CONSERVING THREATENED EXCEPTIONAL PLANT SPECIES: STATEMENT OF NEED
December 3, 2013
Previously Unpublished

Background: A workshop on conserving threatened exceptional plant species was convened by Botanic Gardens Conservation International (BGCI) and the Cincinnati Zoo and Botanical Garden on October 21, 2013 as part of the 5th Global Botanic Gardens Congress in Dunedin, New Zealand. Workshop goals were to define key issues, priorities, and actions needed to effectively conserve threatened exceptional plant species.

Twenty-eight experts in cryopreservation, in vitro propagation, and *ex situ* conservation were invited to participate in the process as part of an Exceptional Plant Species Advisory Group (EPSAG), representing North America, Europe, Africa, Australia and New Zealand. Of these, seventeen individuals were able to attend the workshop and eleven provided consultation remotely. This Statement of Need summarizes outcomes of the workshop, as agreed by the EPSAG, and outlines next steps.

Defining exceptional plant species: Exceptional plant species cannot be conserved *ex situ* via conventional seed banking methods: they require more time- and resource-intensive approaches, including cryopreservation and *in vitro* propagation. We do not yet know how many species are exceptional, but initial estimates range from 10-25% of known plant species.

Any plant species that meets at least one of the following biological or environmental conditions may be considered exceptional:

- Produces recalcitrant seeds
- Produces few or no seeds
- Produces poor-quality or non-viable seeds
- Produces seeds infrequently
- Produces seeds with deep dormancy
- Produces seeds that survive short-term but not long-term banking
- Cannot be easily propagated by seed (with current knowledge/protocols)
- Are not accessible when seeds are mature

NEED 1: Address information challenges. We have incomplete information on which threatened plant species are exceptional, and which researchers and practitioners are currently working with threatened exceptional species. These are currently the most significant information barriers to effective conservation of threatened exceptional plant species, and therefore a priority for action.

As a first step, BGCI and CZBG will work with all 28 EPSAG members to create a first draft global list of threatened exceptional plant species and the individuals that are working with them. This will:

- Allow research and *ex situ* collection efforts to be prioritized
- Provide opportunities to better define and understand the biological and environmental features of exceptional species

- Provide examples for use in decision-making and advocacy efforts
- Identify experts already working with exceptional species
- Support coordination and collaboration

There are many logistical obstacles to compiling this list, but many resources were identified to manage them. These include:
OBSTACLE: Unresolved taxonomic issues. RESOURCE: BGCI's PlantSearch database and access to The Plant List via Kew's web services.
OBSTACLE: Lack of comprehensive global threatened species list. RESOURCE: The Red List as well as many other regional or national lists that the EPSAG is familiar with.
OBSTACLE: Limited access to information on seed production, storage, and germination behavior. RESOURCE: Kew's Seed Information Database, and input from the EPSAG working with individual species.

NEED 2: Identify research priorities. The biology of most threatened exceptional plant species is generally poorly understood and often species-specific. *In vitro* propagation and cryopreservation are currently the primary techniques to conserve threatened exceptional species *ex situ* and to produce propagules for reintroduction efforts, but specialized facilities and expertise is often required to develop protocols for these techniques, and they are often species-specific. Even under the best of circumstances, protocol development is often expensive, time-consuming, and unpredictable.

Research priorities identified include:
- Develop more formal and standardized protocols for identifying threatened exceptional plant species.
- Understand the basic biologies of threatened exceptional plant species, in relation to *ex situ* conservation needs and restoration potential.
- Understand the biology and improve the technology of cryopreservation and *in vitro* methods, in order to identify optimal and tolerance ranges of the protocols for species or groups of species, thereby improving efficiency and predictability of the methods.
- Facilitate more research coordination among cryopreservation, *in vitro* propagation, and seed banking efforts.
- Provide and promote research opportunities to university researchers and graduate students.
- Develop mechanisms for disseminating both successful and unsuccessful research on protocol development.
- Overcome barriers to technology transfer to exceptional species-rich developing countries.

There are many logistical obstacles to addressing these priorities, but many resources were identified to manage them. These include:
OBSTACLE: Technical challenges in approaching the research of improving *in vitro* and cryopreservation methods, due largely to the multiple factors affecting these systems.
RESOURCE: The application of new research tools, such as statistical approaches (Design of Experiments), time-lapse photography, and others, that can facilitate the testing of multiple

factors and significantly increase the quality and the quantity of scientifically sound information that can be gathered by small, resource-limited laboratories.
OBSTACLE: Limited research on the biology of wild, threatened plant species. RESOURCE: Engage more university researchers and graduate students to expand knowledge in this area.
OBSTACLE: Limited access to information on research that has already been done on threatened exceptional plant species, as it is often unpublished or in grey literature.
RESOURCE: Listserves on plant tissue culture and plant propagation, in-country and international networks.

NEED 3: Address funding, communication and coordination challenges. Conserving threatened exceptional plant species *ex situ* is more costly than traditional seed banking. In general, cryopreservation and *in vitro* propagation costs are difficult to quantify or standardize and species-specific, and results are unpredictable. Additional funding for research, outreach, and more effective communication and coordination among the global community working with these species, is needed. Potential avenues to secure funding to support research, outreach, and coordination include targeting major foundations, the corporate sector, and industry leaders.

Next steps: This workshop is only a first step in addressing threatened exceptional plant species conservation. BGCI and CZBG have funding to continue to coordinate this work through February 2014, and until then they will work with workshop participants to carry out the following next steps:

BGCI and CZBG will:

1. Synthesize and share priorities agreed on by workshop participants as a Statement of Need, incorporating input from workshop participants by **December 31, 2013**.
2. Work with EPSAG members to compile a draft global list of threatened exceptional plants species by **January 31, 2014**.
3. Compile list of useful resources on threatened exceptional plant species, with input from EPSAG members by **February 15, 2014**.
4. Update BGCI's Exceptional Species webpage (www.bgci.org/usa/exceptionalspecies) and post all relevant information (draft species list, statement of need, resources, & contacts) by **February 28, 2014**.
5. Consider funding approach(es) and options, and work independently and collaboratively to pursue funding that can support research, outreach, communication and coordination of exceptional plant species conservation efforts.

EPSAG members will:

1. Review and provide feedback on a draft Statement of Need by **December 31, 2013**.
2. Contribute to a draft global threatened exceptional plant species list being assembled by BGCI and CZBG by **January 31, 2014**.
3. Contribute to list of useful resources on threatened exceptional plant species by **February 15, 2014**.
4. Consider funding approach(es) and options, and work independently and collaboratively to pursue funding that can support research, outreach, communication and coordination of exceptional plant species conservation efforts.