Issue 2
August 2020

GGI-Gardens Newsletter

This newsletter will serve to better connect GGI-Garden partners by providing news from the botanic garden community regarding collections and collections preservation; highlighting partner collections and contributions to GGI-Gardens and sharing opportunities such as the GGI-Gardens Partner Awards.

The Global Genome Initiative for Gardens is an international partnership dedicated to collecting and preserving genome quality tissues for all species of plants on Earth

Highlight: GGI-Gardens Gap analysis

GGI gardens has the goal to collect and preserve voucher specimens (including genome-quality tissue) from 50% of the known vascular plant genera. As the network grows with new partners and collecting goals advance, it is important to review progress towards this goal and prioritize activities to most efficiently and effectively reach it. A few big questions which the GGI-Gardens team have is 'Which genera have and haven't been sampled?', 'How many of those genera which haven't been sampled yet are found in the world's botanic gardens?' and 'Which botanic gardens hold those genera?'. Two databases managed by the Global Genome Biodiversity Network (GGBN) and Botanic Gardens Conservation International (BGCI) hold the data which allows us to answer these questions and more. The GGBN database is a portal to the species for which tissue samples have been collected and preserved. BGCI's PlantSearch is a global database of plant taxa reported in botanic gardens and other similar collections.

*'Over **9,000** genera of vascular plants have not yet been sampled in the GGBN database'*

Through comparison of these two databases as well as threatened species in BGCI's ThreatSearch database (containing all known conservation assessments of plants), we can prioritize sampling from living collections with genera that are missing from GGBN. Over **9,000 genera** of vascular plants (approximately 65% of all genera) **have not yet been sampled** by the GGBN database. Of those unsampled genera some 45% (**approximately 4,100 genera**) are **reported as living collections in the world's botanic gardens.** There is great potential within living collections for genomic preservation of the world's plant diversity.

But where can GGI-Gardens start? From our gap analysis we have highlighted a list of **150 genera which have not yet been sampled and are uniquely reported in GGI-Gardens collections.** The list can be found here and is a great starting place for your gardens to collect and contribute to filling the gaps in our genera collecting goals.

How does your garden grow? Analyzing living collections for conservation and research priorities using integrated gap analysis tools

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"Preserving and understanding Earth's genomic biodiversity"

The Global Genome Initiative (GGI) is a six year, $15 million program whose mission is "to preserve and understand the genomic diversity of life." Through international partnership, GGI is committed to creating a systematic understanding of Earth's biodiversity. To achieve the GGI mission our partnership coordinates with the Global Genome Biodiversity Network (GGBN[1]) – an international consortium that began at a GGI-hosted workshop in 2011 – to collect, preserve, and make discoverable for research genomic tissue samples. Essential to this effort is the availability of diverse living tissues. Indeed, the principle challenge for genomic research in the 21st century is not the cost of sequencing genomes, but rather the availability of preserved tissue suitable for sequencing the genomes of life on Earth. **As of June 2020** GGBN-networked biorepositories contain such tissues for just over **4,470 taxonomic families and 25,800 genera**. These collections might be especially valuable for large and ambitious sequencing projects, such as the Earth BioGenome Project[2].

Partnering to preserve the heritage of living collections

To achieve the GGI mission for the Plant Tree of Life, GGI founded **GGI-Gardens**, an international partnership dedicated to sampling and preserving plant biodiversity from the world's extraordinary living collections. Arboreta, botanic gardens, and greenhouses (henceforth, gardens) are living museums that are home to more than 1/3 of all known plant species. The strength of GGI-Gardens lies entirely in its partnerships with gardens. The ultimate goal of GGI-Gardens is to sample and preserve the diversity of all species of plants on Earth.

Figure 1. Becoming involved with GGI-Gardens as a three-step process (left) and (right) a map of GGI-Gardens partners worldwide.

Joining the GGI-Gardens partnership

Since 2015, the GGI-Gardens has grown to encompass an international partnership of 25 gardens (shown in map above). To date GGI-Gardens and its partners have collected nearly 20,000 herbarium vouchers and genomic DNA tissues. If your institution is interested in joining the GGI-Gardens program, please contact the Program Coordinator, Jean Linsky at **jlinsky@brit.org** or Program Director, Morgan Gostel at **mgostel@brit.org** or visit the GGI-Gardens website (http://www.brit.org/research/ggi-gardens) for documents including the Memorandum of Cooperation and Portfolio of Partner Benefits.

GGI-Gardens partner benefits

- Get DNA barcode sequences for specimens in your collection that are new to GGBN;
- Apply for GGI-Gardens Partner Awards (up to $6,000) to contribute collections from your garden;
- Receive training for staff & volunteers to collect herbarium vouchers, preserve genomic tissues, and work with DNA barcode sequences;
- Take part in GGI-Gardens press, media, and outreach opportunities and training resources;
- Use your living collections to support global plant conservation and research, including the Global Strategy for Plant Conservation

Prioritizing for the future of GGI-Gardens

Through comparison of the GGBN database as well as living collections and threatened species in BGCI's PlantSearch[3] and ThreatSearch[4] databases respectively (Figure 2), we can prioritize sampling from living collections with genera that are missing from GGBN. Over **9,300 genera** of vascular plants (approximately 67% of all genera) **have not yet been sampled** by the GGBN database. Of those, **4,302 genera** (46%) have been reported as species records **in the world's botanic gardens**. Further investigation reveals that **4,662 globally and/or regionally threatened species** not yet sampled within the GGBN network **are present in 846 botanic gardens** around the world (Figure 3). Living collections in Australia, China, France, Indonesia, Singapore, the UK, and the USA host 74% of the unsampled, threatened species reported and 34% of the unsampled, threatened taxa are found in **only a single living collection** (Figure 3). GGI-Gardens will use this information to identify potential new partners to contribute tissue samples. Such analyses reveal the importance of living collections for conservation, preservation, and as sources of genomic tissue for understanding Earth's biodiversity.

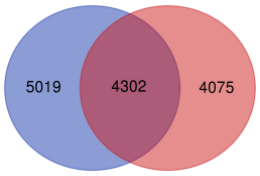

Figure 2. An analysis of the number of plant genera not yet collected by GGBN, but represented in the global botanic garden network via BGCI's PlantSearch living collection database.

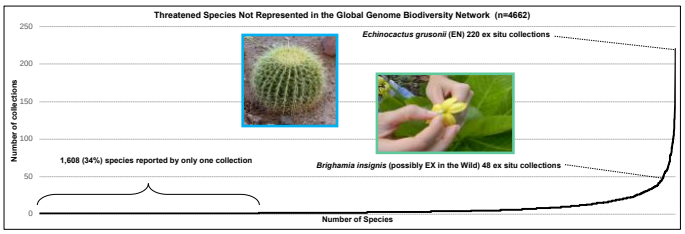

Figure 3. Results from a comparison of the GGBN and PlantSearch gap analysis to identify threatened species from living collections not represented in the GGBN database. Threatened species (CR, EN or VU at global and regional levels) from BGCI's ThreatSearch database were assessed for their presence in the GGBN database, those not yet collected were searched within the PlantSearch database for presence in ex situ collections.

Acknowledgments

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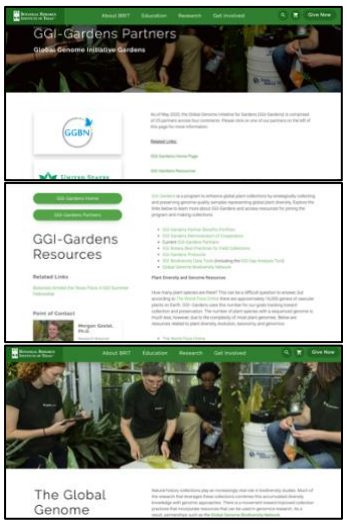
References

(1) Seberg, O., et al. 2016. Annals if Botany 118: 393–399; (2) Lewin, H.A., et al. 2018. PNAS 115: 4325–4333. (3) BGCI PlantSearch, A database that connects researchers and conservationists to 1000's of living botanical collections, Accessed 8 June 2020; (4) BGCI ThreatSearch, The most comprehensive database of conservation assessments for plants, Accessed 8 June 2020.

Zoom in to check out our Botany2020 poster for more information about the gap analysis.

Thanks to the United States Botanic Garden and BGCI-US for their generous support to carry out this work!



Access the new GGI-Gardens via brit.org today!

Resources

GGI-Gardens Website has a new home!
GGI-Gardens has found a new home on the website of the Botanical Research Institute of Texas (BRIT). Visit the new pages to find an overview of the GGI-Gardens program, resources such as the best practices for field collections and the partnership MOC and links to the current partners of the GGI-Gardens Partnership.

Visit http://www.brit.org/research/ggi-gardens to access past issues of the newsletter and connect with GGI-Gardens and the Global Genome Biodiversity Network (GGBN) via Facebook and Twitter.

We're always looking for content from partners to share in the newsletter or via social media so send your stories and links to the emails below at any time.

Use iNaturalist to track your GGI-Gardens collecting!

iNaturalist Resources

Did you know that **you can use iNaturalist to keep track of your GGI-Gardens sampling** and contribute to the Global Genome Initiative Gardens project? GGI-Gardens has created some useful guidance on how to use iNaturalist and join this project. Find it here on the GGI-Gardens Resources page.

Advisory Committee News

The GGI-Gardens Advisory Committee met virtually on June 29th. Thanks to all those who joined!

The topics of discussion for the meeting included reviewing current partner and collection statistics, an update on progress since the last meeting, the creation of a new GGI-Gardens Awards Program call for proposals, the new GGI-Gardens website (see news item above) and newsletter and the GGI-Gardens Gap analysis.

Discussion of taxonomic or geographic groups of plants which may be of interest for focus in the gap analysis included **crop wild relatives, the APGA national plant collections network as well as circumboreal, arctic, alpine and far southern flora**. Additionally, suggestions of targeting gap analysis **on taxa from threatened ecosystems**, those that are '**exceptional species'** (i.e. those that cannot be traditionally seedbanked) and **extinct in the wild** species was made.

Events & Opportunities

Recent:
The **American Public Gardens Association's Virtual 2020 Conference** took place June 25th-July 9th. GGI-Gardens presented a poster 'Gap Analysis and Prioritization for the Global Genome Initiative for Gardens Partnership'

The **Botany 2020-Virtual Conference** took place online from July 27th-31st. GGI-Gardens presented a poster entitled 'How does your garden grow? Analyzing living collections for conservation and research priorities using integrated gap analysis tools'.

The **2020 Texas Plant Conservation Conference** was held on August 13th & 14th. GGI-Gardens presented a poster entitled 'Assessing Conservation Priorities for Texas at the Interface of Botanic Gardens, Conservation, and Genomics'

Upcoming:

Stay tuned for more news about a call for applications for **the GGI-Gardens Awards Program** coming in September! Join our e-mail list to make sure you are notified!

Global Genome Biodiversity Network Conference has been postponed until March 2021.