

# The National Plant Germplasm System: 2023 Status, Prospects, and Challenges

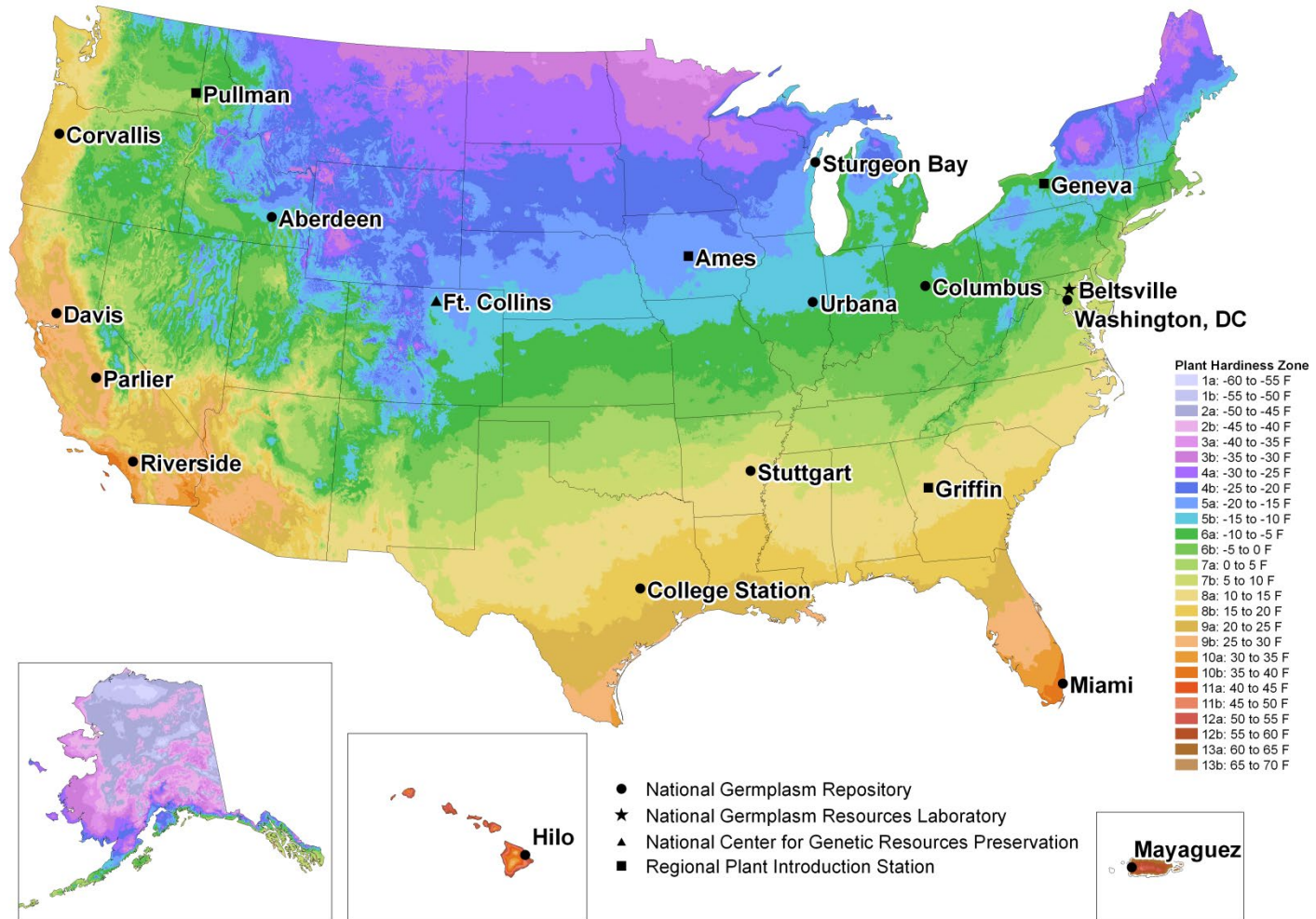
Peter Bretting

USDA/ARS Office of National Programs

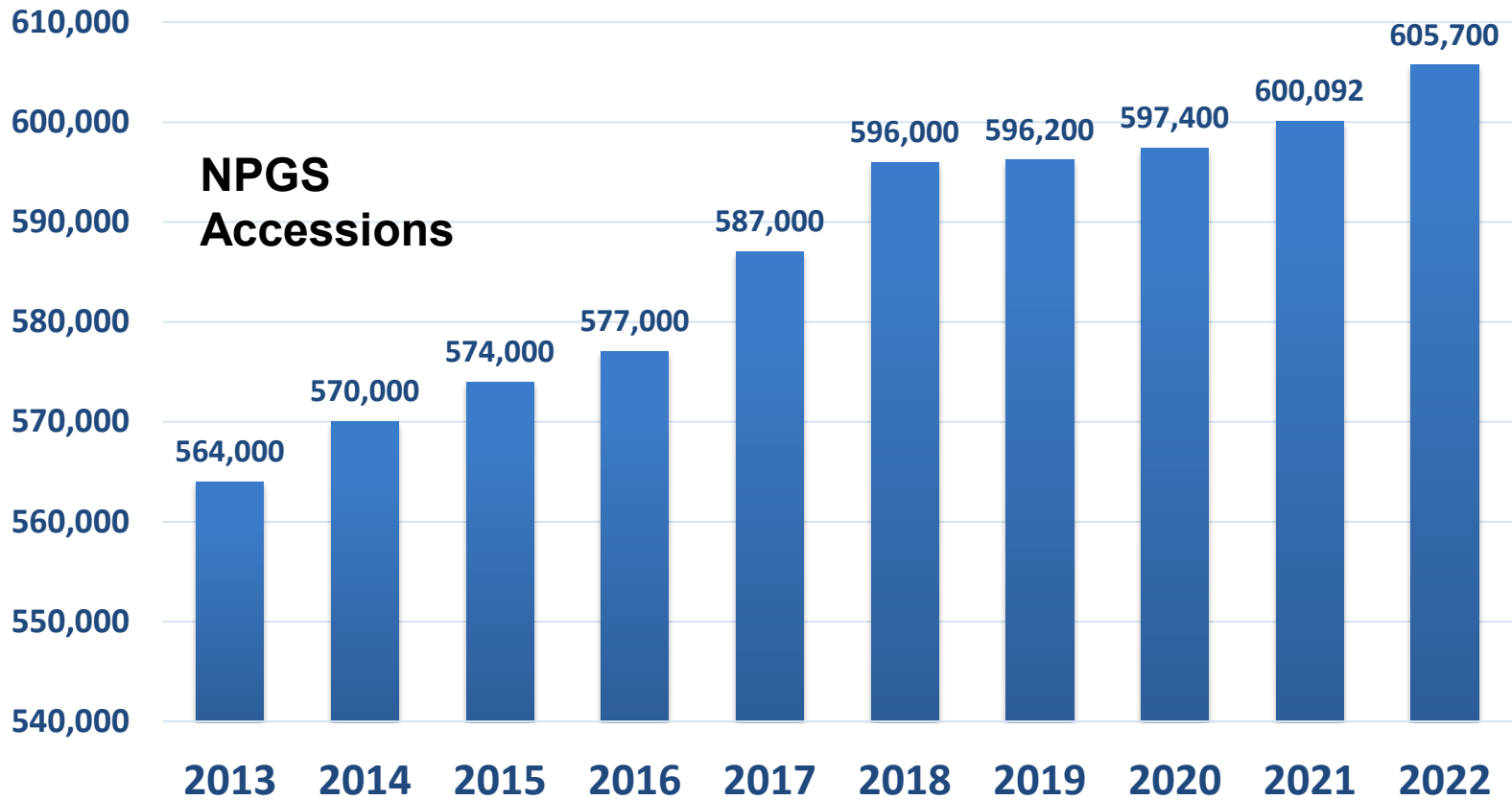
[Peter.bretting@usda.gov](mailto:Peter.bretting@usda.gov)

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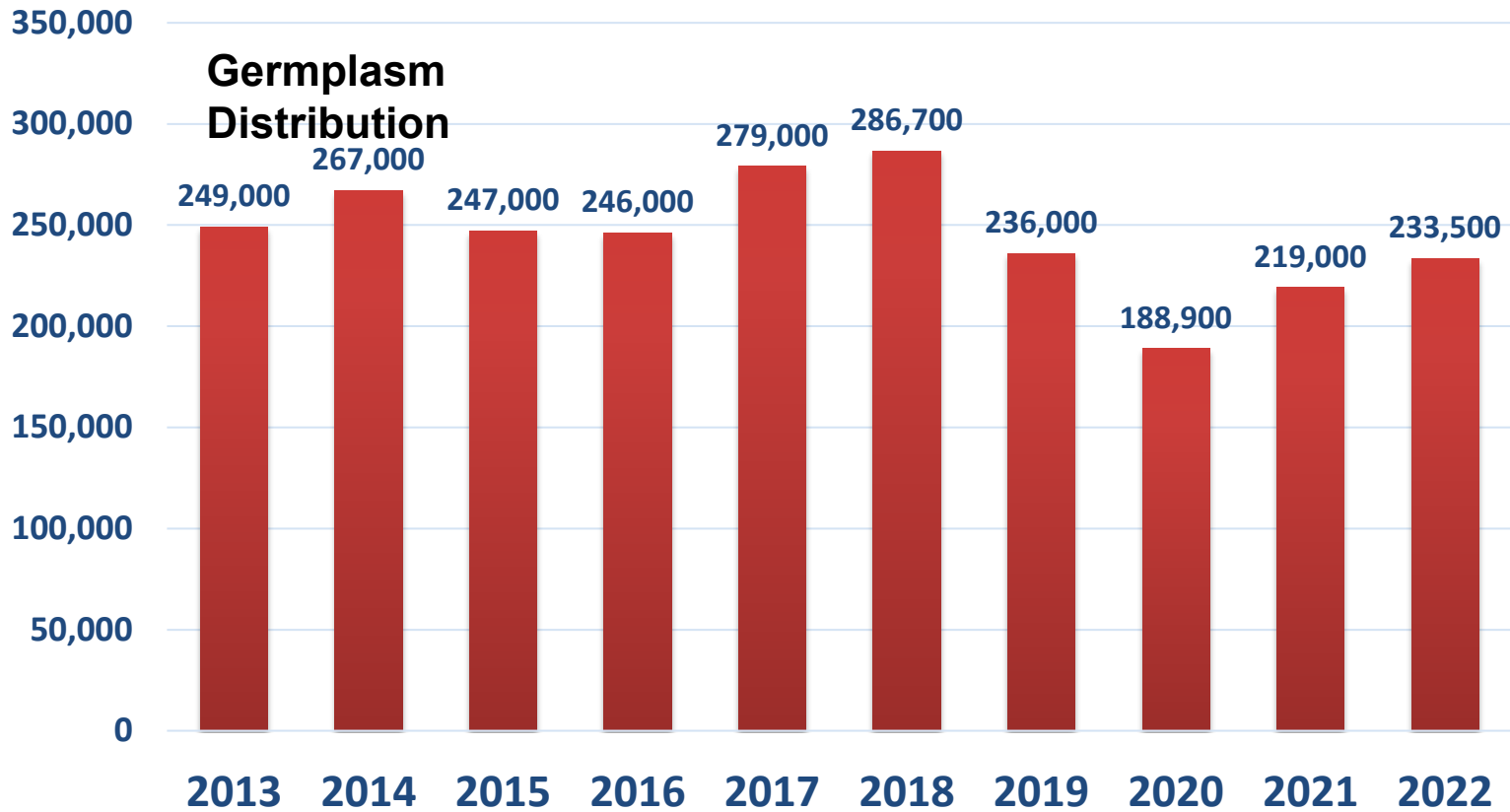
# USDA National Plant Germplasm System (NPGS)



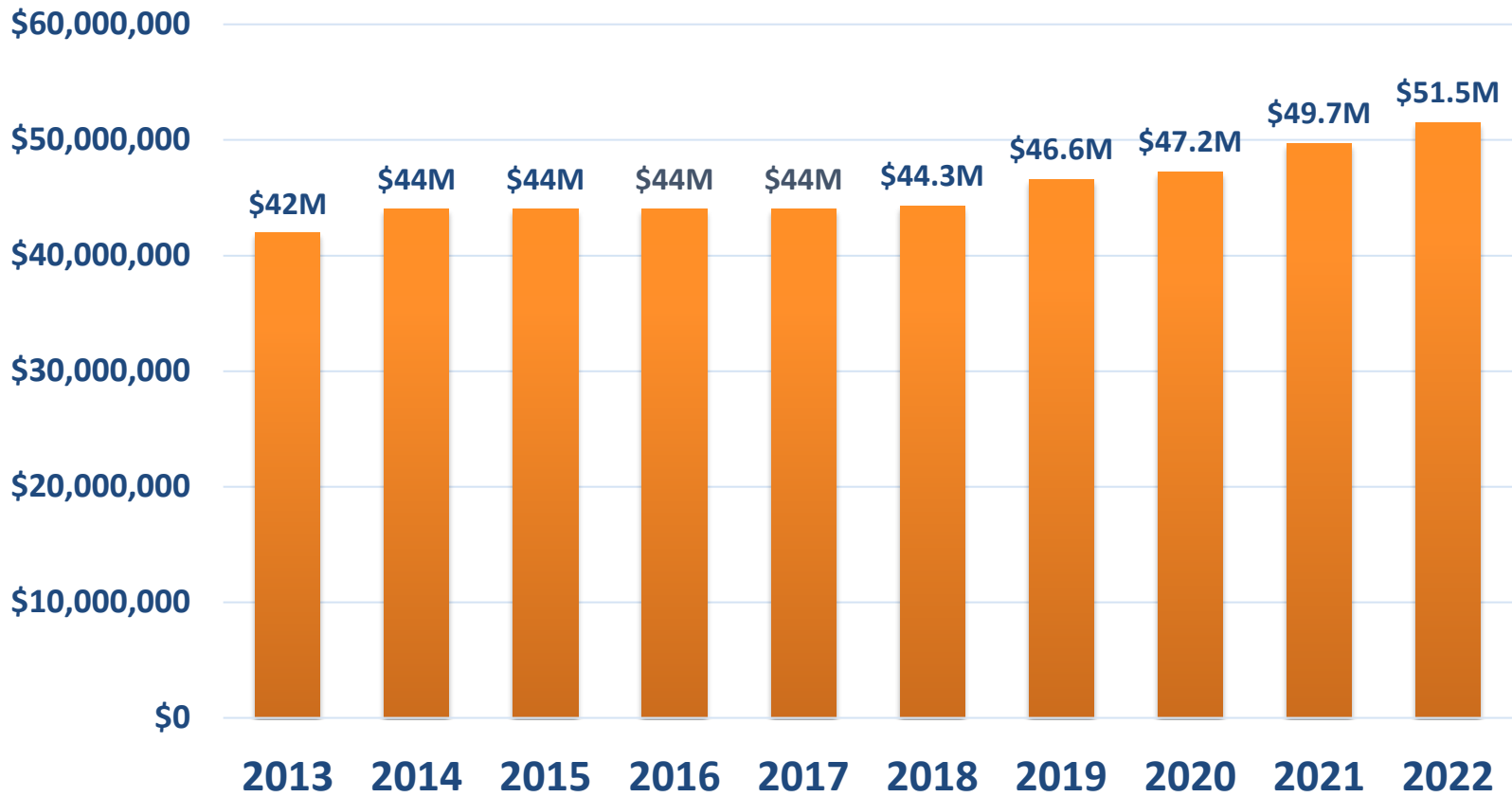
# NUMBER OF NPGS ACCESSIONS 2013-2022



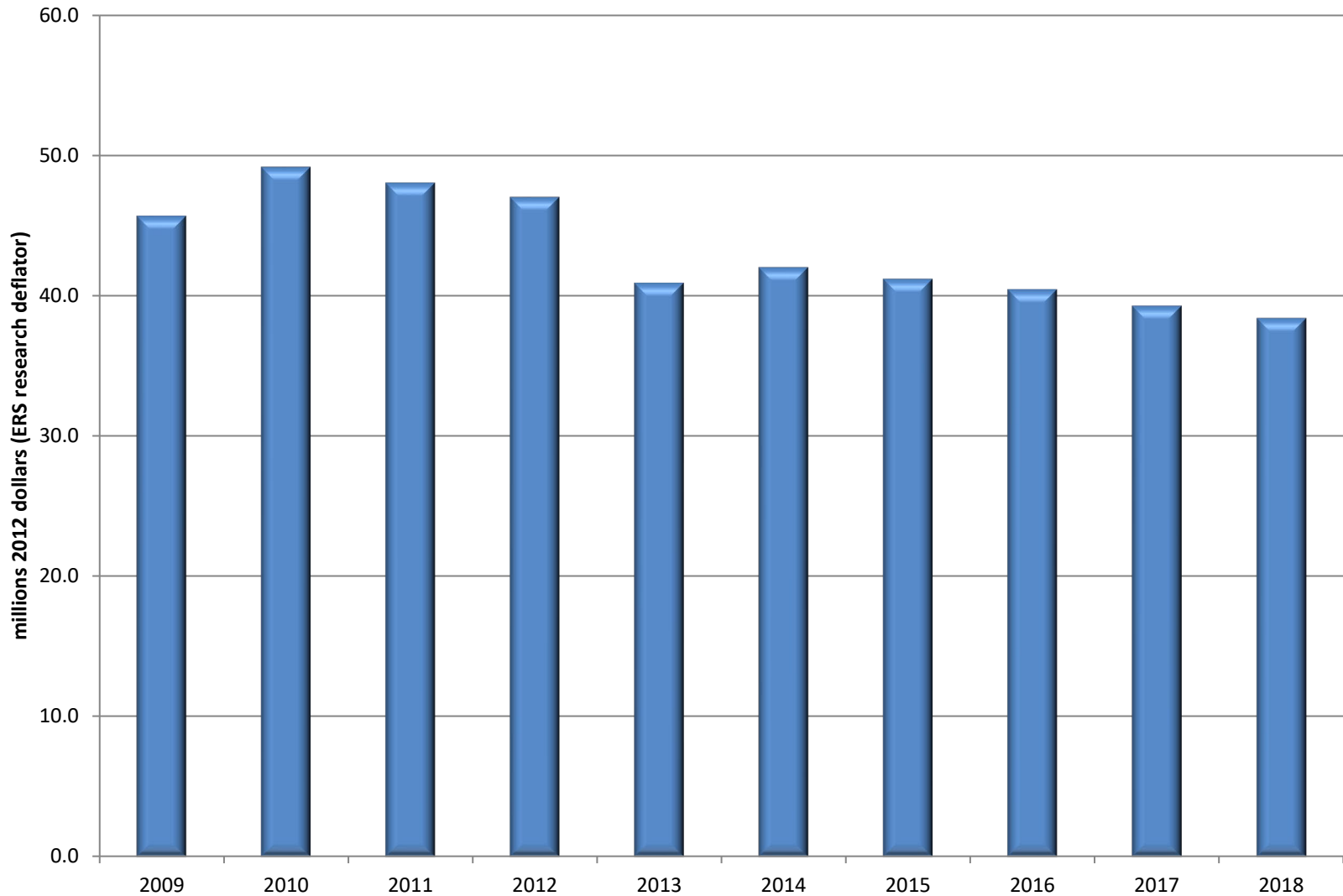
# DEMAND FOR NPGS GERMPLASM 2013-2022



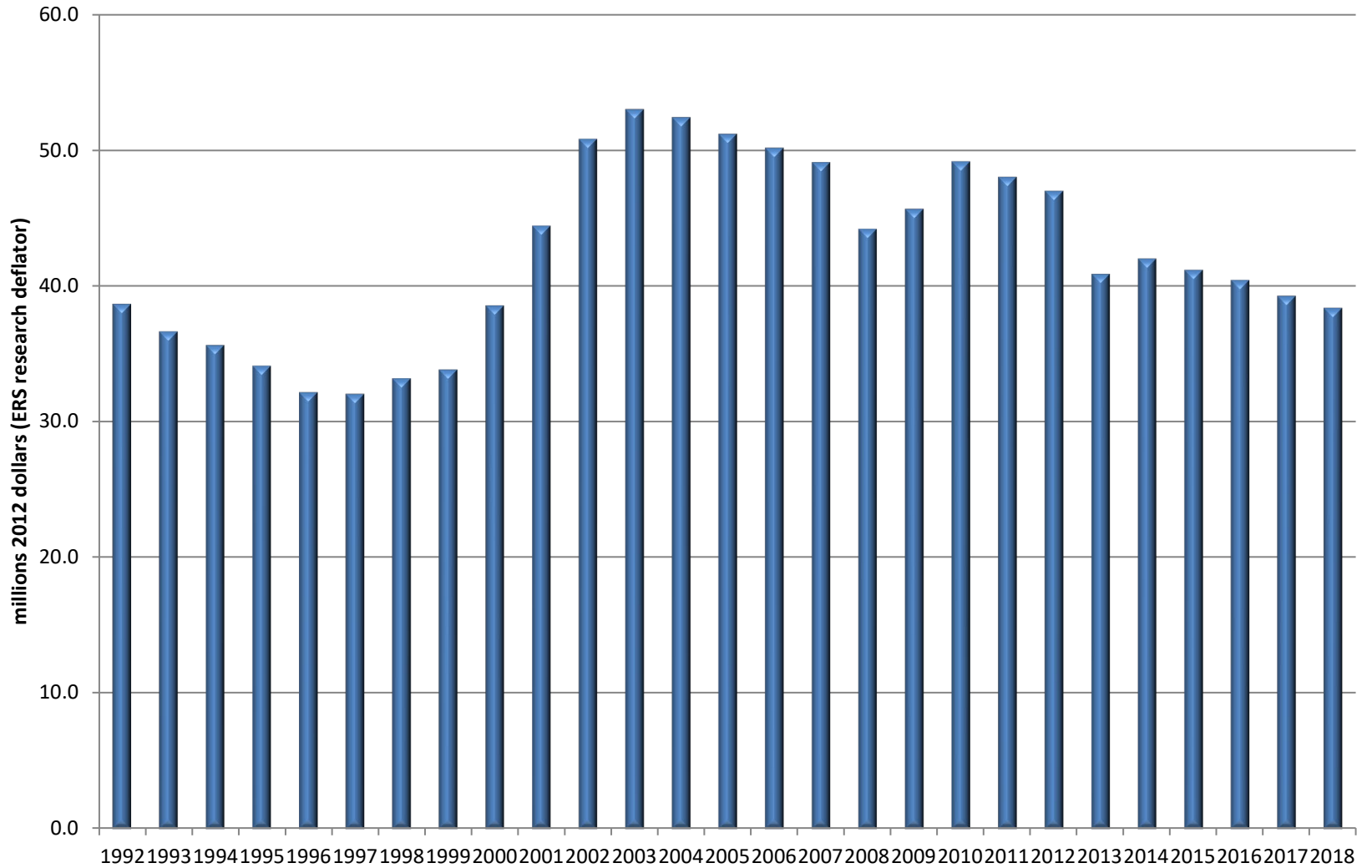
# ARS NATIONAL PLANT GERMPLASM SYSTEM BUDGET 2013-2022



## ARS NPGS real (deflated) budget, 2009-2018



## ARS NPGS real (deflated) budget, 1992-2018



# Some key challenges for the NPGS

- Expanding the NPGS operational capacity and infrastructure to reduce PGR management backlogs and meet increased demand for PGR and associated information.
- Increased operational costs (labor, inputs, overall inflation).  
See <https://www.ers.usda.gov/amber-waves/2022/june/investment-in-u-s-public-agricultural-research-and-development-has-fallen-by-a-third-over-past-two-decades-lags-major-trade-competitors/?cpid=email#>
- NPGS personnel transitions—hiring, training, etc.
- Developing and applying cryopreservation and/or in vitro conservation methods for clonal and some seed PGR.
- BMPs and procedures for managing accessions (and breeding stocks) with an increasing diversity of GE traits in more crops, the occurrence of adventitious presence (AP), and the products of gene editing.
- Acquiring and conserving additional PGR, especially of crop wild relatives.



# PGR Management Priorities: Foundations for Crop Innovation

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

# NPGS Personnel Transitions

- Farewell and best wishes to Stephanie Greene, Curator, (ARS- Ft. Collins); and Kim Hummer, RL (ARS-Corvallis).
- Welcome and best wishes to Robert Krueger, RL (ARS-Riverside); and Marilyn Warburton, RL, Sarah Dohle, Curator, Paul Galewski, Curator, and Bailey Hallwachs, SOS Coordinator (ARS-Pullman); and Claire Heinitz, RL (ARS-Davis and Parlier).
- We are recruiting staff at Ft. Collins, CO; Corvallis, OR; Parlier, CA; and Geneva, NY.

## PGR Management Training Initiative

- Numerous NPGS PGR managers have retired recently; no formal, comprehensive program existed for training new PGR managers.
- G. Volk (ARS-Ft. Collins) and P. Byrne (CSU-Ft. C.) lead a project, supported by ARS and a NIFA grant, to design and develop a training program for PGR management to be delivered primarily through distance-learning.
- A now three module, 3 credit hour Colorado State online course Plant Genetic Resources: Genomes, Genebanks, and Growers to be taught in Aug.-Sept. 2022-- the first time for the three-part course. <http://pgrcourse.colostate.edu/>
- Numerous PGR training/educational materials are freely accessible from GRIN-University at <https://grin-u.org/>
- Infographic posters for PGR, genebanks and conservation, and PGR and food security in 6 languages; download at <http://genebanktraining.colostate.edu/trainingmaterials.html>

# **FY 22 ARS NPGS Budgetary Increases**

- **Pecan PGR (ca. \$600,000): College Station, TX.**
- **Coffee PGR (ca. \$250,000): Hilo, HI**
- **Pulse PGR (ca. \$100,000) Pullman, WA**
- **Pulse PGR (ca. \$100,000) Urbana, IL**

# Many thanks to CGC Chairs!

- **Writing and updating Crop Vulnerability Statements**
- **Assessing Plant Exploration and other proposals**
- **Your invaluable technical input and views regarding crop needs and priorities**



seed  
accessions



Amy Gurza and Dr. Stephanie Greene in the -18C storage vault

- Preserve seeds and clonal germplasm
- Provide genomic tools to improve and access collection diversity

- ~ 1.2 million accessions currently; ~ 15,000 species
- Conventional (-18°C) and cryogenic storage (-175 to 196°C)
- Room to expand collection (~2.5 million accession capacity)
- Research programs to increase management efficiency



Lisa Hill and Remi Bonnart with liquid nitrogen cryovats

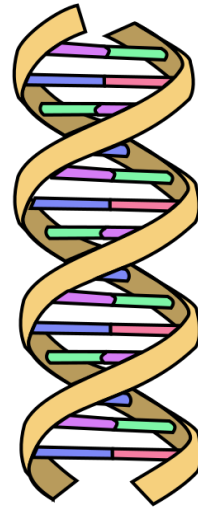


## The 'seed' team



**Principal Investigators:**  
**Christina Walters**  
**Stephanie Greene (retired 11/2022)**

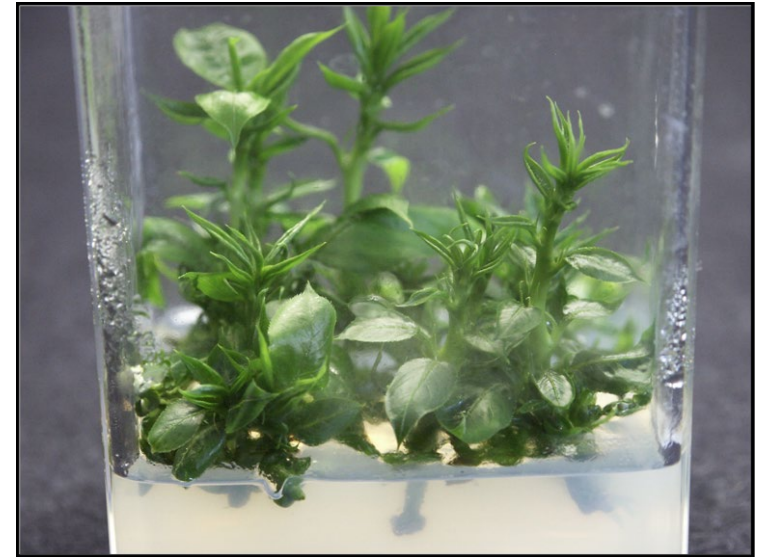
## The 'genomics' team



DNA

**Principal Investigator:**  
**Christopher Richards**

## The 'clonal' team



**Principal Investigators:**  
**Gayle Volk**  
**Maria Jenderek**



## **Changes in Staffing**

### Retirements or transfers in 2022

Stephanie Greene (PI)

Greg Holman (seed curation, LN management)

Renee White (data management)

Amelia James (data management)

### New hires in 2022/3

Hannah Tetreault (support scientist, vice-Crane)

Vincent Warnock (seed analyst, vice-Hernandez)

Torie Kloppenborg (seed analyst, vice-LaTona)

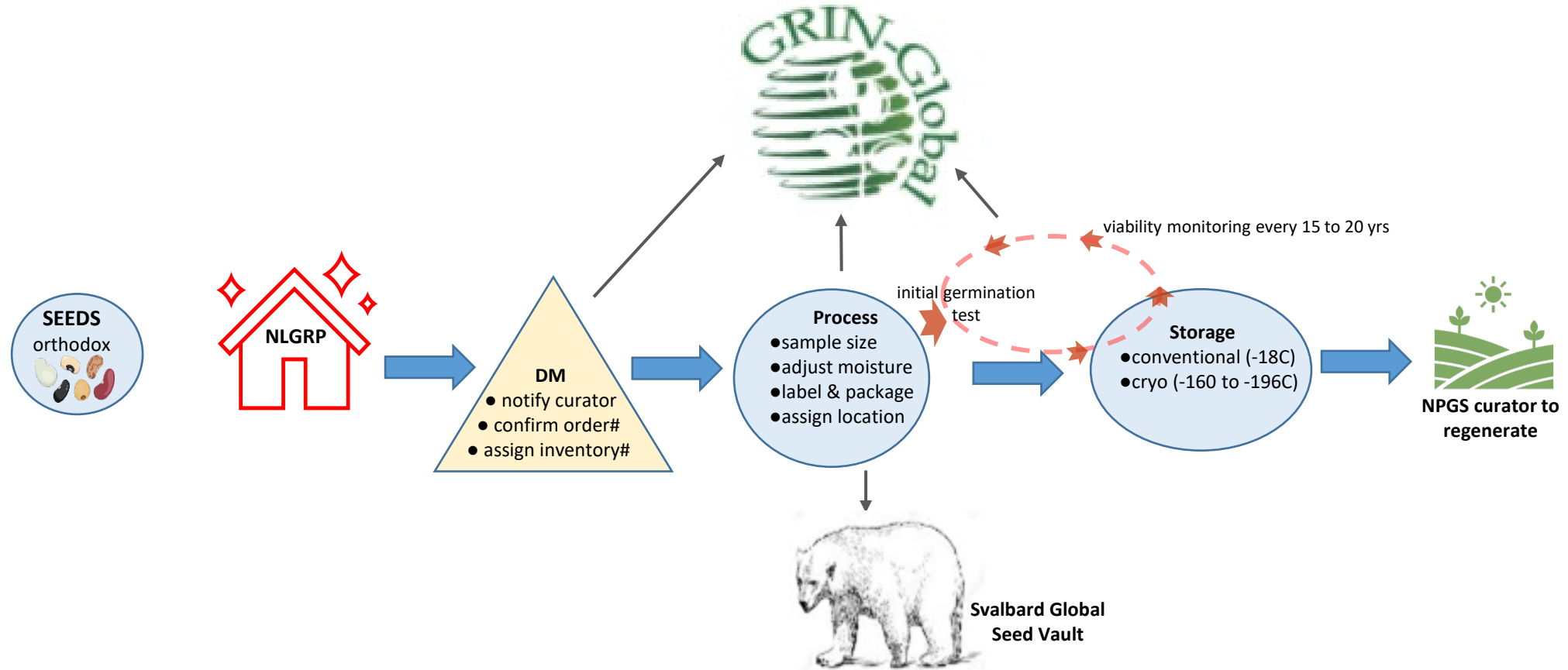
Quincy Robinson (data management, vice-White)

### New supervisors 2022

Lisa Hill – seed quality lab (+ lab manager for Walters)

Cullen McGovern – data management (+ programmer)





NLGRP's process for storing orthodox seeds



## NLGRP seed and microbial holdings

Germplasm	# accessions or isolates
<b>Seed</b>	
NPGS Base collection	432,272
NPGS accns only at NLGRP	10,356
non-NPGS: PVP/JPR	9,105
non-NPGS: Black Box	465,175
Microbes (non-NPGS)	111,066
<b>Total</b>	<b>1,027,974</b>

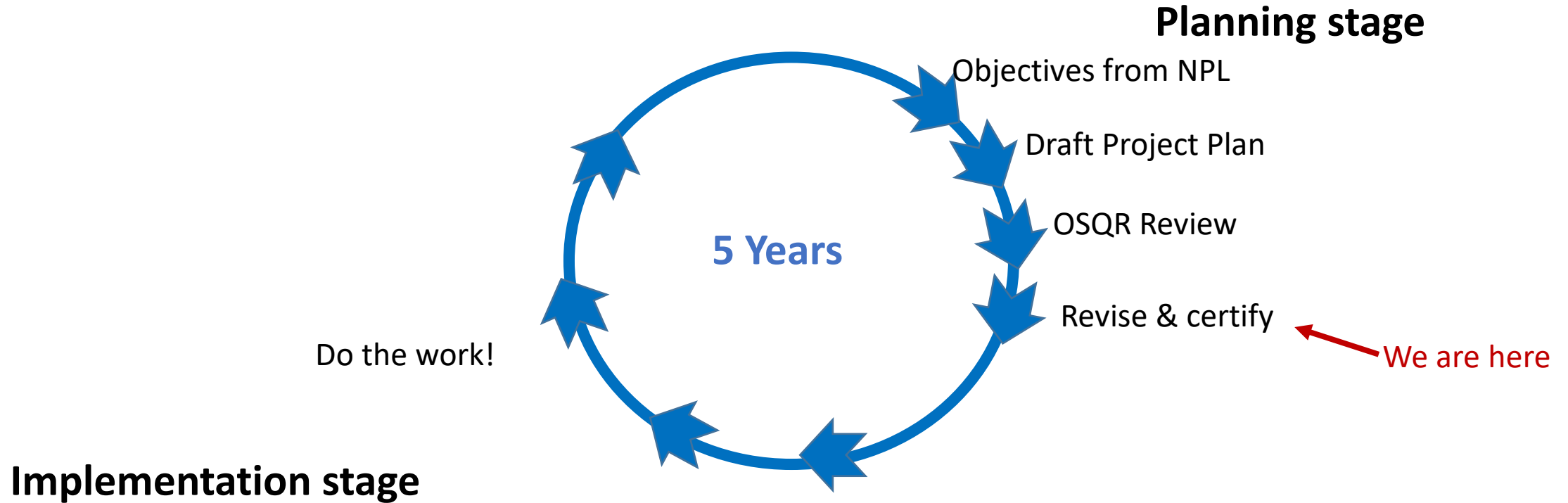
Seed	# accessions
Received per yr (5 yr avg)	6208
monitored tested/yr (5 yr avg)	4740
<b>Total tests/yr</b>	<b>10,948</b>

## % of collection duplicated

Site	Storage at -18°C	Storage in LN
Aberdeen	89	8
Ames	68	13
College Stn	59	0
Geneva	52	19
Griffin	80	9
Parlier	25	11
Pullman	67	9
Sturgeon Bay	30	51
Stuttgart (GSOR)	0	0
Urbana (GSZE)	100	0
Urbana (soy)	98	0
Wash DC (USNA)	5	0
<b>average</b>	<b>56</b>	<b>10</b>



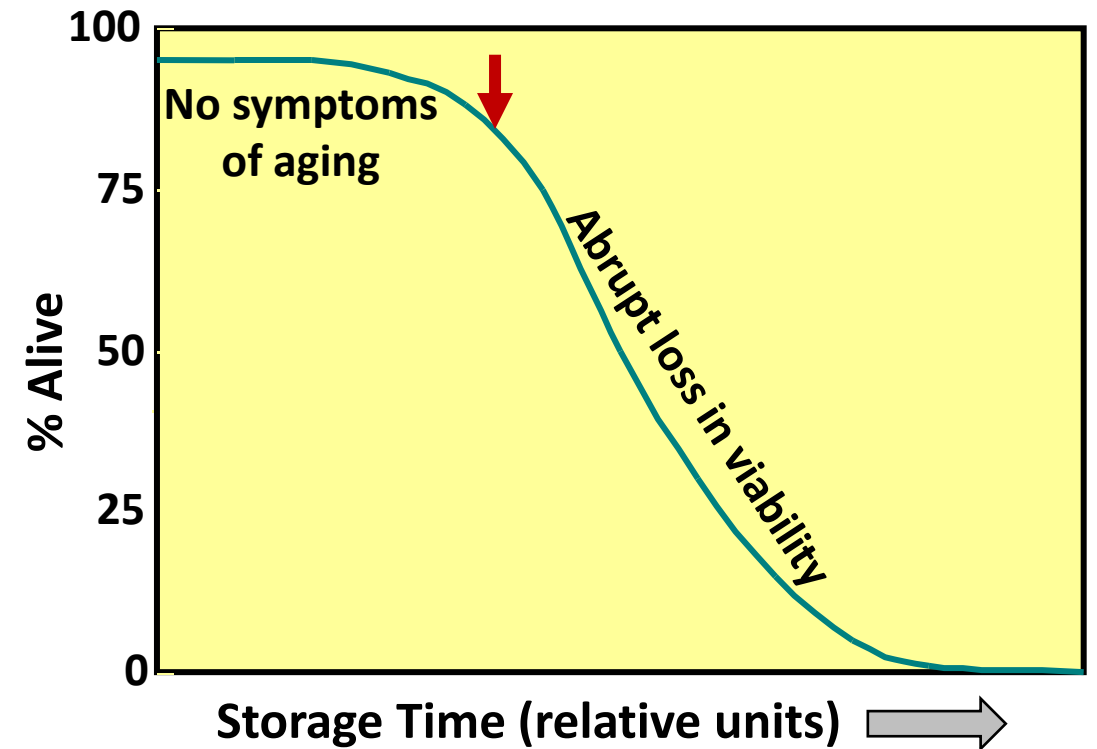
## ARS research and curation cycle





## Some initiatives for seed curation and research

1. Reduce the time between receiving seeds and putting them at storage temperature



*As seeds approach the threshold (↓), low storage temperature becomes less effective.*



## Some initiatives for seed curation and research

**1. Reduce the time between receiving seeds and putting them at storage temperature**

**2. Seeds in cryo-storage. What is currently stored? What should be stored? Does LN storage offer a benefit for the additional cost?**

The top 10 species of seeds that are stored cryogenically at NLGRP based on mass. Total # of genera: 491 Total # of accns: 52781 Total # of tanks: 25  
Average time in cryogenic storage: 23 years

genus with most mass	total mass in LN	# of accns	avg seed age (years)	% of total mass in seed cryotanks
Oryza	456121	5655	28.4	0.26
Sorghum	278261	3988	32.4	0.16
Hordeum	223684	2582	34.5	0.13
Secale	160642	1954	34.0	0.09
X Triticosecale	81945	893	25.0	0.05
Capsicum	46130	2810	30.7	0.03
Beta	34640	785	27.2	0.02
X Elymotriticum	31462	342	24.6	0.02
Solanum	25791	8299	27.9	0.01
Elymus	22688	1022	26.5	0.01



## Some initiatives for seed curation and research

**1. Reduce the time between receiving seeds and putting them at storage temperature**

**2. Seeds in cryo-storage. What is currently stored? What should be stored? Does LN storage offer a benefit for the additional cost?**

**3. Pilot project for cryopreserving 'intermediate' seeds**

crop	Site	total # 'BASE' accns unique to site	total # duplicated at NLGRP (veg+seed)
citrus	RIV	3170	462*
coffee	HILO	0	0
hazelnut	COR	835	45*
hazelnuts CWR	COR	38	0
macadamia	HILO	48	0
papaya	HILO	140	0
pecan	BRW	1351	9*
pistachio	DAV	150	0
Saccharum	MIA	1400	197
walnut	DAV	803	0
woody landscape	NA	12518	673
woody landscape	NC7	1959	908
woody landscape	OPGC	7	3

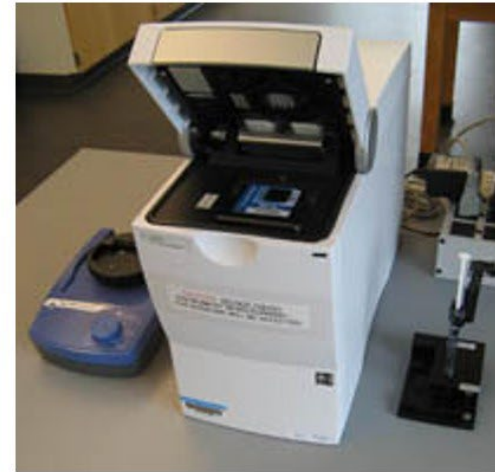
\* Preserved as clonal propagules or pollen (pecan).



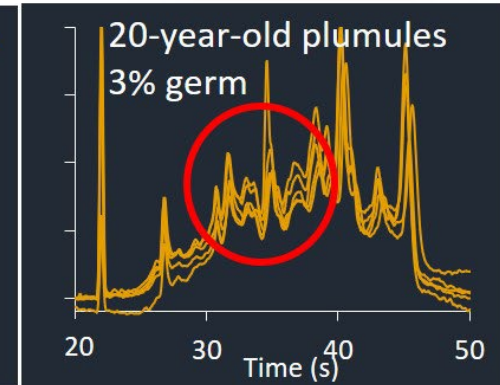
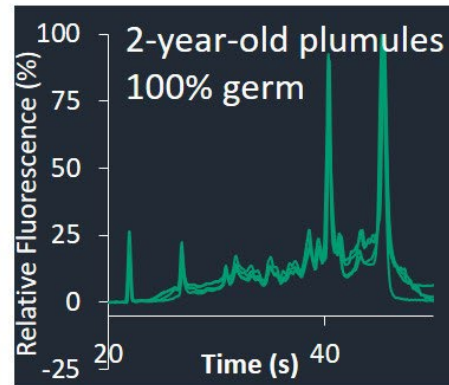
## Some initiatives for seed curation and research

RNA Integrity and pre-mortem gene expression

### 4. Detect seed aging before viability declines



'Bioanalyzer' RIN kits



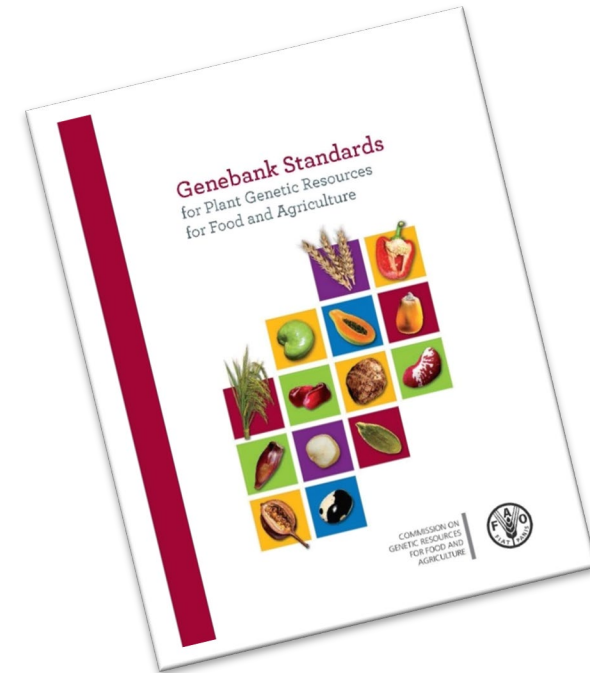
RNA fragments



## Some initiatives for seed curation and research

4. Detect seed aging before viability declines

5. Review standards and improve them for NPGS's needs



### The difference between “duplication” and “back-up”

- 1) > 85% viability
- 2) 1500-3000 seeds
- 3) 15 yr monitoring interval





## Some initiatives for seed curation

4. Detect seed aging before viability declines
5. Review standards and improve them for NPGS's needs
6. A new API "*smile*" for NLGRP to input and retrieve data from GRIN





Thanks  
for  
your  
time!



**And now Gayle Volk will describe  
clonal collections at NLGRP**



Vitrified mint shoot tips. Photo credit: Stephen Ausmus, ARS

# Securing Non-seed Collections at NLGRP

Many fruit and nut crops and some vegetable crops



Field



Greenhouse/screenhouse



Cold storage



*In vitro*



Cryostorage

# Cryopreserved Clonal Collections at NLGRP

<u>Shoot tips</u>	<u>Accn.</u>	<u>Dormant buds</u>	<u>Accn.</u>
Garlic	102	Apple	2152
Strawberry	280	Sour cherry	52
Hops	90	Willow	52
Sweet potato	169		
Mint	48		
Banana	22		
Pear	231		
Currants	199		
Raspberry	201		
Potato	157		
Potato PVP	430		
Blueberry	42		
Sugarcane	25		
Citrus	420		
Grapes	40		

~5000 clonal accn. cryopreserved

12% of the NPGS clonal accns. secured  
82% of NPGS seed accn. duplicated

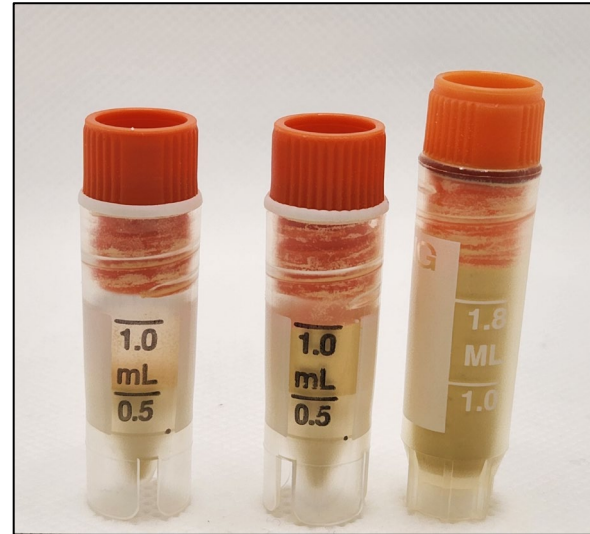
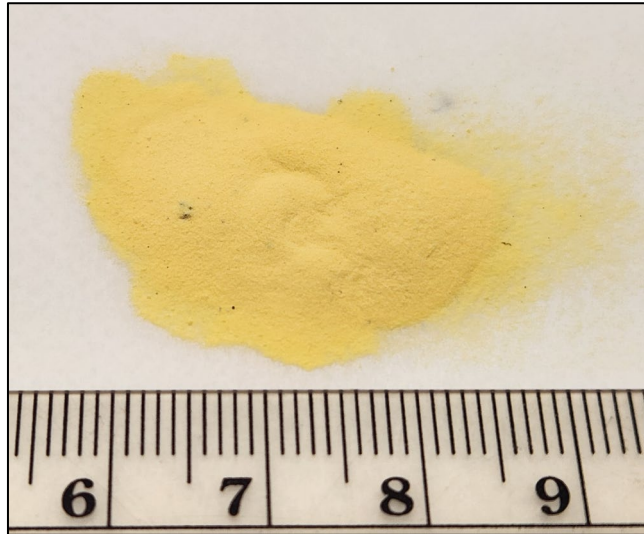


*Grape*



*Mint*

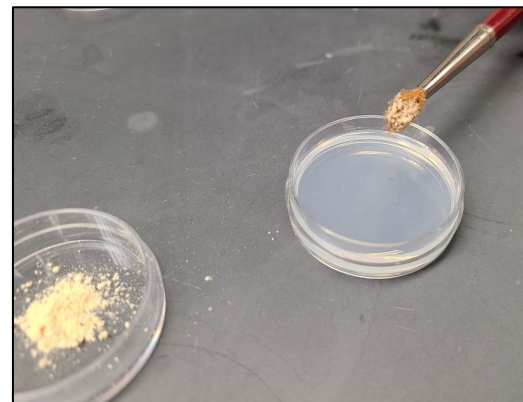
# Pollen Cryopreservation



120 Accessions of

- Date palm
- Prunus
- Walnut
- Pecan

*In vitro*  
germination  
assay to assess  
viability



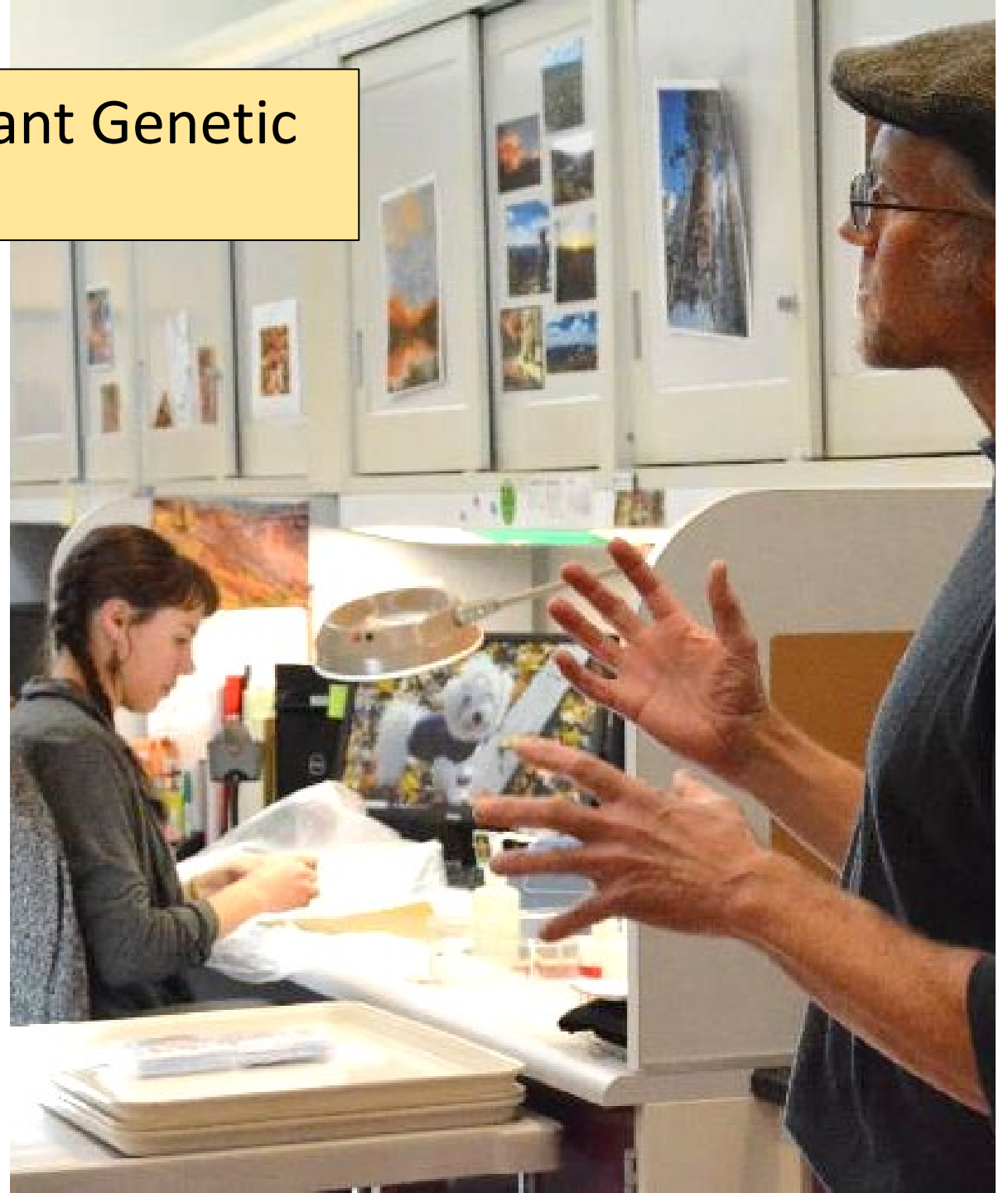
# Clonal Cryopreservation Data Clean-up Effort

- 30+ years of using seed-fields in GRIN to document cryopreservation data for clonal crops
- Reviewing field use and adding appropriate new fields to document processes and results (clonals & pollen)
- Developing new data entry systems that are standardized
- Reviewing all the data for clonal collections in GRIN and revising field use

Goal: Complete inventory-specific clonal cryopreservation reports & data that can be easily downloaded anytime by curation teams

## Developing training materials for Plant Genetic Resources Management and Use

- Many NPGS staff members are retiring
- Training content for current staff and future generations
- NIFA Grant: CSU, USDA, ISU 2020-2023





# GRIN-U

Online learning for plant genetic resources conservation and use

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sent to GRIN-U.org  
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## Check Out Our New Posts!

Plant Genetic Resources: Success Stories

READ BOOK Gayle Volk, Katheryn Chen, and Pat Byrne This eBook documents examples across a variety of crops where plant conservation and breeding efforts were successfully used to address critical agricultural needs.

[Read the post](#)





# Public Ebooks on GRIN-U.org

## Crop Diversity: A Virtual Crop Science Field Tour


Patrick F. Byrne; Meagan Schipanski; and Deana Namuth-Covert

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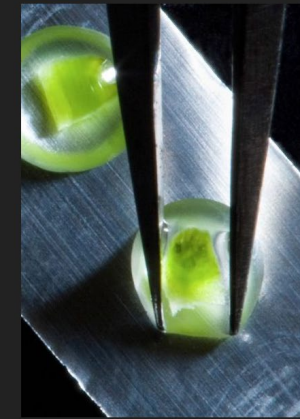


## Training in Plant Genetic Resources: Cryopreservation of Clonal Propagules

Gayle Volk

 Public Domain

[READ BOOK](#)



## Fundamentals of Plant Genebanking

Gayle Volk

 Public Domain

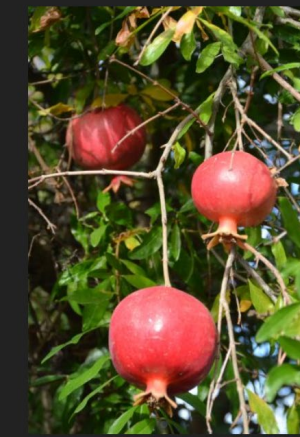


## Field Tour of the USDA National Clonal Germplasm Repository for Tree Fruit, Nut Crops, and Grapes in Davis, California

Gayle M. Volk and John E. Preece

 Public Domain

[READ BOOK](#)



## Crop Wild Relatives and their Use in Plant Breeding


Gayle Volk and Patrick Byrne

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## Applications of Plant Pathology in Genebank Collections

Gayle Volk

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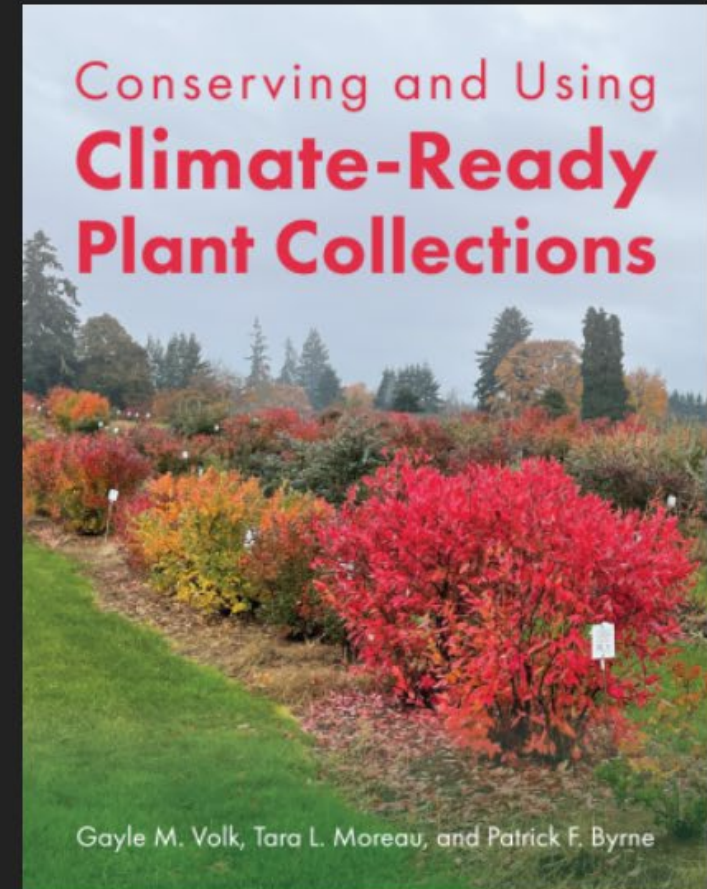
# Conserving and Using Climate-Ready Plant Collections

Gayle M. Volk; Tara L. Moreau; and Patrick F. Byrne



Public Domain

READ BOOK



Released January 2023

# Plant Genetic Resources: Success Stories

Eds. Gayle Volk; Katheryn Chen; and Patrick Byrne



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[READ BOOK](#)



# Seeking Success Story Submissions

## Plant Genetic Resources Success Story Submission Template



### Documenting Success Stories

Documenting success stories and making them available to the public are important for ensuring continued support for plant genetic resources conservation and plant breeding efforts. Our goal is to document successes, broadly defined, that relate to plant genetic resources conservation and use, and crop improvement activities.

To ensure this information is accessible to the broadest possible audience, please keep content concise, minimize the use of jargon and acronyms, and write with a general audience in mind. It is the contributors' responsibility to seek permissions to share success stories from other researchers and breeders. Content may be edited and formatted before being posted on the public [GRIN-U website](#) and/or the [National Association of Plant Breeders website](#). All edits will be shared with the contributor for final approval before posting to websites.

Once completed, email this form and 1-3 high-quality images to [PGRSuccesses@gmail.com](mailto:PGRSuccesses@gmail.com). For questions or comments, please contact Pat Byrne ([Patrick.byrne@colostate.edu](mailto:Patrick.byrne@colostate.edu)) or Gayle Volk ([Gayle.Volk@usda.gov](mailto:Gayle.Volk@usda.gov)).

\*Required fields

### Contributor Information

\*Contributor(s) name: Author1 and Author2

## Strawberry 'Cordial' - Late Season, Long Shelf Life

USDA-ARS Genetic Improvement for Fruits & Vegetables Laboratory



Strawberry cultivar 'Cordial', released in 2020 by the USDA, is a late-season cultivar for planting during the late part of the growing season in the Mid-Atlantic region of the U.S. It is a short-day strawberry, meaning that plants will flower as the daylength grows shorter in the northern hemisphere. 'Cordial' has large attractive fruits that are tough enough for rough handling, have increased shelf life, minimal proportion of produce lost to degradation, and possesses consistently high yields with low rot when grown in plasticulture production systems without fumigation/fungicide.



Cordial strawberries produced in plasticulture.

Photo from Leves and Ems, 2022 (CC BY-NC-ND 4.0)

### PROJECT GOALS

- ✓ Develop non-tart strawberries with increased shelf life
- ✓ Improve resistance to rot and provide consistent high yields

### Problems Addressed

U.S. Department of Agriculture-Agricultural Research Service strawberry research efforts at Beltsville, MD, have resulted in release of several cultivars with high yields and good fruit flavor: 'Keepsake', 'Flavorfest', 'Allstar', 'Galletta', 'Ovation', 'Earlyglow', 'Chandler', etc. Decayed fruit, poor handling and refrigeration tolerance, foliar and fruit disease incidence, and reduced shelf life remained a production problem. The project therefore focused efforts on increasing shelf life, tolerance to rough handling, resistance to diseases, as well as reducing tartness and maintaining consistently high yields.

### Solutions Developed

'Cordial' was developed by cross-pollinating B1893 × B1805. This new cultivar's average total yield was significantly higher than all cultivars tested, with one of the highest marketable yields. 'Cordial' showed significant resistance to crown rot, very mild bacterial angular leafspot disease symptoms, and mild powdery mildew disease symptoms. 'Cordial' fruit skin toughness rating was very high, and it exhibited fruit sweetness similar to 'Flavorfest', 'Keepsake', and 'Earlyglow'. Due to its longer shelf life, less tartness, and disease resistance, 'Cordial' has the potential for a greater market share.



Written by: A. Mahama, S. Gray, W. Suza, K. Chen (editor)

To learn more about this and other success stories, visit [colostate.pressbooks.pub/pgrsuccessstories](https://colostate.pressbooks.pub/pgrsuccessstories)



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Grain and Forage Sorghum | Colorado Field Crop Tour

12K views • 1 year ago

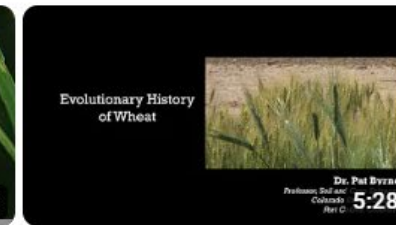
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Millets | Colorado Field Crop Tour

8.7K views • 1 year ago

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Evolutionary History of Wheat

3.4K views • 1 year ago

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Corn Domestication | Colorado Field Crop Tour

2.9K views • 1 year ago

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73 Videos,  
Webinars,  
Virtual tours

# Infographics available on GRIN-U (posters or handouts)

## PLANT GENETIC RESOURCES THE KEY TO GLOBAL FOOD SECURITY

Plant breeders utilize the genetic diversity of plant genetic resources (PGR)—the wide range of crop species and their wild relatives—to develop new crop varieties.

Plant breeders use PGR by evaluating plants for traits of interest, selecting the best, and crossing them to adapted varieties.

PGR are crucial for adapting crops to changing climates, combating new strains of diseases and insects, and developing healthier foods:

- Evolving threats from insects and diseases
- Declining land and water availability
- Increasing demand from a growing human population
- Changing temperatures and rainfall patterns

PGR include current and traditional varieties and related wild plants.

Crop wild relatives are the ancestors of crops and related species found in their native habitat.

Landraces are traditional varieties selected by farmers for adaptation to local conditions.

Crop varieties have been developed by plant breeders and farmers.

Genebanks acquire, maintain, document, and distribute PGR.

After thorough PGR evaluation and often subsequent breeding with current crop varieties, a new improved variety with novel traits is developed.

Plant breeders use PGR to develop improved varieties that are:

- Insect Resistant**: Wheat varieties resistant to the Russian wheat aphid incorporate resistance genes from a variety developed in Turkmenistan.
- Higher Yielding**: Sunflowers with higher seed yield have been developed from several U.S. wild sunflower species. Traits that enabled production of higher yielding hybrid cultivars were obtained from wild sunflowers.
- Disease Resistant**: Resistance to a devastating fungal disease (late blight) of tomatoes was found in a wild tomato relative collected in Peru. This trait has been used in several commercial varieties.
- More Nutritious**: Crop wild relative Malva alensis is used in breeding red-fleshed apples. These apples offer improved nutrition and provide a pink blush to hard cores.

For more information, contact Patrick Byrne@usda.gov or GayleVick@usda.gov. Byrne, Wick, et al. 2018. Sustaining the Future of Plant Breeding: the critical role of the USDA-ARS National Plant Germplasm System. Crop Science 58: 451-458. Design credit: Kuens Design Studio.

## PLANT GENETIC RESOURCES GENEBANKS AND CONSERVATION

Plant genetic resources—the wide range of crop varieties and their wild relatives—are critical to safeguard food security now and in the future.

Plant genebanks have diverse collections that are agriculturally and economically important. These collections conserve PGR that could be lost from their natural habitats or local communities. Collections may be conserved as seeds in cold storage or as plants in the field, greenhouse, or in tissue culture.

High quality genebank collections are critical for the future of global agriculture. Research develops new technologies and helps identify new methods for efficient, cost-effective conservation.

Key disciplines include:

- crop science
- horticulture
- plant pathology
- plant biology and physiology
- taxonomy
- plant genetics and breeding

**Acquisition**  
Collections represent a wide range of genetic diversity. New plant materials come from plant explorations and exchanges within a country and internationally. Foreign imports are inspected or tested to make sure they are free of pests and pathogens.

**Maintenance**  
Plant genebanks are responsible for keeping collections alive and healthy. Seeds in cold storage must be periodically germinated to make sure they are still alive. Sometimes collections are maintained as field or greenhouse plants.

**Evaluation & Characterization**  
Trait data are recorded for the plant collections. In addition, genetic methods assess collection diversity and determine if varieties are true-to-type. These data can also be used to identify collection gaps. Collection documentation is critical for genebank user communities to identify new useful traits and materials of interest.

**Regeneration**  
Plants may be grown in the field or greenhouse using techniques that do not alter each sample's genetic composition.

**Documentation**  
Data for the source, traits, genetics, and maintenance history of genebank collection materials are kept in databases. One example is GRIN-Global, which provides up-to-date information for the genebank collection of the U.S. National Plant Germplasm System.

**Secure Backup**  
Duplicate collections are maintained at a secure secondary location. This ensures that collections will not be lost as a result of disease, pathogens, or environmental disasters. These back-up collections are often safeguarded as seeds in cold storage. Dormant tree buds, shoot tips, pollen, and seeds may be preserved in liquid nitrogen.

**Distribution**  
Samples from plant genebanks are provided to scientists who need access to novel genetic variation and traits for research and breeding.

For more information, contact Patrick Byrne@usda.gov or GayleVick@usda.gov. U.S. National Plant Germplasm System. <https://www.npgs.usda.gov/Pages/Collections>. Design credit: Kuens Design Studio.

English, French, Spanish, Arabic, Chinese, Portuguese

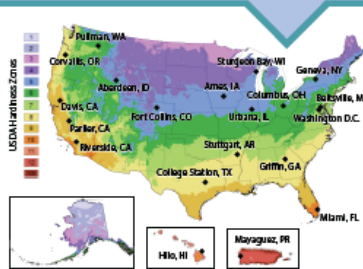
# National Plant Germplasm System

## CONSERVING CROP GENETIC RESOURCES IN THE U.S.

The National Plant Germplasm System (NPGS) is the network of USDA genebanks that safeguards our nation's precious plant germplasm (also termed genetic resources)—living material from which plants are grown.

### NPGS conserves world-class collections of plant genetic resources

Collections include approximately 200 crops and their wild relatives. These are maintained across the country at 20+ locations suited to the biological and environmental needs of each crop.



### Diverse collections are key to agricultural security

Genetic diversity can be used to improve crop quality, yield, pest and disease resistance, tolerance to environmental extremes, and more.

NPGS distributes living plant material to researchers and breeders working to develop and improve crops for a growing population and changing climate.

### Plant germplasm is conserved in many forms

Curators must balance ease of maintenance, protection against loss, longevity, and accessibility.

They maintain living collections as:

- Plants growing in the field, greenhouse, screenhouse, or tissue culture
- Seeds or frozen tissue in cold storage



Watch a video overview of the NPGS



NPGS conserves the crops that sustain our everyday lives. These plants are essential to the future of global agriculture.

NPGS conserves germplasm from **16,000+** plant species

NPGS distributes **200,000+** items for research each year

NPGS safeguards **601,000+** unique kinds of germplasm



### Food and Beverage

Most of NPGS's collections are food crops. This includes fruits and nuts, vegetables, grains, oilseeds, herbs, beverage crops, and more.



### Fiber

Certain crops are cultivated for fiber, such as cotton, hemp, and flax.



### Industrial and Medicinal

Some crops have industrial applications and are used in biofuels, lubricants, cosmetics, and medicines.



### Feed

A variety of crops are used for feeding livestock such as cattle, pigs, and poultry.



### Ornamental

Some plants are grown for their aesthetic interest and role in environmental quality.

Contact: [PublicInquiry@usda.gov](mailto:PublicInquiry@usda.gov)

Design credit: Kai Hany Chen (March 2022)

Funding by USDA-NPGS and the USDA-NIFA Higher Education Challenge Grant Program (2020-2023-3-0393-03), with support from Colorado State University. USDA is an equal opportunity provider, employer, and lender.



To learn more about plant genetic resources, visit [GRIN-U.org](http://GRIN-U.org)

# BOTANIC GARDENS

## AND THEIR VALUABLE ROLE IN CONSERVING PLANT GENETIC RESOURCES

Botanic gardens and arboreta mobilize scientific, collaborative, and strategic approaches to conserve valuable plant genetic resources (PGR)—the wide range of wild and cultivated plants.

### Botanic gardens maintain PGR in a variety of forms:



Living collections



Seed collections



Plant records



Herbarium collections

### Functions of botanic gardens

The role of botanic gardens continually evolves. Rapid decline of biodiversity has increased the need for action. Botanic gardens use diverse strategies to advance local and global conservation efforts.



### Regional and global networks coordinate conservation efforts

Botanic gardens and agricultural genebanks are the leading conservation repositories—facilities that conserve PGR as collections.

- ◆ Agricultural genebanks typically preserve PGR for food and agriculture at locations suited to each crop. North America has 1 international (CIMMYT, Mexico) and 33 national genebanking facilities
- Botanic gardens vary in scope and resources, but tend to conserve diverse PGR with cultural and ecological value. North America has >1,030 botanic gardens



There are at least **3,038** botanic gardens worldwide

© ICG, Gardendirect, May 2021



Botanic gardens collectively manage **>107,000** species in their living plant collections

State of the World's Plants and Fungi 2020



this is equal to approximately **31%** of all vascular plants

State of the World's Plants and Fungi 2020



Botanic gardens attract an estimated **500 million** visitors each year

© ICG, May 2021

For additional resources on botanic gardens, visit [bgci.org](http://bgci.org) and [publogardens.org](http://publogardens.org)

Contact: [Sarah.Johnson@botanicgardens.org](mailto:Sarah.Johnson@botanicgardens.org) or [Tara.Morseau@bgci.ca](mailto:Tara.Morseau@bgci.ca)

Design credit: Kai Hany Chen

Funding by USDA-NPGS and the USDA-NIFA Higher Education Challenge Grant Program (2020-2023-3-0393-03), with support from Colorado State University. USDA is an equal opportunity provider, employer, and lender. Partial funding by USDA-NIFA Higher Education Challenge Grant Program (2020-2023-3-0393-03)




English, Spanish

English, French, Spanish

3 one-credit courses (5 weeks each)  
Fall 2023  
CSU Online  
Geoff Morris (and G. Volk)

- 1) Origins
- 2) Conservation
- 3) Discovery

<https://pgrcourse.colostate.edu/>

 Colorado State University

## PLANT GENETIC RESOURCES: GENOMES, GENE BANKS, & GROWERS

**FALL 2022**

**CSU STUDENT ENROLLMENT NOT REQUIRED**  
Enroll on a 1-credit or non-credit basis

**THREE-PART SERIES**


This series consists of three graduate-level courses, taught by Dr. Geoff Morris, who leads the Crop Adaptation lab at CSU. Each focuses on a different aspect of plant genetic resource use and conservation. Ideal for graduate students & professionals continuing education. Join us for 1, 2, or all 3 courses!


**FLEXIBLE ONLINE LEARNING**  
Featuring asynchronous online classes

**COURSE I: ORIGINS**  
Aug 22 - Sept 23  
Discover the origins of plant genetic resources, their domestication and diversification, and their vital role in global food systems.

**COURSE II: CONSERVATION**  
Sept 23 - Oct 28  
Examine the role of genebanks in the global effort to conserve plant genetic resources. Explore each step from collection to storage, regeneration, and distribution

**COURSE III: DISCOVERY**  
Oct 31 - Dec 9  
Learn how novel traits and genetic variants are discovered, and how they get from genebank to plant breeders, then on to farmers and consumers.

 **ADDITIONAL INFORMATION**  
For more information on course content, fees, and registration, visit: [PGRCourse.colostate.edu](https://pgrcourse.colostate.edu)





For more information about

- Clonal Cryopreservation at NLGRP
- NPGS Training and Education Efforts
- Success Story Submission

Contact: Gayle Volk

[Gayle.Volk@usda.gov](mailto:Gayle.Volk@usda.gov)

# National Germplasm Resources Laboratory Plant Exchange Office

Anne Frances  
Melanie Schori  
Jennifer Friedman

Crop Germplasm Committee Chairs Meeting  
March 1, 2023

# Plant Exchange Office Updates

- Plant Exploration & Exchange Program
- Crop Wild Relatives
- International Distributions (with USDA-APHIS)
- GRIN Taxonomy



*Vitis ripara*,  
Hedrick and  
Booth 1908

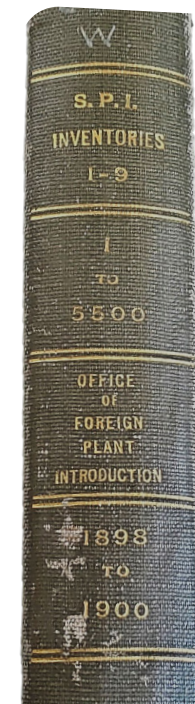
# NPGS Plant Exploration & Exchange Program



Anne Frances  
Plant Exchange Office  
National Germplasm Resources Laboratory  
Beltsville, Maryland  
[anne.frances@usda.gov](mailto:anne.frances@usda.gov)

# NPGS Plant Exploration & Exchange Program

- Fills gaps in the NPGS
- Proposal guidelines on SharePoint
- Proposals accepted yearly (due July 31)
- CGCs and curators must endorse proposals
- Crop Vulnerability Statements help identify priorities
- International explorations require prior informed consent



O. F. Cook,  
*Special Agent in Charge of Seed and Plant Introduction.*

INVENTORY.

OLERACEA. Cabbage.

w, Russia. Received through Prof. N. E. Hansen, February, 1898.  
(res.) "Bronka;" early variety.

# Access and Benefit Sharing for International Explorations

- NPGS explorations abide by the CBD\* principle of national sovereignty over genetic resources
- Prior informed consent (PIC) obtained from national authority (form of a letter, permit, MTA, etc.) via PEO
- Includes agreement on benefit sharing
- Acceptable benefits are “in-kind” (training, equipment purchase, increase projects, etc.)
- SMTA provides terms for some explorations

\*Convention on Biological Diversity <https://www.cbd.int/convention/>

# NPGS Plant Explorations FY 2022

<i>Monarda lindheimeri</i>	US (TX)
<i>Phaseolus polystachios</i>	US (GA, FL)
<i>Solanum jamesii, S. fendleri</i>	US (NM, TX)
<i>Fraxinus anomala, F. velutina</i>	US (AZ, NM)
<i>Salix armeno-rossica</i>	Georgia

# NPGS Plant Explorations



*Monarda lindheimeri* US  
(TX) 📷 Jeff Carstens



*Solanum jamesii* US (NM, TX)  
📷 John Bamberg



*Fraxinus velutina* US (AZ, NM)  
📷 Andy Sherwood



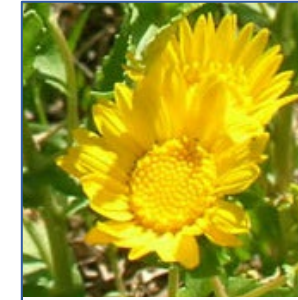
*Salix armeno-rossica*  
Georgia 📷 Tamar Kurdadze



# Postponed Explorations

## Scheduled for 2023

<i>Malus doumeri</i>	Vietnam
<i>Camelina</i> spp.	France
<i>Citrus</i>	Vietnam
Woody plants	United States (WI)
<i>Fraxinus cuspidata</i>	United States (AZ, NM)



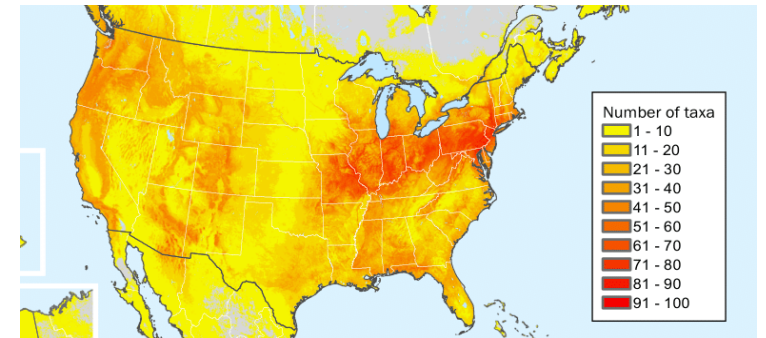
*Grindellia squarrosa*

## Scheduled for 2024

<i>Grindelia squarrosa</i>	United States (CA, ID, NV)
Small fruits	Canada
<i>Daucus</i> and <i>Allium</i> spp.	Jordan
<i>Vicia faba</i> landraces	Morocco

# Crop Wild Relative Conservation

- Many opportunities for gap filling in the NPGS
- National inventory provides potential distributions for 600 taxa, preliminary threat assessments, and conservation gap analyses
- Major *ex situ* conservation gaps were identified for 93.3% of wild relatives assessed



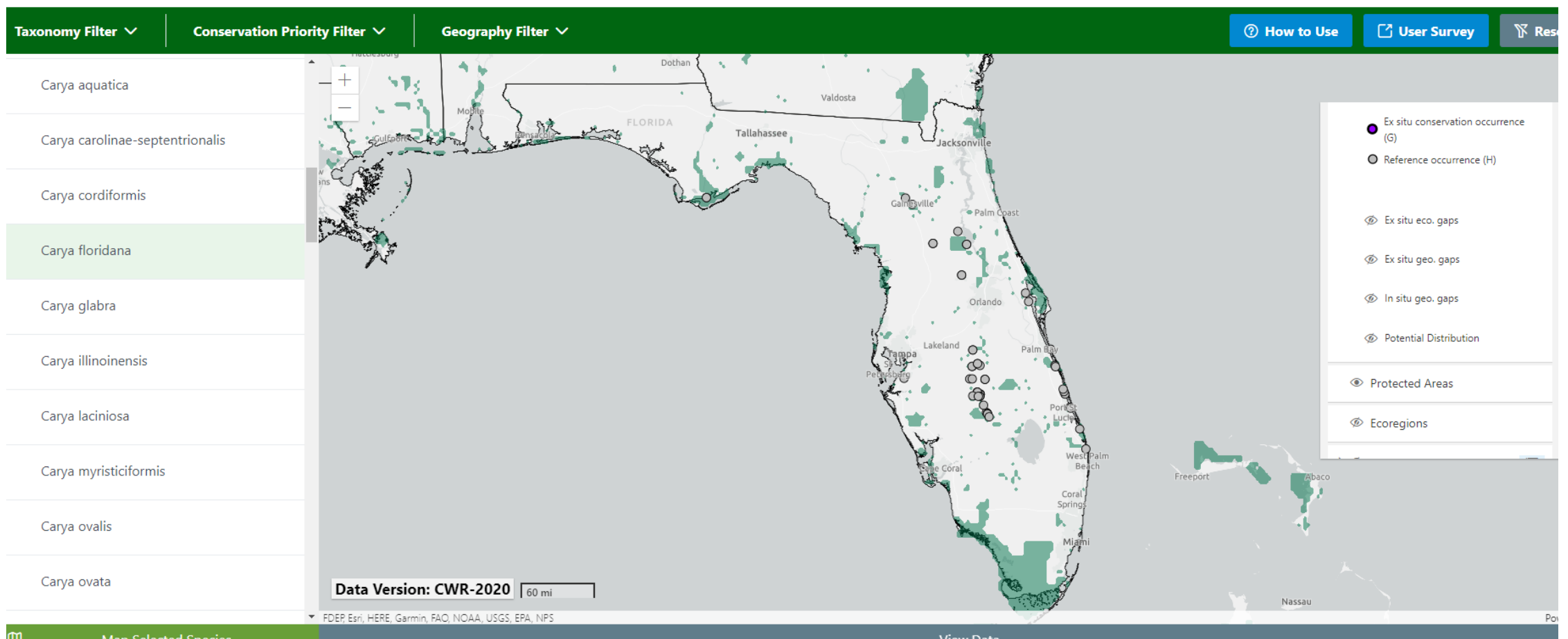
Predicted taxonomic richness map for assessed US CWR/wild food plants in categories 1A, 1B, and 1C.

## Crop wild relatives of the United States require urgent conservation action

Colin K. Khoury<sup>a,b,c,1,2</sup>, Daniel Carver<sup>a,d,1</sup>, Stephanie L. Greene<sup>a</sup>, Karen A. Williams<sup>e</sup>, Harold A. Achicanoy<sup>b</sup>, Melanie Schori<sup>e</sup>, Blanca León<sup>f,g</sup>, John H. Wiersema<sup>h</sup>, and Anne Frances<sup>i</sup>

*Proceedings of the National Academy of Sciences* 117.52 (2020): 33351-33357

# Interactive Map: Crop Wild Relatives of the US



<https://cropwildrelatives.scinet.usda.gov/#/>

# Crop Wild Relative Conservation

- Continued collaborations: Forest Service, US Botanical Garden, NatureServe, etc.
- Presentations to Natural Areas Association, US Biosphere Network with George Wright Society
- Native Grape Conservation Workshop

Saving Wild Vitis: The Conservation of North American Native Grapes Workshop



<https://graperesearch.org/2022/12/27/saving-wild-vitis/>

# NPGS International Distributions (Jennifer Friedman)

National Cotton Germplasm Collection (COT)	Woody Landscape Repository (NA)
Griffin Plant Introduction Station (S9)	Potato Germplasm Introduction Station (NR6)
National Small Grains Collection (NSGC)	Ornamental Plant Germplasm Center (OPGC)
Western Regional Plant Introduction Station (W6)	Desert Legume Program (DLEG)
National Arid Land Plant Genetic Resources Unit (Parlier)	North Central Regional Plant Introduction Station (NC7)
U.S. Nicotiana Germplasm Collection (TOB)	Soybean/Maize Germplasm, Pathology, & Genetics Research Unit (SOY)
Plant Genetic Resources Unit, Geneva*	National Laboratory for Genetic Resources Preservation*

\*Occasional

FY22: 45,226 samples to 62 countries

Contact: [jennifer.friedman@usda.gov](mailto:jennifer.friedman@usda.gov)

# GRIN Taxonomy Updates

## Search Taxonomy Data in GRIN-Global

Note: Use the Shift key + b, f, g, s, r or d to navigate between tabs.

Results of 5000 or more will be returned without links.

<a href="#">Browse</a>	<a href="#">Family</a>	<a href="#">Genus</a>	<b><a href="#">Species</a></b>	<a href="#">Results</a>	<a href="#">Distribution</a>
------------------------	------------------------	-----------------------	--------------------------------	-------------------------	------------------------------

---

<b>Genus or species name</b>	<b>Specific or infraspecific name</b>
<input type="text" value="e.g., Avena or Avena b or Avena fatua"/>	<input type="text" value="e.g., sativa or sat"/>

Melanie Schori  
Plant Exchange Office  
National Germplasm Resources Laboratory  
Beltsville, Maryland  
Melanie.Schori@usda.gov

# Taxonomy search page updates

## Search Taxonomy Data in GRIN-Global

Note: Use the Shift key + b, f, g, s, r or d to navigate between tabs.

Results of 5000 or more will be returned without links.

Browse	Family	Genus	<b>Species</b>	Results	Distribution
--------	--------	-------	----------------	---------	--------------

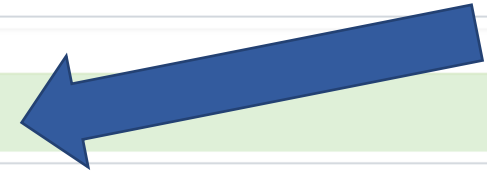
### Genus or species name

### Common name

Exact match

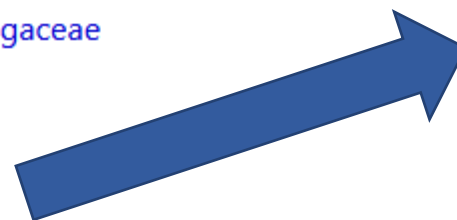
### Specific or infraspecific name

### Hybrid parentage



# Hybrid parentage

Name	Synonym of	Taxon Family	Hybrid Parentage
<i>Quercus</i> × <i>auzandrii</i> Gren. & Godr.		Fagaceae	= <i>Quercus coccifera</i> × <i>Q. ilex</i>
<i>Quercus</i> × <i>bebbiana</i> C. K. Schneid.		Fagaceae	= <i>Quercus alba</i> × <i>Q. macrocarpa</i>
<i>Quercus</i> × <i>beckyae</i> Gaynor		Fagaceae	= <i>Quercus macrocarpa</i> × <i>Q. prinoides</i>
<i>Quercus</i> × <i>bimundorum</i> E. J. Palmer		Fagaceae	= <i>Quercus alba</i> × <i>Q. robur</i>
<i>Quercus</i> × <i>comptoniae</i> Sarg.		Fagaceae	= <i>Quercus lyrata</i> × <i>Q. virginiana</i>
<i>Quercus</i> × <i>crenata</i> Lam.		Fagaceae	= <i>Quercus cerris</i> × <i>Q. suber</i>





# Crop Wild Relatives

## Crops

Achira  
Ahipa  
Aji  
Alfalfa  
Almond  
Amaranth, Purple  
Annatto  
Apple

Reset Crops

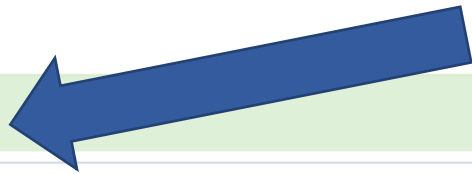
## Families

Anacardiaceae  
Apiaceae  
Araceae  
Asteraceae  
Brassicaceae  
Bromeliaceae  
Cannabaceae  
Chenopodiaceae

Reset Families

## Crop common name

e.g., pigeon-pea



# Regulation search

## Query Regulation Data in GRIN Taxonomy

Use the Genus or species name search box to find regulations that apply for a species (results will include applicable genus and family regulations). Use the Genus name search box to find genus-level regulations (including applicable family regulations). These two searches cannot be used at the same time, but either one can be combined with a family search. CITES regulations will be included for all geography options unless one or more regulation types or states is selected.

**Note:** Every effort is made to ensure the query results for regulations are accurate and current. However, regulations frequently change. Users should consult with the appropriate state or federal agencies with any questions about the accuracy of the regulatory content presented here.

Search

Results

**Genus or species name**

e.g., Sorghum or Sorghum b

**Genus name**

e.g., Saccharum

**Family name**

e.g., Poaceae or Poa

Clear row

### Geography

- All\*
- Worldwide (CITES)
- United States (federal)
- U.S. states and territories

\*Must include species, genus or family.

### Regulations in selected U.S. states and territories

All states will be searched if nothing is selected.



Alabama  
Alaska  
American Samoa  
Arizona

Clear States

### Regulation type

All types will be searched if nothing is selected.

Aquatic Noxious Weed  
Federally Endangered  
Federally Threatened  
Narcotic Production

NAPPRA is a separate federal import category. Parasitic includes federal noxious weeds and quarantine pests. Seed includes Federal Seed Act and state regulations. Terrestrial includes multiple federal and state regulations.



### Regulations in selected U.S. states and territories

All states will be searched if nothing is selected.

- Alabama
- Alaska
- American Samoa
- Arizona

Clear States


- Include U.S. regulations
- Include CITES regulations

### Regulation levels in Alabama

All

- AQUATIC: B – Class B Noxious Weed
- AQUATIC: C – Class C Noxious Weed
- SEED: PROHIBITED – Interstate Shipment Prohibited by Federal Seed Act
- SEED: RESTRICTED – Interstate Shipment Restricted by Federal Seed Act

# Regulation results



Species	Taxon Family	Note	Locality	Type	Description	Link
<i>Alternanthera philoxeroides</i> (Mart.) Griseb.	Amaranthaceae	" <i>Althernanthera</i> "	Alabama	Aquatic Noxious Weed	Class C Noxious Weed	<a href="#">Regulation source details</a>
<i>Egeria densa</i> Planch.	Hydrocharitaceae		Alabama	Aquatic Noxious Weed	Class C Noxious Weed	<a href="#">Regulation source details</a>
<i>Eichhornia crassipes</i> (Mart.) Solms	Pontederiaceae		Alabama	Aquatic Noxious Weed	Class C Noxious Weed	<a href="#">Regulation source details</a>
<i>Lythrum salicaria</i> L.	Lythraceae		Alabama	Aquatic Noxious Weed	Class B Noxious Weed	<a href="#">Regulation source details</a>

# World Economic Plants search

Query World Economic Plants in GRIN-Global

Enter one or more search terms or options below. Selections must apply to all results. For example, it is not possible to search for the genus *Celtis* and the family Fabaceae at the same time.

Search

Results

Common Names

Distribution

## Genus or species name



e.g., celtis

## Common name (full or partial)



e.g., wheat or (partial name) amar

Exact match

## Families

Select one or more families

## Infrafamilial name



e.g., Amygdaleae

# World Economic Plants search

## Economic Importance

Classes

Animal food  
Bee plants  
Environmental  
Food additives

Reset Classes

Subclasses

Food additives – adulterant  
Food additives – clarifier  
Food additives – coloring  
Food additives – dietary fiber

Restrict to names with accessions in GRIN

Include synonyms

# World Economic Plants results

- Search
- Results
- Common Names
- Distribution

[Click to display query parameters.](#)

Economic importance      Food additives – clarifier, Food additives – coloring  
 Include synonyms

Include references in results

Search:

Showing 1 to 10 of 32 entries

Taxonomy	Family	Economic Use	Usage Type	Note	Reference
<a href="#">Aronia melanocarpa</a> (Michx.) Elliott	Rosaceae	Food additives	coloring		<b>Hanelt, P., ed.</b> 2001. <i>Mansfeld's encyclopedia of agricultural and horticultural crops</i> . Volumes 1-6
<a href="#">Basella alba</a> L.	Basellaceae	Food additives	coloring		<b>Wu Zheng-yi &amp; P. H. Raven et al., eds.</b> 1994-. <i>Flora of China</i> (English edition).
<a href="#">Beta vulgaris</a> L. subsp. <i>vulgaris</i>	Chenopodiaceae	Food additives	coloring		<b>Leung, A. Y. &amp; S. Foster.</b> 1996. <i>Encyclopedia of common natural ingredients used in food, drugs, and cosmetics</i> , ed. 2



# World Economic Plants results

- Search
- Results
- Common Names
- Distribution

## Common names

Excel

Show 100 rows

Search:

Showing 1 to 344 of 344 entries

TAXONOMY	LANGUAGE	NAME	ALTERNATE NAME	NOTE	CITATION
<a href="#">Aronia melanocarpa (Michx.) Elliott</a>	English	black chokeberry			<b>Huxley, A., ed.</b> 1992. The new Royal Horticultural Society dictionary of gardening
<a href="#">Aronia melanocarpa (Michx.) Elliott</a>	English (Canada)	black chokecherry		Agriculture & Agri-Food Canada official name	<b>Darbyshire, S. J.</b> 2003. Inventory of Canadian Agricultural Weeds Agriculture and Agri-Food Canada. 131.
<a href="#">Aronia melanocarpa (Michx.) Elliott</a>	French (Canada)	aronie à fruit noir		Agriculture & Agroalimentaire Canada nom officiel	<b>Darbyshire, S. J.</b> 2003. Inventory of Canadian Agricultural Weeds Agriculture and Agri-Food Canada. 131.



Thank you!  
Questions?

Anne Frances  
[anne.frances@usda.gov](mailto:anne.frances@usda.gov)

Melanie Schori  
[Melanie.Schori@usda.gov](mailto:Melanie.Schori@usda.gov)

Jennifer Friedman  
[jennifer.friedman@usda.gov](mailto:jennifer.friedman@usda.gov)

GRIN-Global

Public Website  
&  
Server Changes

...some stats...

4 major  
releases  
since last CGC

130+ tickets  
addressed

next  
release:  
March 4, 2023

# Changes



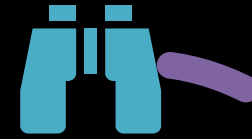
Searches



Taxonomy



User Experience



# Searches

- Results weighted by fields (Narrative < Genus)
- Recent PI's listed before older PI's
- Frequently used criteria
- Search Results – can be filtered

The screenshot displays a search interface with a search bar at the top right containing the text "Denmark". Below the search bar, there are navigation buttons: "Previous", "1", and "Next". The main content area shows a table with columns: ACCESSION, NAME, TAXONOMY, ORIGIN, REPOSITORY, IMAGE, and AVAILABILITY. Below the table, there are three search filters: "Search ACCESSI", "Search NAME", and "Search TAXONOMY". A yellow arrow points to the "ORIGIN" column. The table contains three entries, all with "Denmark" as the origin and "PVPO" as the repository. The "AVAILABILITY" column for all entries is "Not Available".

ACCESSION	NAME	TAXONOMY	ORIGIN	REPOSITORY	IMAGE	AVAILABILITY
<input type="checkbox"/> PI 685024	'Lilput'	<i>Brassica napus</i> L. subsp. <i>napus</i>	Denmark	PVPO		Not Available
<input type="checkbox"/> PI 676029	'SilverShadow'	<i>Brassica napus</i> L. subsp. <i>napus</i>	Denmark	PVPO		Not Available
<input type="checkbox"/> PI 674014	'Witt'	<i>Brassica napus</i> L. subsp. <i>napus</i>	Denmark	PVPO		Not Available

# Taxonomy

- Taxonomy Searches
- Hybrid Parentage
- Crop Wild Relatives
- Regulations
- World Economic Plants

# User Experience

- Screen changes for accessibility (WCAG Compliance)
- Seasonal availability
- / choice of inventory items
- Availability check at submit
- Detailed FAQs and Help

Details for: Ames 2917, *Gymnocladus dioicus* (L.) K. Koch, JDC/GD/2013/001/445

Summary **Passport** Taxonomy Other Pedigree IPR Observation

### Core Passport Data

Taxonomy: [Gymnocladus dioicus](#) (L.) K. Koch  
Top Name: JDC/GD/2013/001/445  
Origin: Collected – Illinois, United States  
Maintained: [North Central Regional PI Station](#)  
Received by NPGS: 02 Apr 1984  
Improvement Status: Wild material  
Form Received: Seed

### Source History

**Collected**

**26 August 1982.** Illinois, United States  
**Locality:** East bank of the Mazon River, SE 1/4 of SW 1/4 of Section 12, T33N R7E, Morris Quad, Grundy County.  
**Coordinates:** 41.3460, -88.3774 ([Map it](#))  
**Elevation:** 159m.  
**Habitat:** Mesic floodplain forest.

**Number of plants sampled:** 2  
**Associated species:** *Acer saccharum*, *Aesculus glabra*, *Alium tricoccum*, *Asarum canadense*, *Asimina triloba*, *Carya cordiformis*, *Celtis occidentalis*, *Fraxinus pennsylvanica*, *Laportea canadensis*, *Platanus occidentalis*, and *Smilax ecirrata*.

**Collector(s):**

- [Hedborn, E., The Morton Arboretum](#)

### Accession Names and Identifiers

**JDC/GD/2013/001/445** **529-82**  
Type: Collector identifier  
[Carstens, Jeffrey D. USDA, ARS, NCRPIS](#) Type: Other or unclassified name  
Represents Morton Living Accession Number #529-82

**445-1**  
Type: Other or unclassified name  
Specimen number - single mother tree sample. Extremely dense large, likely clonal patch. Sampled numerous ramets in immediate area.  
[Carstens, Jeffrey D. USDA, ARS, NCRPIS](#)

**Ames 2917**  
Type: Site identifier  
Group: AMES  
NC-7 Research Numbers  
[USDA ARS NCRPIS](#)

**445-2**  
Type: Other or unclassified

**JC0213**  
Type: Exploration identifier  
Group: PEO-EXPLORATIONS  
[Exploration ID links](#)

**UE24**  
Type: Site identifier  
Lumb, S. 2018. Population Genetics and Scarification Requirements of *Gymnocladus dioicus*. M.S. Thesis Trent University pp. 1-91  
[Freeland, Joanna Trent University](#)

**UF25**



[Accessions](#)

[Descriptors](#)

[Reports](#)

[GRIN Taxonomy](#) ▼

[GRIN](#) ▼

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Main menu



Contact Us

Please do!

# CGC Business

*How do I update CGC reports, minutes, Crop Vulnerability Statements, etc. on GRIN?*

- Send updates to Gary Kinard, who will post them to the site.

*How do I update CGC membership rosters?*

- Two options:
  - We can give you permission to update them real-time on the CGC page (Google spreadsheet). This is the preferred method.
  - If it's a minor update, Gary can make it for you.
- Note: Feel free to delete or omit detailed information such as mailing address and phone numbers if you choose. We recognize there is more sensitivity to public access to this information than in prior times. ARS would primarily like to know the names and affiliations of CGC members. As chairs, you might find the rosters a convenient way to maintain an email group for your committee.

We've recently revised the GRIN site, mostly for ease of maintenance and concordance with USDA themes, although the functionality is also better.

**Thank you for serving as a CGC Chair.**