# Botanic Gardens Conservation International's Gardensearch and Plantsearch Databases: the World's Botanic Gardens and Living Collections at Your Fingertips[©1]

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## INTRODUCTION

Botanic Gardens Conservation International (BGCI) maintains two free, online databases to support plant conservation in botanic gardens: GardenSearch and PlantSearch. GardenSearch is an on-line directory of the world's botanic gardens and related institutions while PlantSearch provides an account of the plant species held by these institutions. Information included in these databases is provided by each institution which is responsible for regularly updating its own record, using an on-line log-in facility.

**Some Statistics GardenSearch**
- Records (institutions): 3,200
- Number of countries represented: 176
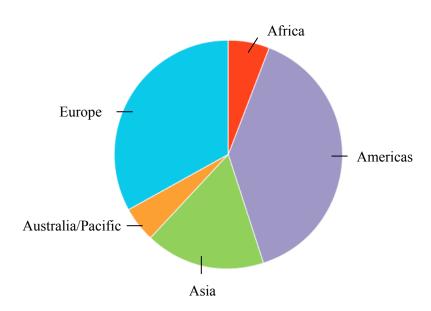- Breakdown of institutions per region (Fig. 1)



Fig. 1. Regional breakdown of institutions represented in GardenSearch.

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[1]This article has been adapted from: Sharrock, S. and Hird, A. 2014. Networking Botanic Gardens for Conservation—the role of Botanic Gardens Conservation International's (BGCI's) Databases. BGjournal 11(2):3-6.

# ONLINE DATABASES

**PlantSearch**
- Collection records 1,255,261
- Taxa 413,167
- Institutions providing data 1,079
  There has been a significant increase in the amount of data included in these databases in recent years (Fig. 2).
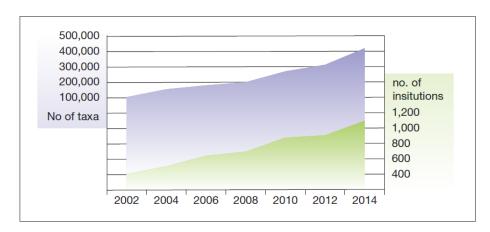


Fig. 2. Number of taxa and number of institutions providing data to PlantSearch.

**GardenSearch**
Botanic Gardens Conservation International's GardenSearch database is a gateway to information about the world's botanic gardens (Fig. 3). Each garden record provides basic information about the garden and where applicable, a link to the garden's own website. For smaller gardens that do not have their own website, GardenSearch provides a web presence they would not otherwise have. All records in GardenSearch are georeferenced, allowing easy mapping of search results using a mapping "applet" available via GardenSearch. As well as botanic gardens, GardenSearch also includes an increasing number of related institutions (seed/gene banks, zoos, etc.), with a common interest in conservation and maintaining plant collections.
  GardenSearch fields are divided into three sections:
- Section 1: Allows the garden to provide basic information in a free text format, including uploading an image. This information can be provided in the garden's local language and/or English. This provides an opportunity for the garden to promote itself in whatever way it prefers.
- Section 2: Consists of a form to collect information on features and facilities, plant collections, and conservation, research and education programs in a standard format. This section forms the "backbone" of the database and the data provided is compiled into a unique, searchable global directory of skills, expertise, and facilities relevant to plant conservation.
- Section 3: Allows the garden's record to be linked to related resources (journal articles, news items, etc.) that appear elsewhere on the BGCI website.
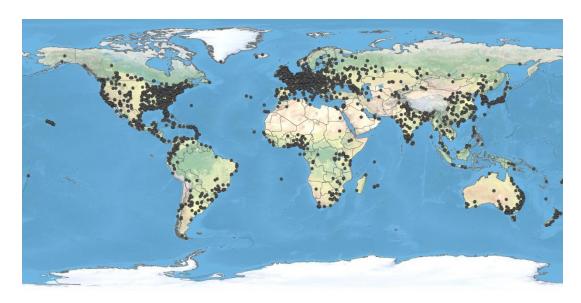
Fig. 3. Global map of institutions recorded in GardenSearch (map by Adam Smith).

**Advanced Searching**

In 2012, BGCI launched an Advanced Search function for GardenSearch. The Advanced Search function not only locates institutions geographically and by keyword, but also allows users to explore in more detail the conservation, research, education and public outreach facilities and expertise offered at botanic gardens around the world. GardenSearch includes a total of 63 searchable fields related to the work of botanic gardens, each of which can be searched at the global or national level.

GardenSearch, as well as providing a unique tool to identify specific expertise and resources in countries around the world, also allows major gaps in botanical capacity to be identified. GardenSearch also supports studies related to plants and climate change, allowing the identification of gardens offering different climatic conditions in which to test and potentially grow plants in the face of changing environmental conditions. An example of this is provided by Smith et al. (2014).

**PlantSearch**

Botanic Gardens Conservation International's PlantSearch database is the only global database of plant species maintained in the collections of botanic gardens and similar organizations. In addition to hundreds of living plant collections around the world, PlantSearch includes taxon-level data from gene and seed banks as well as cryopreserved and tissue culture collections. This dynamic collections database was originally developed to measure progress toward Target 8 of the Global Strategy for Plant Conservation (GSPC) by tracking which threatened species are in botanical collections throughout the world (GSPC 2020 Target 8: At least 75% of threatened plant species in ex situ collections, preferably in the country of origin, and at least 20% available for recovery and restoration programs). Through its online interface, PlantSearch also connects collections directly to conservationists, educators, horticulturists, researchers, policy makers, and many others around the world who are working to save and understand plant diversity.

All data included in PlantSearch are uploaded by collection holders directly to PlantSearch via an on-line facility. Uploaded taxa lists consist of seven taxonomic fields ranging from genus to cultivar name. Before being included in PlantSearch, records are screened against existing names in the database and IPNI (International Plant Names Index) to ensure that only valid names enter the database. As of July 2014, the PlantSearch database included 1,255,261 collection records, representing 413,167 taxa, at 1,079 institutions. Each record in PlantSearch is linked to a record in GardenSearch, thus

providing a georeferenced location for each plant. Location details are however not made public, to ensure the anonymity of species in cultivation. A "blind email" request system has been developed to allow users to request further information on species of interest.

  PlantSearch has direct links to a number of other databases, most notably the IUCN Red List, but also other taxonomic databases (IPNI, Tropicos), a list of CITES species and lists of socioeconomically useful plants (medicinal, crop wild relatives). Work is presently ongoing to also add links to information on invasive species.

**Benefits for Data Providers**
PlantSearch provides a useful collection management tool for collection holders. By uploading a plant list, the collection holder will be notified of misspelled or unrecognized plant names in their list. Once uploaded, the list can be compared with the global database, allowing collection holders to identify how many other gardens are maintaining the same taxa. Plant lists are also automatically screened against the IUCN Red List and CITES lists, so that rare and threatened species in the collection can be easily identified. This can facilitate the establishment of conservation priorities for the collection holder and contribute to collection evaluation (Aplin, 2008, 2013).

**Using PlantSearch Ex Situ Surveys**
PlantSearch can be used to carry out surveys of ex situ collections on a global, regional or national level, as well as for taxon-level surveys. At the global level, monitoring progress toward GSPC Target 8 is constrained by lack of progress in Red Listing, with, to date, only 6% of plants having been assessed at the global level. A recent assessment by BGCI identified 29% of globally threatened species in ex situ collections, but the lack of information on which species are under threat means that this is probably a considerable under-estimate. As national and regional lists of threatened species are more widely available, BGCI has also carried out a number of national/regional assessments on ex situ conservation progress. In the USA, a recent review found that 39% of threatened native U.S. species are now maintained in living plant and seed bank collections. This is up from 37% in 2010. This leaves more than 3,000 threatened species to add to collections by 2020 for the USA to meet the 75% ex situ target. For more details on this assessment, visit: <www.bgci.org/usa/naca>.
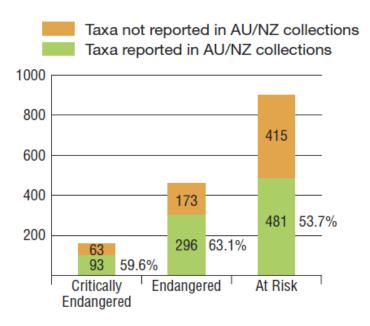


Fig. 4. Results of an assessment of ex situ collections in Australian and New Zealand botanic garden collections.

In Australia and New Zealand, 56% (854 of 1,519) of threatened species are safeguarded in living plant collections (Fig. 4). Although this is the best regional progress toward GSPC Target 8 found so far, there is still work to be done to reach the 75% goal by 2020. Furthermore, nearly 40% of reported threatened native species in the region are reported in only one collection, which suggests that collections contain low levels of intraspecific genetic diversity. For more details on this assessment, visit <www.bgci.org/usa/bganz2013>.

**Taxon-Based Surveys**
BGCI and its partners also use PlantSearch to carry out ex situ surveys of the conservation status of plant family groups. So far, these have included magnolias, oaks, rhododendrons and, most recently, conifers.

These surveys are typically carried out by BGCI following the publication of a Red List for the family or group in question, with the aim of identifying how many collections are cultivating species identified as threatened during the Red Listing process.

A summary of the results obtained through recent assessments:
- Conifers: The survey identified 81% of globally threatened conifer taxa in over 800 ex situ collections. However 134 threatened conifer taxa are known in very few or no collections. These are highlighted as priorities for establishing a more effective safety net against extinction of threatened conifers (Shaw and Hird, 2014).
- Rhododendrons: The survey identified 12,068 rhododendron records from 304 institutions in 42 countries. However, only 276 ex situ records represent just 48 of the 77 most threatened rhododendrons. This means that nearly 40% of the critically endangered or endangered taxa are currently not known in cultivation <www.bgci.org/ourwork/rhododendron_survey>.
- Magnolias: The survey included 2,274 *Magnoliaceae* records from 238 institutions in 47 countries. However, only 362 of these records represent 37 of the 89 most threatened *Magnoliaceae*. This means that more than half of the critically endangered or endangered taxa not currently documented and protected in living collections <www.bgci.org/ourwork/magnoliasmain>.
- Oaks: The survey identified 3,796 oak records from 198 institutions in 39 countries. However, only 91 ex situ records representing just 13 of the 29 most threatened oaks were located. This means that more than half of the critically endangered or endangered oak taxa are not currently reported by living plant and seed collections worldwide <www.bgci.org/ourwork/2358>.

**NETWORKING PROJECTS**
Botanic Gardens Conservation International's databases can also be used to support projects that require a networking approach — helping to identify gardens with similar research interests, or growing specific plant species. One such example is the International Plant Sentinel Project, a new BGCI-coordinated project that aims to bring botanic gardens and arboreta together to share information on pest and disease attacks on plants in their collections <www.bgci.org/ourwork/ipsn>. The overall aim is to develop an early warning system for new and emerging pests and diseases in a globally distributed network. The knowledge of which gardens are cultivating which plant species is an essential tool in the development of this network.

**FUTURE DEVELOPMENTS**
Botanic Gardens Conservation International is keen to further develop its databases as a tool to support the conservation of threatened plant species and to promote and strengthen the work of botanic gardens in this area. There is clearly a high demand for information on plants in collections as evidenced by the approximately 2,000 requests passed through the PlantSearch "blind email" request system every year. While PlantSearch does not publicly identify which gardens hold which species, many gardens are already publishing their collections data online [e.g., the catalogue of the Living Collections of the Royal

Botanic Garden Edinburgh <http://elmer.rbge.org.uk/bgbase/livcol/bgbaselivcol.php>. Botanic Gardens Conservation International is therefore considering various options of how to make information on plants in collections more accessible to bona fide users, while still maintaining anonymity where this is required. Other areas where developments are ongoing are in the identification of synonyms (using information from The Plant List) and better verification of cultivar names (in collaboration with the Royal Horticultural Society in the UK). Of course, as with any database, the value of the GardenSearch and PlantSearch databases is only as good as the data they contain. Botanic Gardens Conservation International continues to encourage awareness of and participation in these unique and powerful tools to support plant conservation and the work of botanic gardens and the broader botanical community.

For further information and to consult the databases please visit: <www.bgci.org/garden_search.php> and <www.bgci.org/plant_search.php>.

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