

Crop Germplasm Committee Chairs

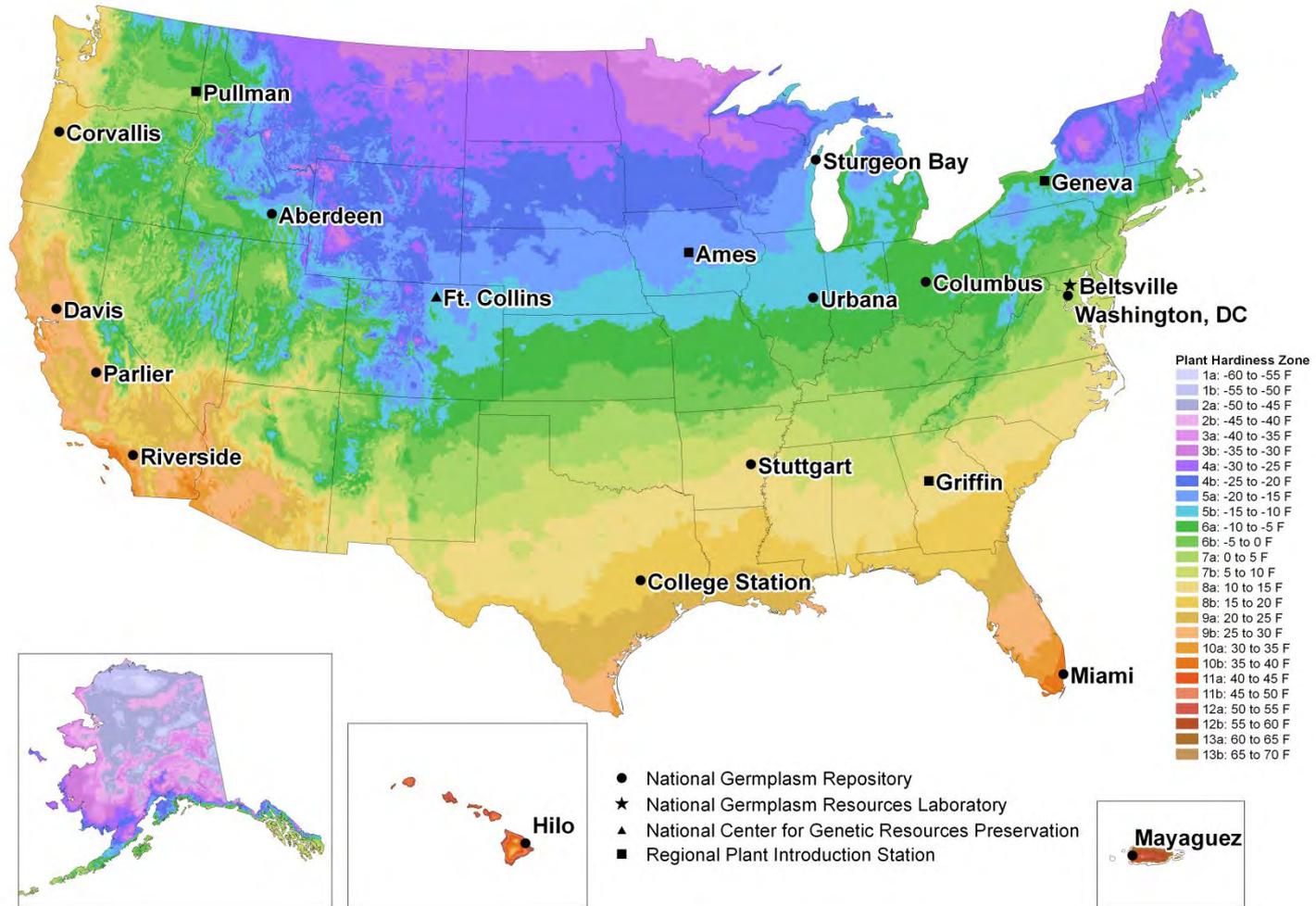
Webinar

March 25, 2019

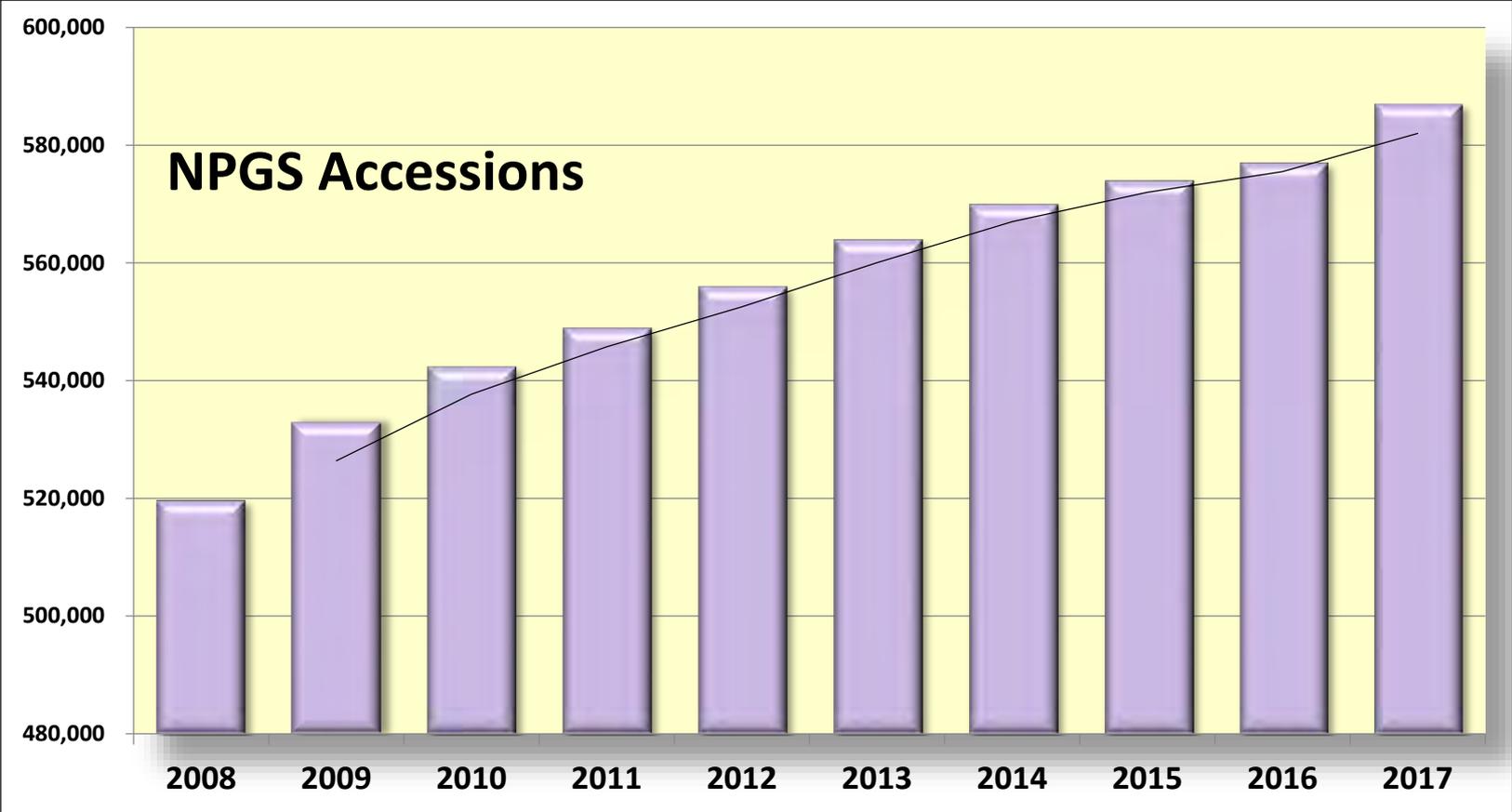
The National Plant Germplasm System: 2019 Status, Prospects, and Challenges

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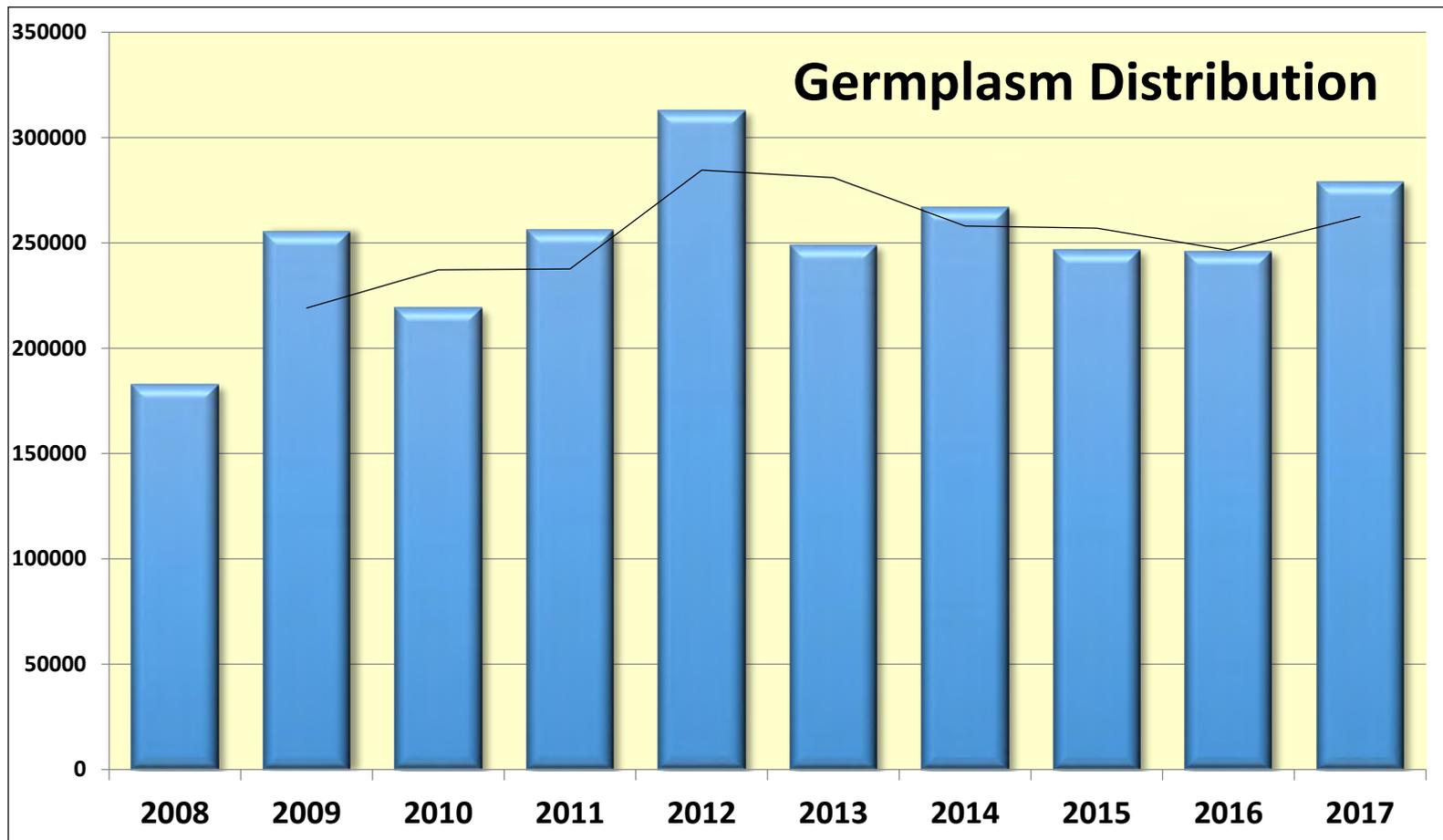
USDA National Plant Germplasm System (NPGS)



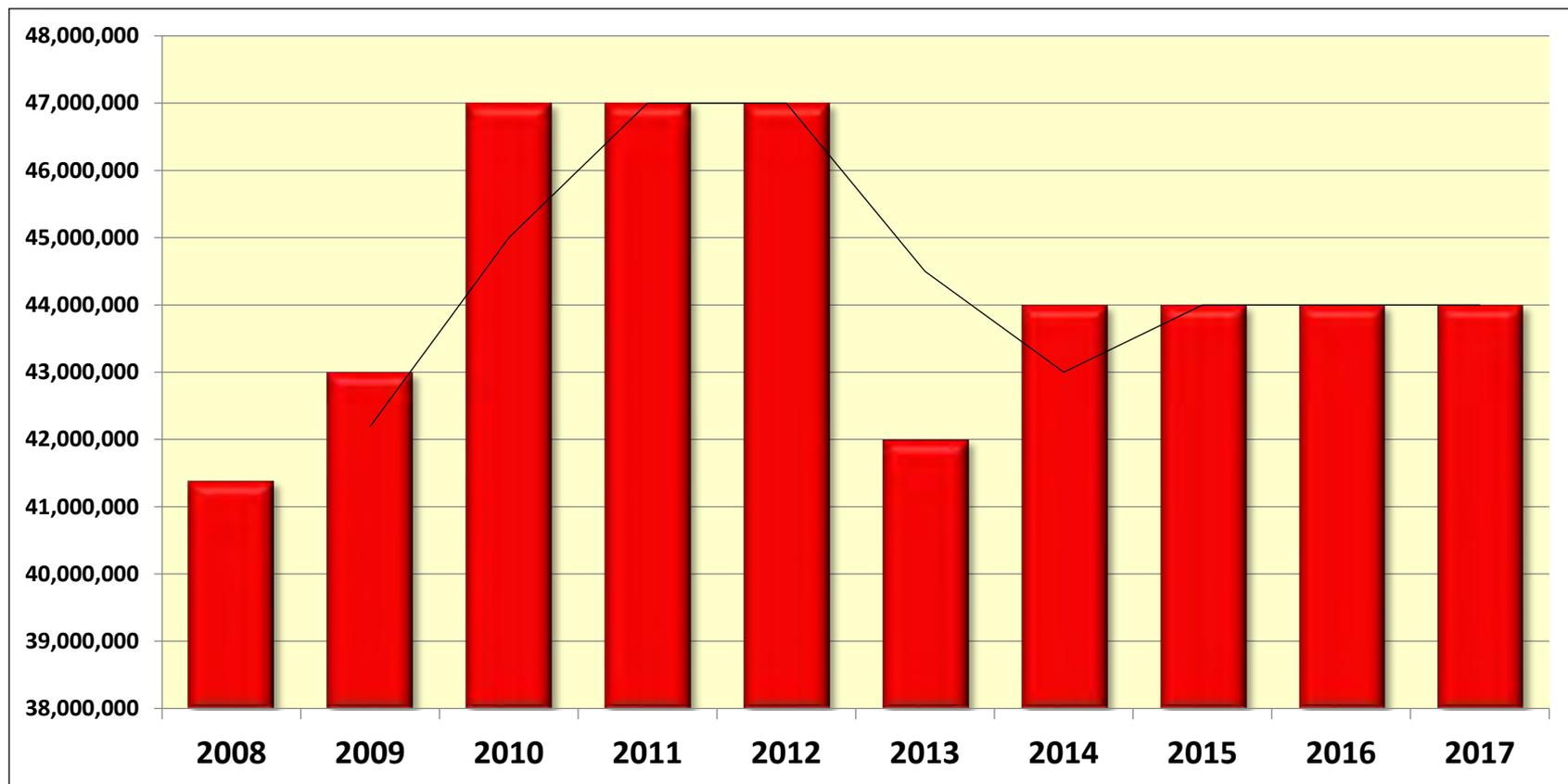
NUMBER OF NPGS ACCESSIONS 2008-2017



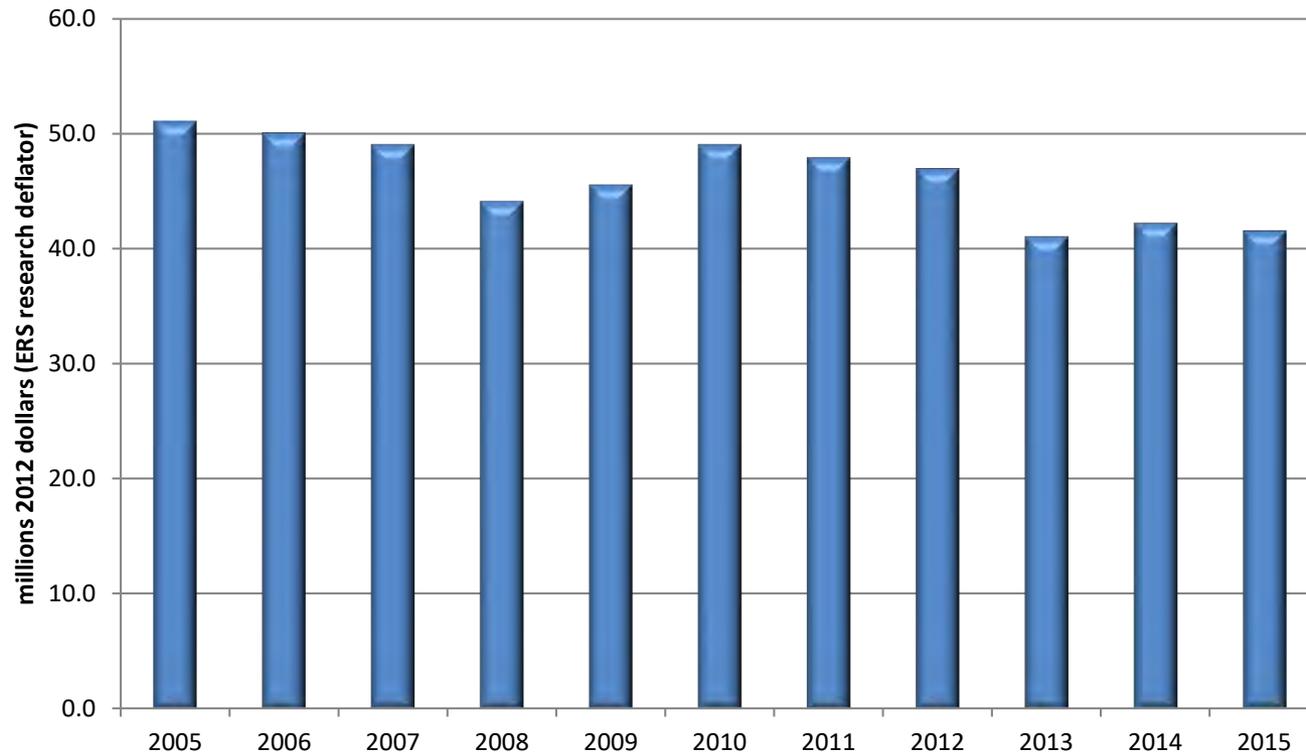
DEMAND FOR NPGS GERMPLASM 2008-2017



ARS NATIONAL PLANT GERMPLASM SYSTEM BUDGET 2008-2017



Real ARS National Plant Germplasm System Budget, 2005-2015, converted to 2012 dollars with ERS research deflator



Note: Deflator for 2015 is preliminary

Some key challenges for the NPGS

- **Managing and expanding the NPGS operational capacity and infrastructure to meet the increased demand for germplasm and associated information.**
- **Recent and upcoming NPGS personnel retirements.**
- **Developing and applying cryopreservation and/or in vitro conservation methods for clonal germplasm.**
- **BMPs and procedures for managing accessions (and breeding stocks) with GE traits and the occurrence of adventitious presence (AP).**
- **Acquiring and conserving additional germplasm, especially of crop wild relatives.**

Genetic Resource Management Priorities

- **Acquisition**
- **Maintenance**
- **Regeneration**
- **Documentation and Data Management**
- **Distribution**
- **Characterization**
- **Evaluation**
- **Enhancement**
- **Research in support of the preceding priorities**

Personnel Changes

- Farewell and best wishes to John Wiersema, (ARS-Beltsville); Dave Stout, Frank Dugan, and Vicki Bradley (ARS-Pullman); Jack Peters, (ARS-Corvallis).
- Welcome and best wishes to Ben Gutierrez, new cold-hardy grape curator at ARS-Geneva, Joanne Labate (now permanent) vegetable curator at ARS-Geneva, and Vivian Bernau, a second maize curator at ARS-Ames.
- With the hiring freeze partially lifted, we hope to hire additional staff in the near future, including curators at Hilo, HI; Stuttgart, AR; Pullman, WA; and Urbana, IL.

Plant Genetic Resource (PGR) Management Training Initiative

- **At least 1/3 of NPGS PGR managers could (likely will) retire within 5 years.**
- **Currently, no formal, comprehensive program exists for training new PGR managers.**
- **G. Volk (ARS-Ft. Collins) and P. Byrne (CSU-Ft. C.) secured a USDA/NIFA grant for a workshop at Ft. C. 24-26 April 2018 that discussed designing & developing a training program for PGR management to be delivered primarily through distance-learning.**
- **The workshop generated numerous insights; workshop participants are extending concepts and ideas from the workshop to develop prototype educational materials.**

National Laboratory for Genetic Resources Preservation



Agricultural
Research
Service

Dr. Stephanie Greene, Seed Curator
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NLGRP- reorganized

Plant and Animal Genetic Resources Preservation Unit

- Plant Preservation Program (Seed, Clonal, Microbes)
 - Dr. Stephanie Greene
 - Dr. Maria Jenderek
- National Animal Germplasm Program
 - Dr. Harvey Blackburn (Acting RL)
 - Dr. Phil Purdy

Plant Germplasm Preservation Research

- Dr. Christina Walters (RL)
- Dr. Gayle Volk
- Dr. Chris Richards



Agricultural Genetic Resources Preservation Research Unit (RL- Dr. Daren Harmel)

Plants (seed, clonal, microbe)

- Dr. Christina Walters (Lead Scientist)
- Dr. Gayle Volk
- Dr. Chris Richards
- Dr. Stephanie Greene
- Dr. Maria Jenderek

National Animal Germplasm Program

- Dr. Harvey Blackburn (Lead Scientist)
- Dr. Phil Purdy

But, we are still called NLGRP!

Number of unique plant and microbial accessions secured at NLGRP

Germplasm	Accessions/isolates
Seed	
NPGS Base collection	426,244
NPGS accessions only at NLGRP	10,817
Non-NPGS-PVP/JPR	9,105
Non-NPGS (Black box)	465,175
Clonal	
NPGS-cryopreservation	5,927
Non-NPGS (PVP)	350
Microbes	
Non-NPGS	111,066
	1,028,684

80% of NPGS seed accessions are backed up

15% of clonal collections are backed up as cryopreserved samples

Seed and microbe storage



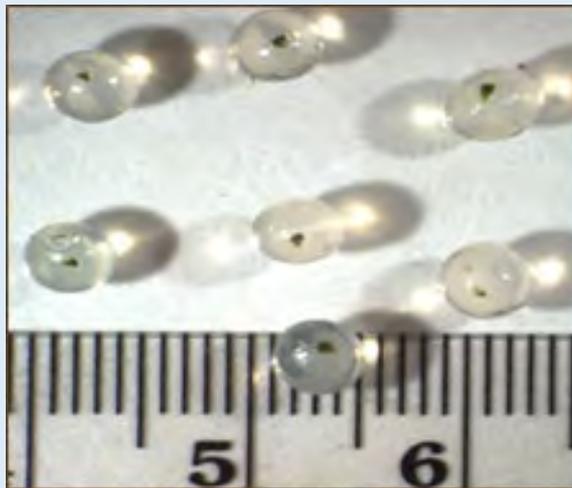
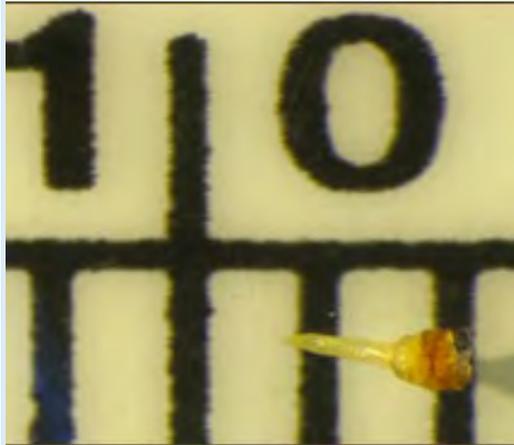
Cold Storage (-18°C)



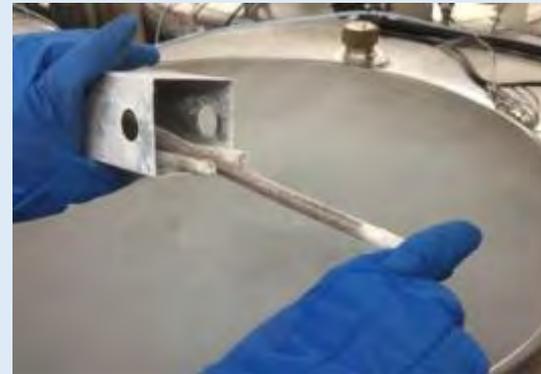
Liquid nitrogen vapor (-165 °C)

Cryopreservation of clonal crops

Shoot meristems

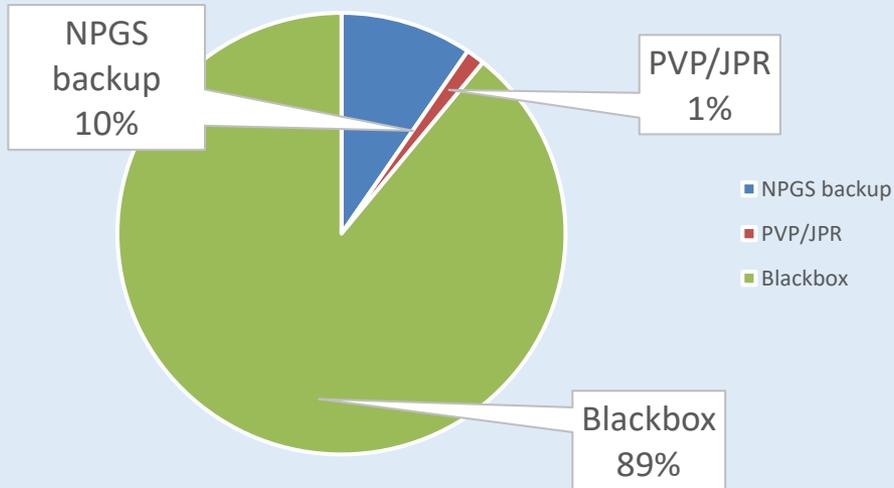


Dormant buds



Activities in 2018

- Received and processed 52,379 samples



- Wheat black box collection received from CIMMYT (44,140)
- Conducted ~ 7800 germination tests
- Prepared 15,000 NPGS accessions for shipment to Svalbard Global Seed Vault
- Assessed recent monitor tests for base collection



10th Anniversary Svalbard Shipment



February



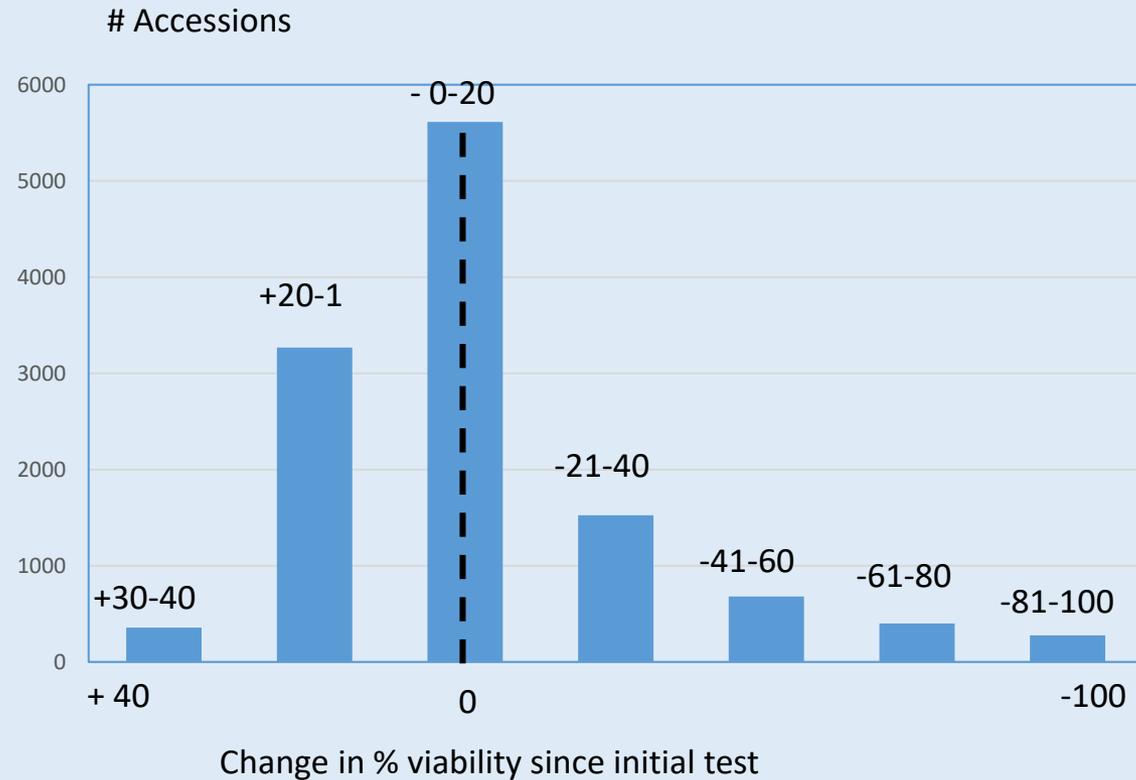
Monitoring Base Seed Collection

2014-2017- focused on monitoring vulnerable base samples

- species with short-lived seed (≤ 60 years based on Walters 2005)
- no viability test for at least 10 years
- stored at -18°C , > 500 live seed

Results

conducted 12,495 monitor tests



71%- viability changed (\pm) < 20 percentage points

23%- viability declined > 20 percentage points

- 2885 base samples (335 taxa) have declined more than 20% since initially tested
- Yet to be assessed- decline of base samples with monitor tests prior to 2014 (~128,000 samples)

Top 15 genera

Genus	# Accessions
Arachis	1056
Brassica	221
Capsicum	169
Sorghum	128
Allium	114
Lactuca	88
Gossypium	75
Paspalum	65
Ricinus	64
Daucus	58
Apium	54
Vigna	49
Oryza	41
Andropogon	39
Hordeum	38

Looking forward in 2019

Three seed analysts are retiring this Spring. This leaves us with only two junior certified analysts and 2 temporary workers who are currently being trained as analysts. We are waiting to hear if our vacancies can be filled

Questions?



NATIONAL PLANT GENETIC RESOURCES TRAINING PROGRAM

USDA National Plant Germplasm System, Universities, and Partner Institutions

Goals

- To build and sustain the human capacity to appreciate, maintain and promote utilization of plant genetic resources.
- To educate professionals in principles and practices of genetic resources management, utilization, and conservation.

Objectives

- Develop content about genebanking/pre-breeding concepts and specific techniques (videos, webpages, PDFs)
- Create a Resource Library website to access freely-available content
- Provide university-hosted educational opportunities that use content: Certificate program, Distance learning courses
- Provide topic-specific workshops, tours, demonstrations, webinars, etc...

Related publications

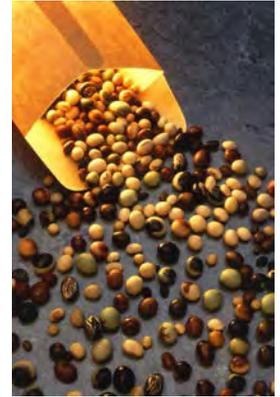
Byrne et al. 2018. Sustaining the future of plant breeding: The critical role of the USDA-ARS National Plant Germplasm System. *Crop Science* 58:451-468.

Volk et al. 2019. Training in plant genetic resources management: A way forward. *Crop Science* (in press).

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Plant Exchange Office National Germplasm Resources Laboratory Beltsville, Maryland

Karen A. Williams Karen.Williams@ars.usda.gov



The NPGS Plant Exploration/Exchange Program

- 🍃 fills gaps in the NPGS
- 🍃 proposals accepted yearly by NGRL- PEO for explorations the next fiscal year
- 🍃 proposals for 2020 due July 26, 2019
- 🍃 guidelines distributed to CGC Chairs
- 🍃 supports both explorations and exchanges
- 🍃 CGCs and curators must endorse proposals



2018 Plant Explorations

Reed canarygrass

Italy

Hydrangea quercifolia

United States (southeast)

Woody landscape plants

United States (NC)

Small fruits

United States (VA, WV)

Wild blueberry

United States (FL)

Wild apple

United States (OH)

Wild bean (2 trips)

United States (KY, TN)

Wild potato

United States (AZ, NM)

Monarda luteola

United States (AR, TX)

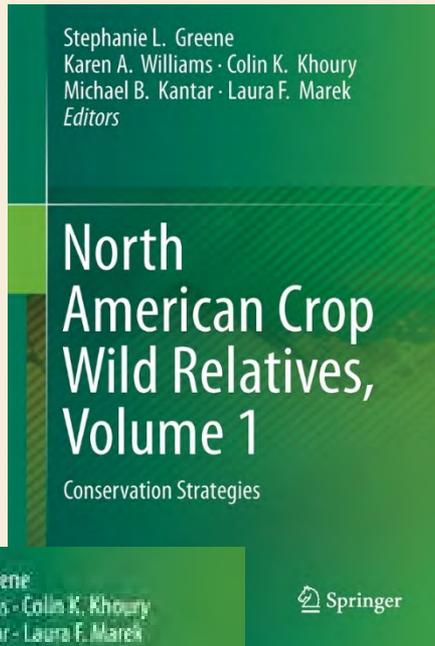
Sapindus saponaria

United States (KS, OK)

Access and Benefit Sharing for International Explorations

- prior informed consent (PIC) for access obtained from national authority
- PIC may be in the form of a letter, permit, MTA, etc.
- includes agreement on the sharing of benefits
- acceptable benefits are “in-kind” (training, equipment purchase, increase projects, etc.)
- PEO obtains PIC
- SMTA provides terms for some explorations

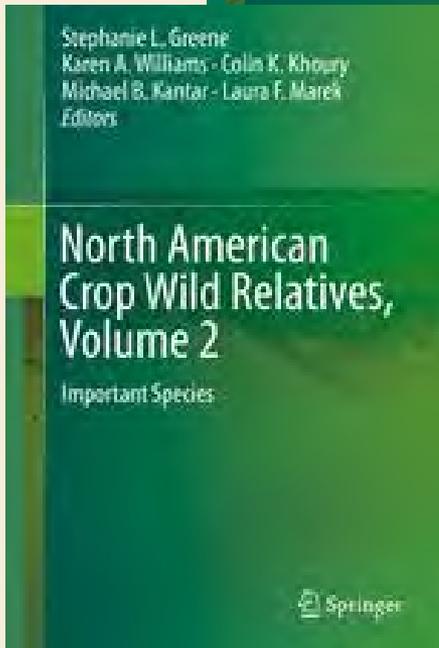
North American Crop Wild Relatives



Volume 1: Conservation Strategies
Volume 2: Important Species

Editors: Stephanie Greene, Karen Williams, Colin Khoury, Michael Kantar, Laura Marek

Foreword by Gary Nabhan



<https://link.springer.com/book/10.1007/978-3-319-95101-0>

<https://link.springer.com/book/10.1007%2F978-3-319-97121-6>

North American Crop Wild Relatives

Volume 1: Conservation Strategies

Part 1

- Overview of wild plant genetic resources in North America
- Status of CWR conservation by country
 - 🌿 Canada
 - 🌿 Mexico
 - 🌿 U.S.
- Working with indigenous communities

North American Crop Wild Relatives

Volume 1: Conservation Strategies

Part 2

- The genepool concept applied to CWR
- Conservation status and threat assessment for North American CWR
- Sampling wild species to conserve genetic diversity
- Practicalities of collecting wild plants in North America: Insights from the U.S.
- *Ex situ* conservation of germplasm collections from natural populations
- Practical considerations for increasing seed samples of wild species
- Public education and outreach opportunities for CWR in North America

North American Crop Wild Relatives

Volume 1 Authors

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North American CWR

Volume 2: Important Species

Maize	Temperate tree fruits
Wildrice (<i>Zizania</i>)	Tropical tree fruits
Lettuce	Temperate nut crops
Other grain crops	Sunflower
Beans	Minor oil and rubber crops
Cucurbits	Fiber crops
Chile peppers	Forage and turf grasses
Root, bulb or tuberous vegetables	Herbaceous ornamentals
Temperate small fruits (berries)	Medicinal and social use crops
Grape	

North American CWR, Vol. 2: Important Species

Chapter Contents

- Introduction to crop: origin, modern use, challenges in cultivation
- CWR: genepool classification, distribution (with maps), utilization
- Wild utilized species
- Conservation status (*in situ* and *ex situ*): activities, needs, challenges



V. corymbosum L.



Tripsacum dactyloides

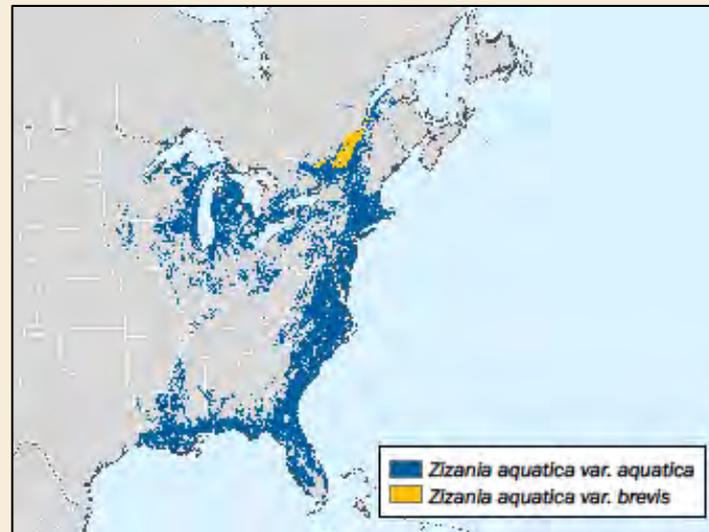
North American Crop Wild Relatives

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North American CWR Maps

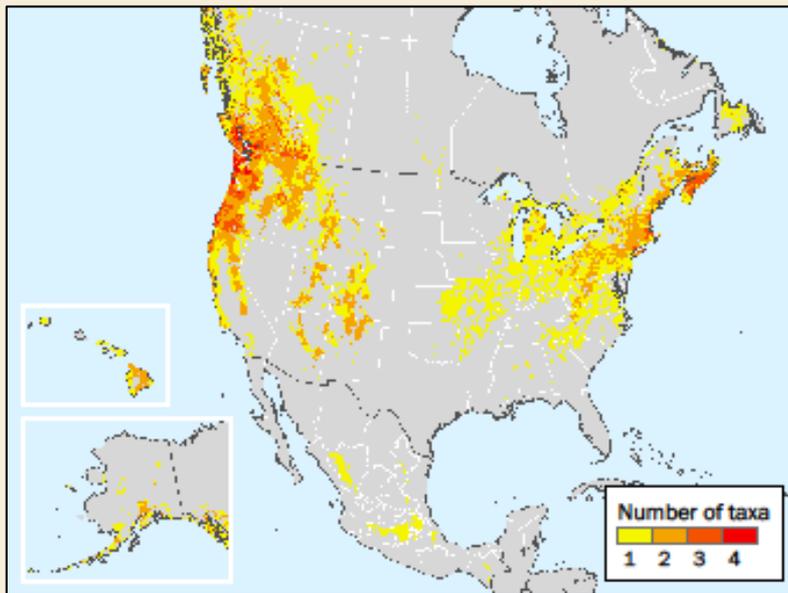
- Occurrence records from herbaria and genebanks
- Potential species distribution maps modeled using the maximum entropy (Maxent) algorithm with unique occurrence locations and ecogeographic variables (altitude, climatic, edaphic)
- Developed by Colin Khoury and Chrystian Sosa
- Reviewed by authors



618 maps

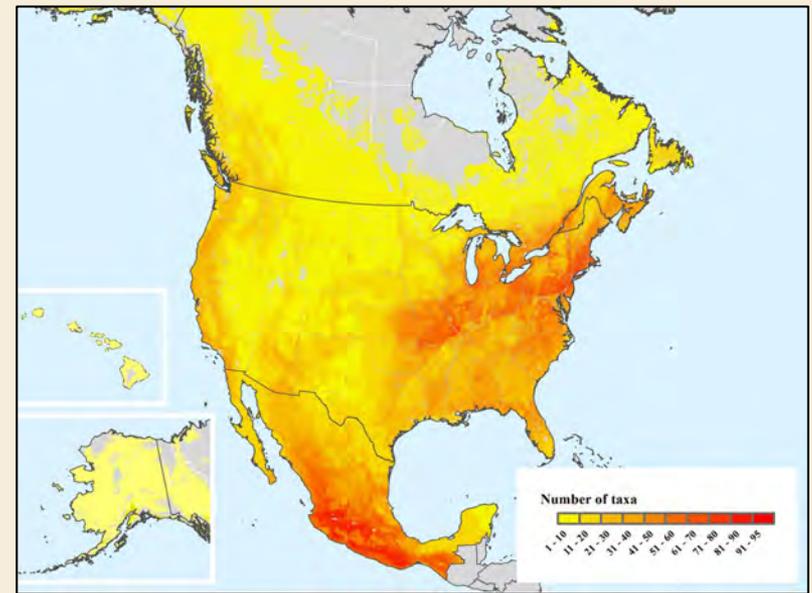
North American CWR Maps

Richness maps for genera
from overlay of species
distribution maps



Fragaria richness

Richness maps for all taxa



Crop Wild Relatives Meetings

Crop Wild Relatives and Genetic Resources for
Interesting Traits - CSSA Symposium
Baltimore, MD
November 6, 2018

Crop Wild Relatives of the Desert Borderlands
Tucson, AZ
January 2019

Celebrating Crop Diversity Symposium
Des Moines, IA
April 3 – 4, 2019

A photograph of three people in a field of low-lying vegetation. One person stands on the left, wearing a black jacket and a grey cap. Two other people are crouching on the right, one in a grey and yellow jacket and another in a black jacket. The background is a dense forest of evergreen trees.

Thank you!

Questions?

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National Germplasm Resources Lab (NGRL) Update

- Melanie Schori – Taxonomist
- Martin Reisinger – Training & Documentation
- Gary Kinard – Research Leader