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Gene banks offer breeders access to germplasm: Germplasm collections help to preserve genetic diversity

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Germplasm collections help to preserve genetic diversity

By James Robbins, Mark Widrechner, Richard Olsen, Sandra Reed, Alan Meerow, Kim Hummer, Peter Bretting, Pam Allenstein and Mark Krautmann

Although most of us would agree that access to germplasm is the lifeblood of our nursery industry, how many of us know that behind the scenes there is a coordinated public and private effort to deal with germplasm issues?

Imagine you're a plant breeder with a specialty in ornamental pears. As a breeder, you would benefit from knowing about private and public sources of pear germplasm to use in your breeding program. One place to look might be the National Plant Germplasm System (NPGS) of the USDA's Agricultural Research Service. The NPGS is one component of the USDA's National Genetic Resources Program, which also conserves genetic resources of animals, microbes and invertebrates. NPGS's mission is to acquire, document, evaluate, distribute and preserve the diverse array of plants needed to improve the quality and production of economic crops important to agriculture.

The NPGS encompasses more than 20 gene banks across the U.S., 12 of which conserve many woody landscape plants (WLP). These sites were selected to encompass the broad geographical and climatic regions of the U.S. so all temperate, subtropical and tropical germplasm might be conserved. WLP gene banks are in Maryland-District of Columbia, New York, Georgia, Florida, Iowa, Texas, California, Oregon, Hawaii and Puerto Rico. Germplasm is held at these sites as seeds or plants (or both). Gene bank curators apply a wide range of methods to preserve these valuable genetic resources.

Importance of gene banks

The 12 NPGS gene banks with important collections of woody landscape plants deal directly with germplasm users and are dedicated to making germplasm and information available for

research and crop improvement. The managers of these important collections strive to introduce, maintain and distribute diverse genetic resources of trees and shrubs, often of wild origin, for research, evaluation, and, ultimately, landscape use. This germplasm may also have been evaluated for production potential and adaptation, such as through the NC-7 Woody

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This *Acer griseum* is growing at Cornell Plantations, which is part of the NAPCC *Acer* multi-site collection.

Banks help the green industry

Do germplasm gene banks actually help the green industry?

Harold Pellett, a breeder at the Landscape Plant Development Center, used *Pyrus* germplasm maintained at the ARS National Clonal Germplasm Repository in Corvallis, Ore., to develop 'Silver Ball' pear.

Jim Gilbert, owner of One Green World nursery in Molalla, Ore., focuses on unique fruits and ornamentals from around the world. He has benefited from the materials provided by the Cor-



Distribution of germplasm from 'Fiji Dwarf' coconut palm (*Cocos nucifera*) has already led to the establishment of new seed orchards in South Florida.

Ornamental Plant Trials coordinated by the NPGS site in Ames, Iowa, and further characterized via biochemical and molecular DNA technologies.

Although this material is freely distributed, the NPGS is not meant to be perceived as a wholesale source of propagules for ornamental producers, nor a "giveaway" to hobbyists or amateurs. The requesting individual is expected to show a bona fide research purpose and only small quantities are distributed per request.

Committees help with focus

How does the nursery industry fit into this public system designed to collect, conserve and exchange plant material? Many years ago the ARS recognized the need for a more formal mechanism for securing technical input for its germplasm management programs. To assist in this effort, they established groups called Crop Germplasm Committees (CGCs). There are now 40 CGCs. Some focus on a single crop or genus, such as citrus, cotton, wheat or *Prunus*.

For ornamental horticulture, the ARS established two CGCs, one for Herbaceous Ornamentals and the other for Woody Landscape Plants



Harold Pellett used *Pyrus* germplasm maintained at the ARS National Clonal Germplasm Repository in Corvallis, Ore., to develop 'Silver Ball' pear.

vallis gene bank. Gilbert's most popular pear variety, 'Ubileen Gift,' an early-ripening variety from Bulgaria, came from the Corvallis gene bank.

In South Florida, palm growers hungry for new and locally available landscape coconut varieties have benefited from germplasm at the NPGS gene bank in Miami, where a sizable grove of the highly attractive 'Fiji Dwarf' ('Niu Leka') variety has already led to the establishment of new seed orchards in other South Florida locations from which the industry will be able to obtain propagules. Distributions of germinated seeds have also been made direct to growers.

(WLPCGC). The WLPCGC was established in 1986 with members representing industry, academia, public gardens and the USDA.

Although the initial role of CGCs was to develop lists of common descriptors for characterizing NPGS germplasm collections, their roles have expanded. A CGC may provide input on technical aspects of gene bank operation and maintenance and assess needs for plant exploration and germplasm enhancement. Input from a CGC contributes to ARS's planning process as it develops germplasm research, exploration and funding



Pyrus salicifolia grows in its native habitat, the dry steppes of Eastern Georgia.

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priorities. The WLPCGC meets once a year at various sites, often in conjunction with major nursery trade shows.

Collections are critical

Maintaining secure, well-documented collections of plants is critical. Although there is great potential for many genera to be used as landscape plants, the genetic base of individual species under cultivation can be quite narrow. Some woody landscape plants are represented by a single collection or even a single clone.

For instance, one of the true aristocrats of temperate gardens, the paperbark maple (*Acer griseum*), was introduced from Hubei, China, into the U.S. by E.H. Wilson via the Arnold Arboretum in 1907. Only two plants were successfully imported, and these two plants, which are still growing at the Arnold, are the original source of most of the paperbark maples in the U.S.

Another concern is the reliance upon just a few genera, or even species, for planting in urban forests and gardens. Such a narrow genetic base results in increased vulnerability to catastrophic loss by insects, diseases and environmental stress. Several woody species have suffered devastating losses to diseases and insects during the past 50 years. We are all aware of the case studies on the American elm and Dutch elm disease. Other cases include lethal yellowing phytoplasma and coconut palms in Florida, the imported woolly adelgid and hemlocks in the Eastern United States, and most recently, concern over emerald ash borer and *Fraxinus*.

Other organizations

The NPGS is not the only organization devoted to conserving woody landscape plant germplasm. Plant collections at botanical gardens and arboreta also conserve large, important collections of plant genetic resources from throughout the world.

With nearly 300,000 accessions growing on approximately 100,000 acres, collections at North American gardens represent priceless reservoirs of genetic variability. They are vital to horticultural and botanical research, breeding programs, nursery industry production, conservation efforts and pharmaceutical research.

To coordinate and strengthen this network of extensive and valuable genetic resources, the American

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Public Gardens Association (APGA) established the North American Plant Collections Consortium (NAPCC). NAPCC's goals are to develop a network of botanical gardens and arboreta working to coordinate a continentwide approach to germplasm preservation and to promote high standards of plant-collection management.

Web sites offer details

NPGS

<http://www.ars-grin.gov/npgs/>

CGC list

www.ars-grin.gov/npgs/cgclist.html

WLPCGC

www.ars-grin.gov/npgs/cgc_reports/woody.htm

One Green World

www.onegreenworld.com

American Public Garden

Association (formerly the
American Association of Botanical
Gardens and Arboreta: AABGA)

www.publicgardens.org/

NAPCC

www.publicgardens.org/web/2006/06/napcc_home.aspx

Landscape Plant

Development Center

www.landscapecenter.org/new/

The NAPCC program is partly supported by the ARS, and it is coordinated with NPGS preservation efforts through APGA participation on the WLPCGC. The overall approach is designed to make more efficient use of available resources and strengthen collections through combined collaborative activities.

Contact information for all of these gene banks can be found at www.ars-grin.gov/npgs/holdings.html.

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