  
1 Brookside  
Cambridge CB2 1JE**

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