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Policy Brief

Living plant collections policy of the Finnish Museum of Natural History

Marko-Tapio Hyvärinen‡, Mikael Lindholm‡, Heli Fitzgerald‡, Mari Miranto‡, Aino Anttila‡, Outi Pakkanen‡, Merja Pulkkinen‡, Pertti Pehkonen‡, Henry Väre‡, Pasi Sihvonen§, Anniina Kuusijärvi|, Leena Myllys‡, Björn Kröger¶, Mikko Heikkinen|, Aino Juslén§, Markku Oinonen¶, Leif Schulman#

‡ Botany Unit, Finnish Museum of Natural History, Helsinki, Finland
§ Zoology Unit, Finnish Museum of Natural History, Helsinki, Finland
| Biodiversity Informatics Unit, Finnish Museum of Natural History, Helsinki, Finland
¶ Natural Sciences Unit, Finnish Museum of Natural History, Helsinki, Finland
# Finnish Museum of Natural History, Helsinki, Finland

Corresponding author: Marko-Tapio Hyvärinen (marko.hyvarinen@helsinki.fi)

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Abstract

The collections policy of the Finnish Museum of Natural History Luomus is hierarchically structured. The general collections policy defines the overall principles and guidelines. The sub-collections policies, such as the Living collections policy, comply with and apply the general collections policy and specify its guidelines and instructions, taking the special nature of the sub-collections into account. The living plant collections policy guides the care of the collections in the botanic gardens and the seed bank, excluding DNA and tissue samples which are covered by a separate genomic resources policy. The purpose of the collections policy is to help guide the care of the garden collections and the processing of information relating to the collections, thereby providing the basis for developing the botanic gardens.

Keywords

Living plant collections, botanic gardens, collection management, horticulture, ex situ conservation, seed bank, biodiversity

1. Status and implementation of the living plant collections policy

Living plants and fungi (‘lichen garden’) are part of the Luomus national natural history collections, as referred to in the Universities Act (2009). The maintenance of the collections contributes to the implementation of the Luomus mission of being responsible “for the preservation, accumulation and exhibition of the national natural history collections and for research and education relating to them”.

The living plant collections policy (hereafter ‘collections policy’) is partially based on the unpublished policy document entitled “Living collection policy: Safeguarding science at Kaisaniemi & Kumpula”, whose content from 2011 has been updated and supplemented to correspond to the guidelines of the general collections policy and new development goals of Luomus. The wild plant seed bank is a new resource included in the collections policy. In terms of content, a new feature of the policy is an emphasis on responding to climate change in the development of both collections care and their content and use.

The collections policy was prepared by the Luomus Botany Unit, discussed by the collections steering group on 10 April 2019 and 3 October 2019 and approved by the management group on 28 October 2019.

As a rule, the implementation of the collections policy is the responsibility of the Horticulture Team as well as the Vascular Plants Team, the Mycology and Bryology Team, which are responsible for research data about the botanical and mycological collections. It also applies to each employee and visiting researcher using the living collections when they work with the Luomus collections under the name of Luomus.

Goals of the collections policy

The goal of the collections policy is to ensure the high scientific quality of the collections and related information as well as seamless physical and digital access to the collections for the purposes of scientific research.

The policy defines and outlines the purpose of the collections, the objectives and content of related activities, the division of responsibilities for the administration and care of the collections within the organisation, and the general principles and practices for the acquisition, preservation, availability and use of the collections. Related specific practices and processes are described separately in team instructions (e.g., care plans for living collections or protocols of the seed bank).

Definition of a collection

A collection is a group of organised specimens and closely connected information, from which the specimens can be accessed based on either saved collection data or the location of the specimens. In accordance with the general collections policy, specimens not yet organised in a scientific collection are not considered to be part of it.

At the botanic gardens, plants made available for public viewing for their ornamental value or other non-scientific reasons need not be included in scientific collections. Correspondingly, wild plants and fungi that spontaneously appear in the botanic garden area can be included in collections (see the definition of living collection).

The datasets (e.g., specimen databases or databases of origin) included in a collection are stored and organised together with material not included in the collection (e.g., observation files). The Digital Data Policy (unpubl.) of Luomus is also applied to all such data.

Living collection

In this document, the term ‘collection’ (in the narrow sense) refers to the plants and fungi (lichen garden) included in the collections of the Kumpula and Kaisaniemi botanic gardens as well as the wild plant seed bank. Temporary (e.g., annual) flowering plants, adventive plants and other plants and fungi naturally occurring in the area are usually excluded from the actual collection. For practical reasons, however, annual flowering plants grown from seed are included in the Kotka collection management system (Heikkinen et al. 2019). Annual plants acquired for the systematic section, the garden of useful plants and the garden of the senses are also recorded in the database. Rare or otherwise valuable, spontaneously occurring wild plants can also be added to the collection and documented in the collection management system. Occasionally, it is also appropriate from the perspective of collection care to include the immediate organic and inorganic environment of plants and fungi in the Kumpula and Kaisaniemi collections (collection in the broad sense).

Purpose of the collections

The primary purpose of the collections is to accrue and preserve natural specimens representing biodiversity for research and university-level teaching. Most of the living collections have also been made available to the public, serving the purposes of science education and environmental education and the needs of educational institutions.

The plants in the collections document the structural and genetic diversity of species as well as their distribution. The collections promote knowledge of the world’s plant and fungi species, understanding of the evolution of species, and appreciation for biodiversity. They are part of a global network of natural science collections, which constitutes a key resource for biodiversity research and is part of the infrastructure shared by the national and international research communities that has been built over centuries and must also be preserved for future generations.

Collection responsibilities in the Botany Unit

The director of the Botany Unit has overall responsibility for the Luomus botanical and mycological collections, including preservation, acquisition, documentation and use. The responsibility for ensuring that the collections remain scientific is shared between the Vascular Plants Team (Kaisaniemi Botanic Garden and seed bank of wild plants), the Plant Geography Team (Kumpula Botanic Garden) and the Bryology and Mycology Team (lichen and moss garden). The Horticulture Team is responsible for the appropriate care and maintenance of the collections as well as related development. Practical responsibilities for the care of the collections and the supervision of work are agreed by the Horticulture Team, and this division of responsibilities is documented in the guidelines for the care of the collections, such as care manuals.

2. Principles for collection acquisitions

Material included in the collection

Collections are supplemented systematically on the basis of the objectives for collection and research policy, not haphazardly. Acquisitions focus on research strengths as well threatened or rare species. The scientific value of the collections is enhanced by expanding and supplementing them and replacing and supplementing deficient material.

The content of the collections is guided by the potential information content of specimens and their utility for research. The content may be related to the documentation of diversity between taxa or within a taxon (taxonomy and systematics), of the distribution history of species, or of their current or future geographical distribution (geobotany, environmental change research). The rarity of taxa may also guide the development of content (conservation biology and, in particular, *ex situ* conservation).

Active and high-quality collection-oriented research provides the primary basis for acquisitions. The collections grow with specimens obtained from the work performed by the Luomus staff, through the exchange of seeds and plants with other botanic gardens, and with donations received from other researchers, students, authorities and, to a small extent, private individuals. In addition, the collections can be expanded by purchasing plants.

At a general level, the specimens added to the collections are prioritised as follows:

1. Scientifically valuable plants that support the Luomus strengths and are important for current and emerging research
2. Plants that supplement existing valuable sets of collections and add to their coverage (e.g., by supplementing geographical or taxonomic coverage)
3. Plants with no immediate research value that can be used in university instruction or serve societal interests, such as the objectives of science education or environmental education and the presentation of biodiversity.

4. If possible, plants will be selected that meet more than one of the above priority criteria.
5. Plants that constitute a whole together with other collections in the botanic gardens can also be included in the collections. When storing specimens for other collection-oriented or collection-supporting purposes in conjunction with the collection of specimens for research, the accruals can be justified with synergies between different collections.

Collection strengths and responsibilities

The following focus areas guide the expansion of the living collections of plants and fungi:

- Plant and fungi groups that are actively investigated at Luomus. In the 2020s, these focus areas determined by research include ferns in the group of vascular plants (e.g., the *Asplenium* and *Dryopteries* genera), the families Asteraceae, Chenopodiaceae, Cyperaceae, Gesneriaceae and Solanaceae as well as, in other groups, lichenised fungi and mosses. Research on conservation biology has focused on rare and threatened taxa.
- Geographical areas corresponding or almost corresponding to the climate of Southern Finland (particularly the collection of the Kumpula Botanic Garden): Fennoscandia and neighbouring areas, Japan, the Far East, eastern and western North America as well as mountainous areas of Europe.
- With regard to the tropical greenhouse collections as well as the temperate zone, the areas (Balkans, eastern parts of Southern Europe) more or less in the same longitude as Finland (21–29°E) as well as eastern and southern Africa
- Tropical and sub-tropical islands, particularly if supporting the *ex situ* conservation of threatened species
- With regard to European species, plants from areas corresponding to the future climate of Finland (e.g., 50 years from now)
- Other responsibilities that guide the expansion of the collections include threatened and rare Finnish species and their *ex situ* conservation (wild plant seed bank as well as outdoor collections, particularly in Kumpula) as well as support for *in situ* conservation.

Quality criteria for collection plants

The quality criteria for the specimens and specimen data listed in the general collections policy guide the development of the collections. These criteria are applied when expanding and pruning collections (disposing of specimens) to enhance the standards of the collection content. The quality criteria for the living plant collections include:

- Reliability and accuracy of the information on plant accessions
- Provenance: as a rule, the plants grown in the outdoor collections are originally from conditions corresponding to the hemi-, south- and mid-boreal climate (see above) and are thus winter-hardy, with the exception of plants from more temperate zones that are considered capable of withstanding the conditions of the Helsinki

region due to climate change (e.g., the garden section presenting the effects of climate change on vegetation)
- Sufficient level of taxonomic determination (e.g., genus or family), with the exception of plants whose determination cannot be verified even at family level before they have been grown to flower (e.g., tropical plants)
- Status of plants as part of a wider collection or research field, particularly their connection to a focus area or strength
- Special historical values
- Legal and ethical criteria for collecting

Ethics and legality

The collections are expanded in line with principles and practices for the protection and promotion of our planet's biodiversity. Specimens must be collected in accordance with the laws and provisions of the countries of origin, Finnish legislation and the international conventions Finland has ratified (e.g., CITES 1973, Nagoya Protocol 2010). When accessioning new specimens, the required information on the permissibility of the specimens and their terms of use is entered into the collection management system. Those providing specimens may be required to supply written documentation on the origin and terms of use of the specimens.

National division of work

The collections of the Luomus botanic gardens are part of the Finnish natural history collections. The definition of the strengths of these collections requires knowledge and recognition of the focus areas of collections at other institutions so that the expansion of various collections can be guided and directed to increase the value of individual collections and, at the same time, rationalise the division of work. Other botanic garden collections may, for example, focus on specific geographical areas in Finland or elsewhere.

3. Receipt and accessioning of plants

Accessioning and cataloguing

New individual plant accessions do not become part of a collection until they are catalogued in the Kotka CMS. When accessioning a new plant, its data are stored, and the accession is assigned a unique persistent identifier.

Decision-making

The accessioning of a plant is a decision made by the scientific curator of the relevant collection or a person assigned by the coordinator in accordance with the instructions given. The head gardener or a collection coordinator or horticulturist assigned by him or her can decide on ornamental plants included in the collection.

When accessioning plants, the following general criteria must be applied in addition to those presented in the above quality requirements:

- Scientific significance and documentary value (genetic representativeness, number of individuals)
- Whether the specimens expand the content and coverage of the collections, or duplicate existing material
- The manner in which the specimens promote the strengths of Luomus as well as its collections policy and research policy objectives
- Current and future facility needs
- Particular care must be taken in assessing the following:
    - Whether the introduction of a plant is safe and cannot cause the spread of dangerous plant diseases or pest insects
    - Whether the plant is under control and cannot spread outside the garden and become an invasive alien species (Finnish and EU-level lists and bans)

Terms attached to the receipt of plants

As a rule, plants are not accepted into the collections if they come with terms other than those of regular transfer agreements. A template agreement on the transfer of plant material (Appendix 1) includes the terms for the transfer of plants from Luomus to third parties.

International Plant Exchange Network

The living collections of Luomus are part of the International Plant Exchange Network (IPEN), whose code of conduct (IPEN 2018) Luomus has agreed to follow. With regard to the exchange of material within IPEN, the storage of related documents in the original garden as well as the IPEN number attached to the material has been separately agreed. The IPEN number carries information on the original garden from which the material was obtained as well as any restrictions on the use of the material. When exchanging plant material with gardens not belonging to IPEN, all documentation must be provided together with the material.

4. Collection management

The availability and real utility value of collections depend on the systematic organising of the collections and the data documenting them as well as on the understanding of these practices. Collection management refers to this process of organising and documenting collections. Compliance with the principles of collection management is monitored, and related practices are developed in teams under the supervision of team leaders and collection coordinators and together with the Biodiversity Informatics Unit.

Metadata

Metadata about the structure of botanical and mycological collections document the division of the collections into sub-collections as well as the composition, scope and location of the collections. Such metadata are specified at a general level in the Kotka CMS. The scientific experts curating the collections are also recorded in the system. These metadata are openly available to all.

Information on origin and the collection management system

Detailed information on the collecting and origin of all new specimens are recorded in Kotka CMS. Information recorded in Kotka CMS also includes the care and use history of the plants, which is not openly available.

Plants are marked with labels that feature key information on their origin as well as an identifier that complies with uniform standards (‘register number’) and links them to the collection management system.

Registration of accession-specific information

The most important required information on specimens relate to the place and time of collecting. The only exception are the ornamental plants whose origin or collector are not accurately known.

At least the following information must be entered into the collection management system on new specimens to be accessioned (quality criterion):

- Sufficient taxonomic determination (e.g., up to genus and family levels), with the exception of plants whose determination has not been confirmed even at family level before being grown to flower (e.g., tropical plants)
- Site where found (country, area, coordinates and information on the coordinates used, georeferencing where possible)
- Exact date of collecting
- Collector and collecting identifier (if used)
- Voucher specimen, if any, in the herbarium

Recommended additional information includes:

- Number (or estimated number) of individuals in the population
- Detailed description of the site where found
- Habitat (macro- and micro-habitat), culture medium, host organism (if any) and companion species
- Reference to collecting event (e.g., research project, excursion, expedition) and its metadata
- References to publications in which the plant accession has been used as part of a dataset can also be added later

Physical organisation of collections

The living collections of Luomus are located in the Kaisaniemi (5 ha) and Kumpula (6.1 ha) botanic gardens in Helsinki, Finland. The former garden has not only outdoor collections, but also glasshouses with plants from vegetation zones warmer than the boreal zone. Also situated in Kaisaniemi is the wild plant seed bank, which contains the seeds of a large number of threatened Finnish wild plant taxa.

The outdoor collections of the Kaisaniemi Botanic Garden have been grouped into several sections, such as the arboretum of woody plants, the systematic tree of life depicting the evolution of plants, the rock garden featuring rock plants, the garden of the senses, as well as the lichen and moss gardens. The western part of the area is used for educational purposes.The majority of the Kumpula Botanic Garden has been divided into geographical sections (geobotanical garden). These sections represent vegetation zones reminiscent of Southern Finland, and their species are solely based on collecting efforts made for this purpose in such areas and in the natural sites of the plants. In addition, the Kumpula area includes a historical manor garden as well as gardens of medicinal and useful plants.

Both botanic gardens also feature ornamental plants either as a separate section or in smaller areas, such as along footpaths.

Mycological collections: lichen garden and spontaneous collections (e.g., epiphytes on tree trunks).

Bryological collections: Moss garden and spontaneous collections.

5. Collection maintenance

The care of collections follows international standards for the care of botanic gardens and seed banks. Permanent collections staff monitor and maintain collection plants and regularly supervise the conditions in collection facilities. Collections are maintained under the team leader’s supervision in accordance with agreed practices.

The principles of care are in line with the aims of sustainable development as well as the organic nature of plants (e.g., regarding growth type). It is particularly important to preserve

plant accessions that are valuable for the collection (criteria identical to those applying to the receipt of plants, see section 3) and to renew them before they deteriorate.

Safety and security

Safety and security coordinators have been designated for collection facilities. Staff have received orientation on the emergency plan, which is also readily available in written form. The University's occupational health and safety organisation monitors general occupational safety.

Responsibility for the acquisition of hazardous chemicals as well as the supervision of their storage has been assigned within teams to coordinators, who must ensure that related safety data sheets and laboratory work instructions are available to all. Hazardous volatile substances are processed in fume hoods. The above coordinators also ensure that personal protective equipment and clothing are available and are responsible for the transport of hazardous waste from the site.

Visitors working with collections also receive orientation relating to key safety and security instructions and work practices.

Definition and scientific evaluation of collections

The continuous scientific evaluation of collections by the staff as well as support (e.g., facilities and tools) for visiting researchers working with collections are key for their high-quality maintenance. Staff organise the collections so that they are easily accessible and available to specialists.

6. Disposal of plant accessions

In accordance with the objectives of the collections policy, each plant added to the collections is potentially important for their aims, that is, relevant and usable documentation of biodiversity. However, the quality of collections and the efficient use of facilities can be improved by deaccessioning, or disposing of, plant accessions.

Under the general collections policy, deaccessioning needs to be approved by the unit director. Decisions on the disposal of individual accessions are made by the scientific curator, based on discussions between the curator and the horticulturist.

The disposal of a plant accession can be considered if information on its origin is missing and is unlikely to be found. In exceptional cases, individual plants in good condition that represent a taxon otherwise missing from the collection can remain in it even if information on their origin is missing. Ornamental plants acquired solely for the exhibition collection constitute a permanent exception. In addition, historical collections (e.g., in Kaisaniemi BG) can be retained on a discretionary basis.

When disposing of plant accessions, any reliable observation data are saved, as are, at the curator's discretion, herbarium and/or DNA specimens. In the case of specimens in poor condition that are to be disposed of, related observation data must be retained in the collection management system if reliable collection data and determinations are available.

Individual plants (those in poor condition or that are dangerous, such as trees) can be disposed of as part of the regular care of the garden. In the case of a conflict between preserving an accession and disposing of an individual plant in poor condition, a negotiation must take place between the gardener and the curation staff on preservation or possible renewal strategies.

7. Use and availability of collections

The collections are used primarily for scientific research and university-level teaching and secondarily for other teaching as well as science education and environmental education.

The collections can be explored in the Luomus botanic gardens. In accordance with international practice, material included in the collections can be provided for research use or to other botanic gardens either free of charge or for a handling fee.

Availability and user rights

The availability of collections is their key quality criterion and value indicator. The aims of the collections policy include making the collections available for effective use by the scientific community.

The use of the collections requires permission. The person who primarily decides on such permission is the relevant scientific collection coordinator, his or her deputy, a team leader or the director of the Botany Unit. The person granting the right to use the collection determines, on a case-by-case basis, the scientific significance of the use, the user's qualifications and the risks involved.

Seed exchange

Seed exchange with member gardens of the International Plant Exchange Network (IPEN) is considered safe and appropriate scientific use and complies with a pre-determined protocol (see Miranto et al. 2019). With regard to other gardens, the information available must be used to consider whether the recipient is a scientific and non-commercial garden. In unclear cases, the person responsible for seed exchange can request further information.

Openness of datasets

Metadata related to the collections and, as a rule, digitised data about plant accessions in the Kotka CMS are considered open data in accordance with the Luomus Digital

Data policy (unpubl.) and are available to the scientific community and the general public through the Finnish Biodiversity Information Facility (as a rule, CC Attribution 4.0 or more recent). With regard to sensitive species, the recommendations included in the list maintained by the Finnish Biodiversity Information Facility are followed concerning the accuracy of open data.

Access to collection facilities

Access to the collection facilities not open to the public requires authorisation (access control). The team leader or the collection coordinator of the relevant facility provides permission for access. Staff as well as those with a work contract with Luomus have free access to the collection facilities, whereas others can use the collections with guidance from the collection staff of the relevant team. Assisting visitors is one of the core duties of the teams.

Requests to access collections are handled and considered without delay. The aim is also to duly provide the opportunity for a collection visit: visits lasting up to one working day within a two-week period and longer visits within a one-month period.

Destructive sampling

Tissue samples taken of collection plants that have been handed over as well as DNA preparations of them are formally processed as loans, similarly to the loans based on the separate Genomic Resources Collection Policy (submitted to RIO). The right of ownership to, and use of, DNA preparations remains with Luomus, unless otherwise agreed, and the borrower reports on the use of specimens. The borrower is responsible for ensuring or obtaining the right of use for purposes referred to in the Nagoya Protocol (2010), and this is stated in the loan document.

Other use

The use of collections for exhibitions and the rental or loan of plants to not just scientific research and collection units, but also to other parties are based on the instructions of the general collections policy (Hyvärinen et al. 2020).

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