

The National Plant Germplasm System: 2021 Status, Prospects, and Challenges

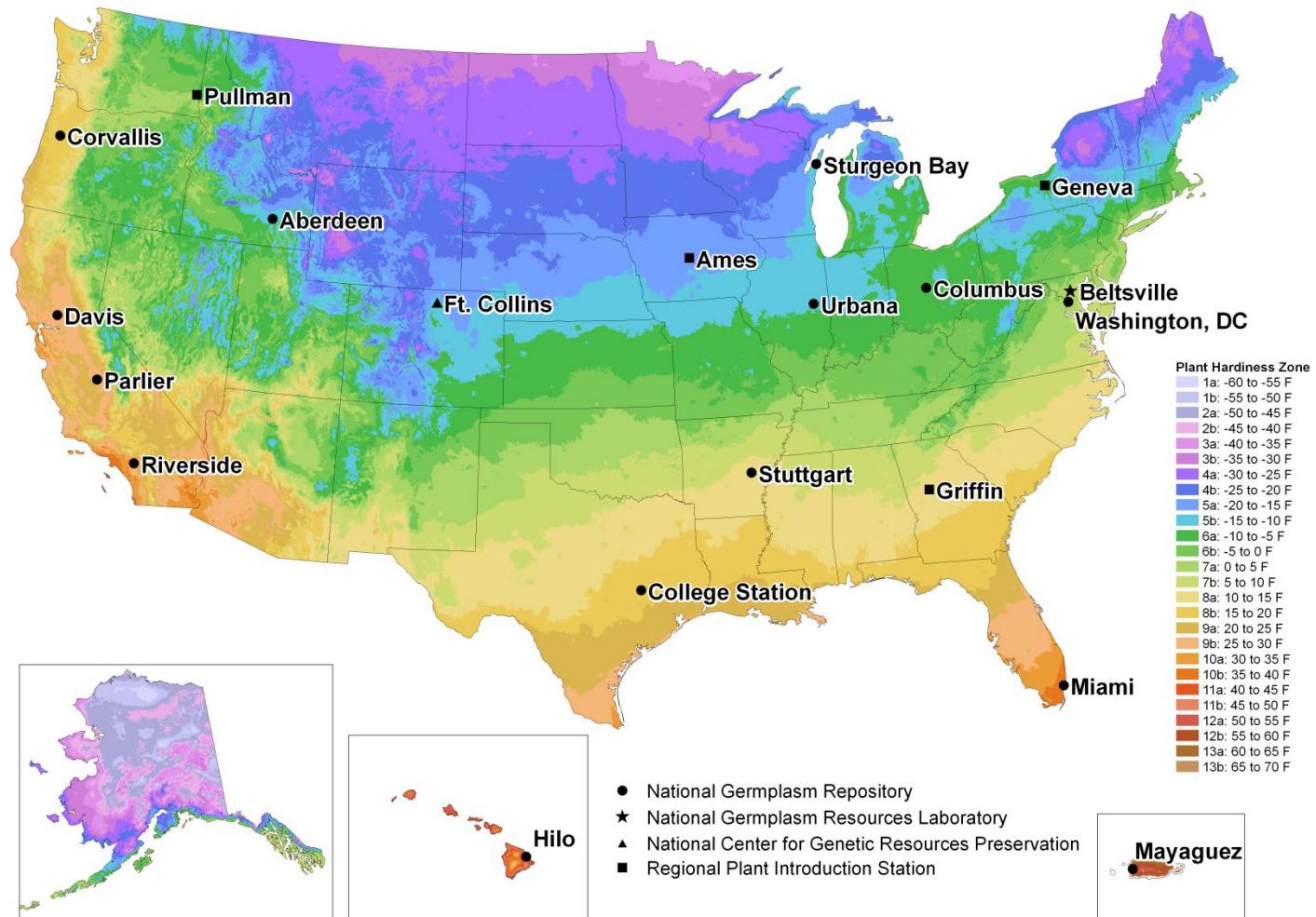
Peter Bretting
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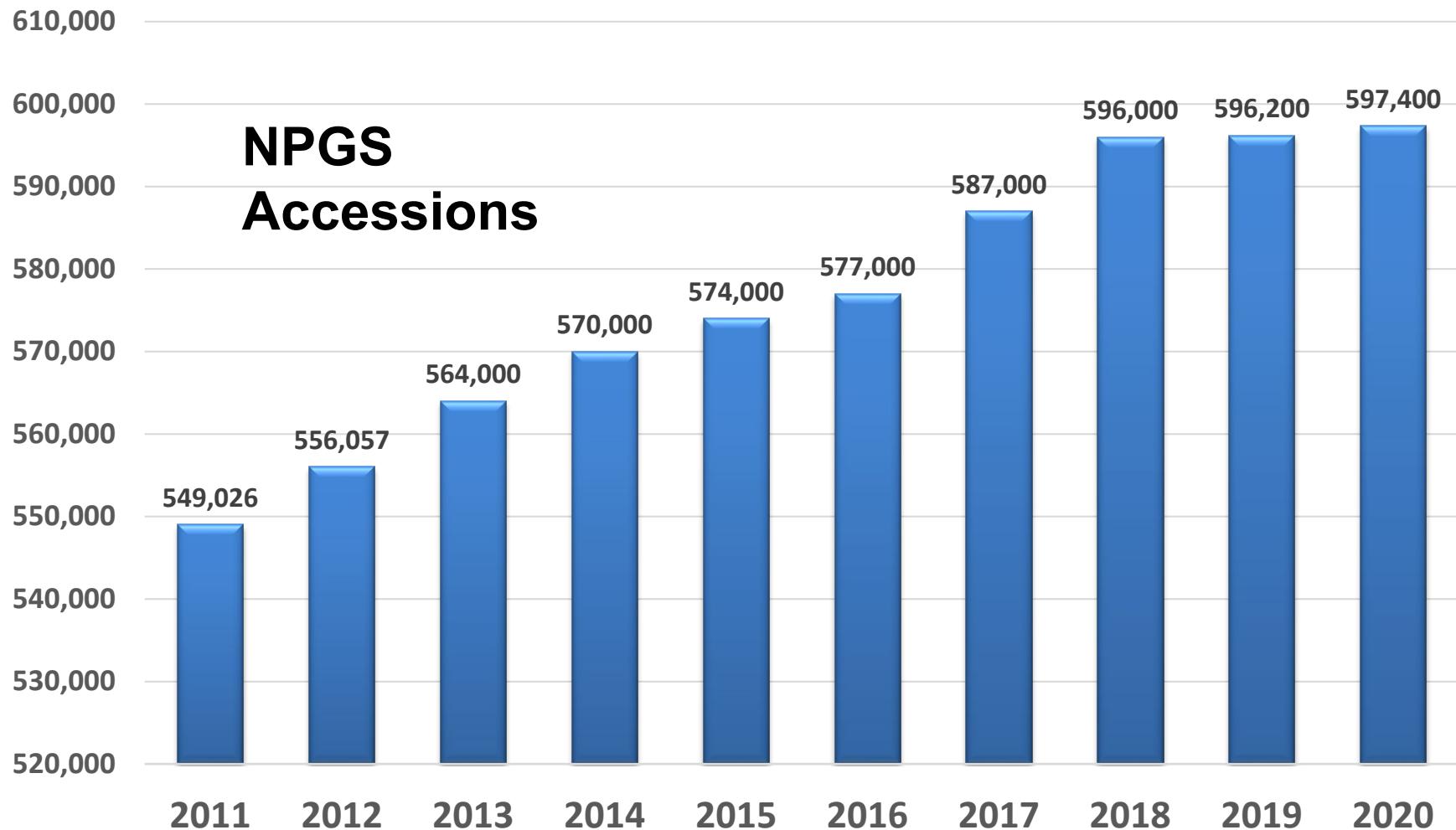
Cell: 1.240.447.9983

USDA National Plant Germplasm System (NPGS)



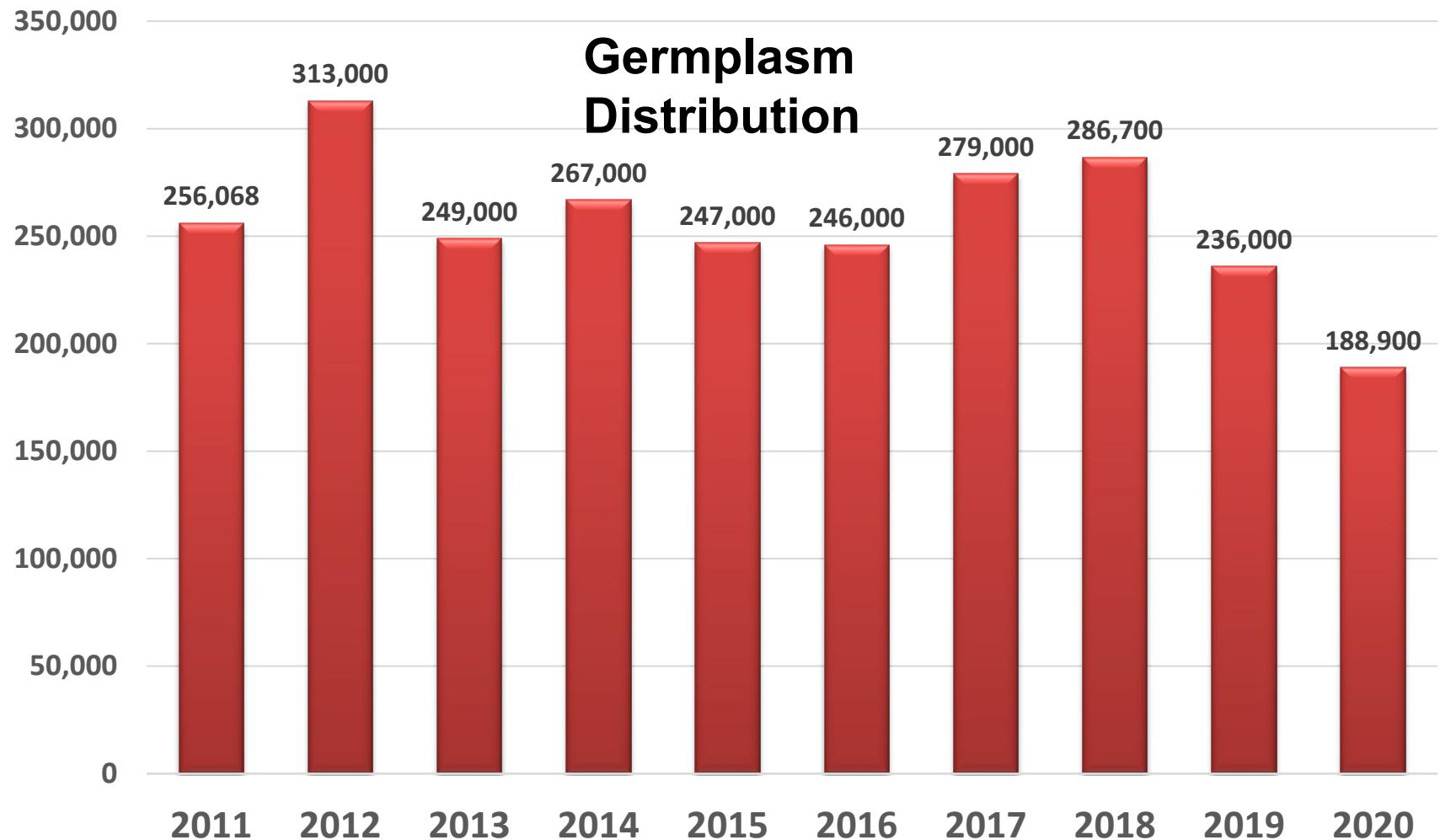
NUMBER OF NPGS ACCESSIONS

2011-2020



DEMAND FOR NPGS GERMPLASM

2011-2020



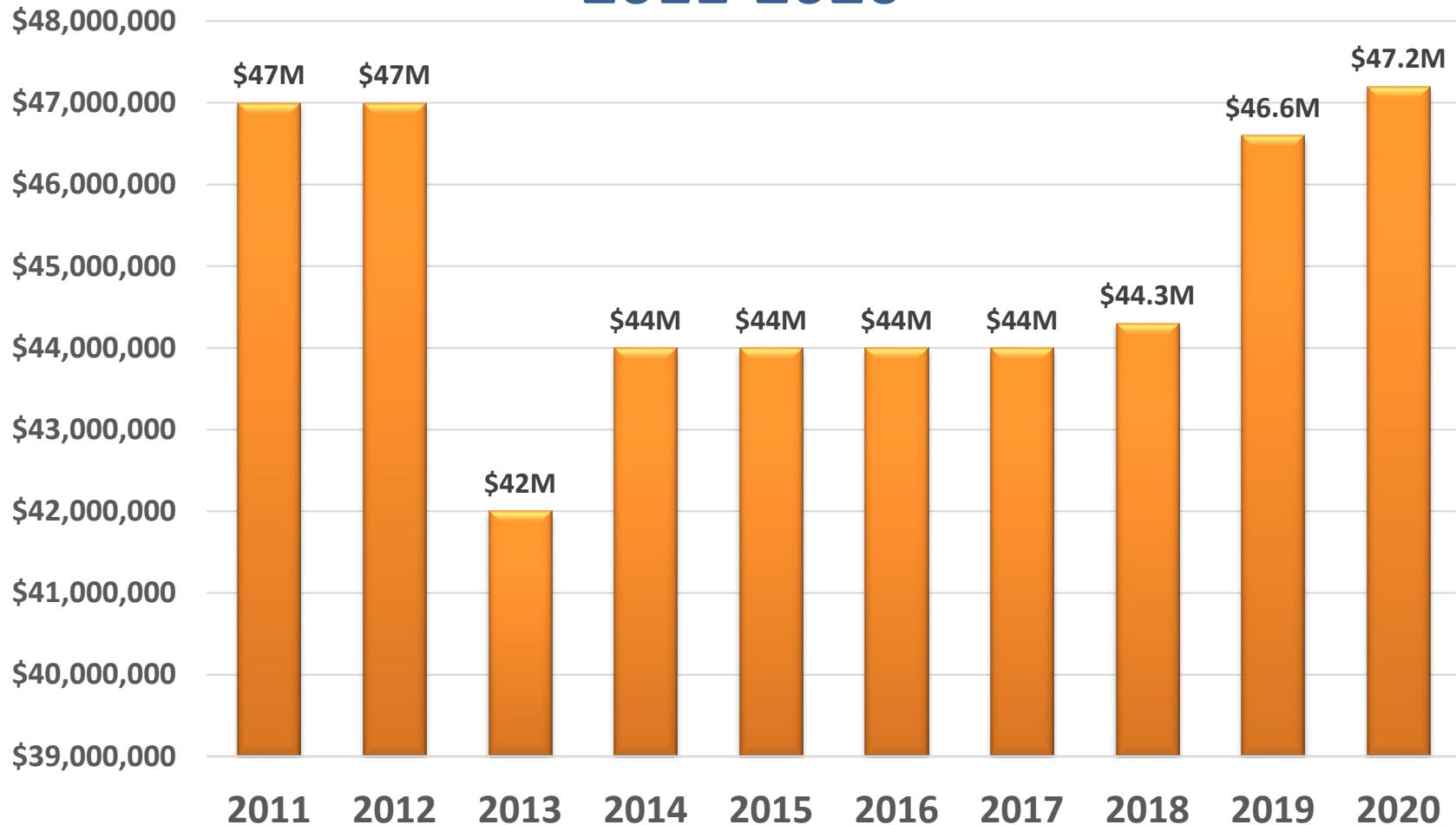
Effects of CoVID-19 as of 16 Feb. 21

- Some international germplasm shipments have ceased because of suspended service and uncertain delivery conditions.
- A few NPGS genebanks have ceased all germplasm shipments because of Federal, State, and local (university) directives for social distancing, stay-at-home, etc. But most genebanks are shipping some germplasm.
- # of samples distributed fell by ca. 20% in 2020.
- GRIN-Global has functioned normally.

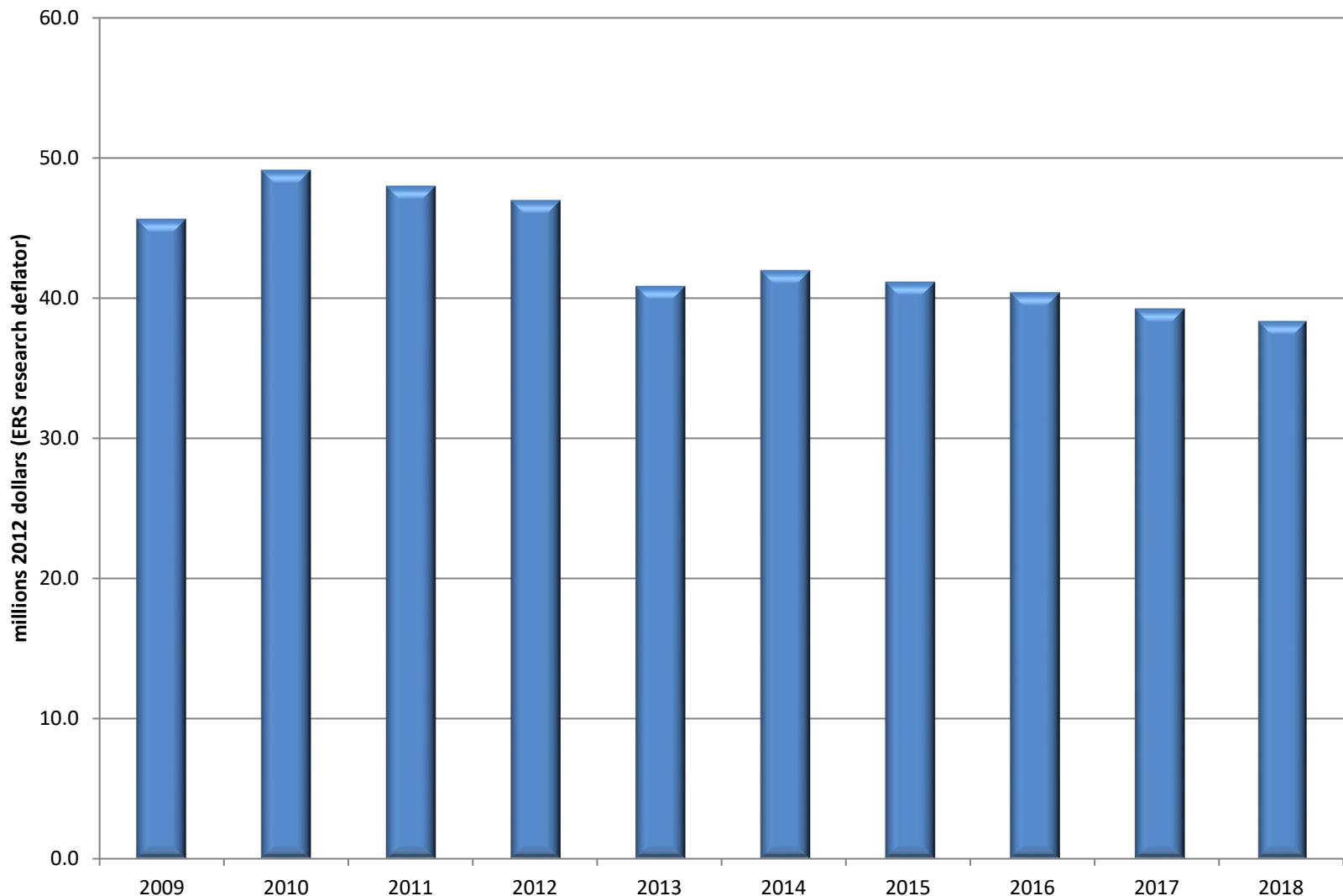
ARS NATIONAL PLANT GERMPLASM SYSTEM

BUDGET

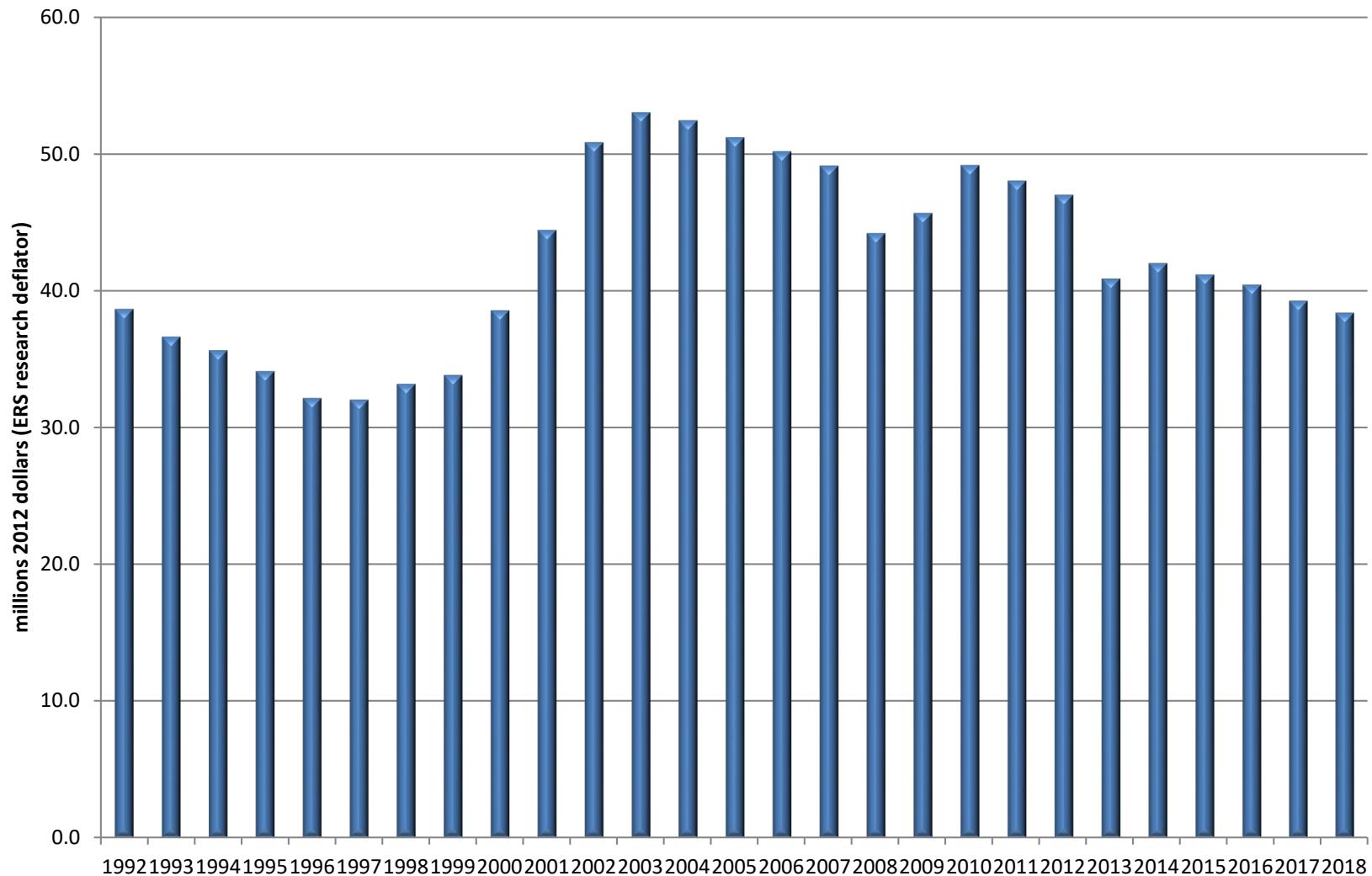
2011-2020



ARS NPGS real (deflated) budget, 2009-2018



ARS NPGS real (deflated) budget, 1992-2018



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; hiring and training new staff.**
- **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: Foundations for Crop Innovation

- **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 Candice Gardner, RL (ARS-Ames).
- Welcome and best wishes to Dave Peters, RL (ARS-Ames); Jeff Gustin, Maize Genetic Stock Curator (ARS-Urbana); Adam Mahan, Soybean Curator (ARS-Urbana); and Zachary Stansell, Hemp and Vegetable curator (ARS-Geneva).
- We are recruiting leadership and curatorial staff at Hilo, HI; Pullman, WA; College Station, TX; Corvallis, OR; Riverside, CA; Geneva, NY; and Miami, FL.

Plant Genetic Resource (PGR) Management Training Initiative

- At least 1/3 of NPGS PGR managers could retire within 5 yrs.
- Currently, no formal, comprehensive program exists 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.
- Instructional e-books are under development--see <https://colostate.pressbooks.pub/cropwildrelatives/> for an e-book about conserving crop wild relatives.
- Infographic posters for plant genetic resources genebanks and conservation, and plant genetic resources and food security have been produced in 6 languages; download at <http://genebanktraining.colostate.edu/trainingmaterials.html>

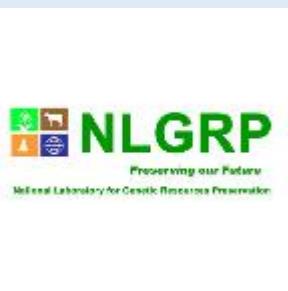
FY 20-21 ARS NPGS Budgetary Increases

- Small grains genetic resources (\$190,000):
Aberdeen, ID.
- *Vaccinium* genetic resources (\$150,000):
Corvallis, OR.
- Hemp genetic resources (\$1.35 million):
Geneva, NY.

NPGS Video

- Pullman, Griffin, Ames, Corvallis, and Geneva staff developed a new tactic for discouraging “non-research requests” for germplasm by communicating that the NPGS benefits everyone by ensuring global food security through research and breeding, not by providing seeds for home gardens.
- Led by Barbara Hellier at Pullman, the NPGS genebanks and USDA Communications filmed a video of NPGS operations accessible from the ARS YouTube site at: <https://youtu.be/uHOclGNELuw>
- Feel free to post this link on your websites, and share it with customers/stakeholders, colleagues, family, and friends.

National Laboratory for Genetic Resources Preservation



NLGRP

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

Plants Team (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

NLGRP

Plants Team (seed, clonal, microbe)

- Efficiently and effectively preserve and back up plant genetic resource collections under conventional (freezer) conditions.
- Efficiently and effectively cryopreserve and back-up plant and microbial genetic resource collections using liquid nitrogen as the cryogen.
- Design and test methods and strategies for exploiting genomic data to enhance the efficiency and effectiveness of the NPGS's plant genetic resource management projects.
- Formulate and validate methods and strategies for efficiently and effectively sampling, preserving, and using the genetic diversity of selected crop wild relatives (CWR).

Seed Collections

<u>Source</u>	<u>Accessions</u>
NPGS Active site seed collections	532,389
NPGS Seed collections at NLGRP	431,437
NLGRP-only seed collection	10,359
PVP Seed collections	11,054
Black Box (other genebanks)	~500,000



Seed storage

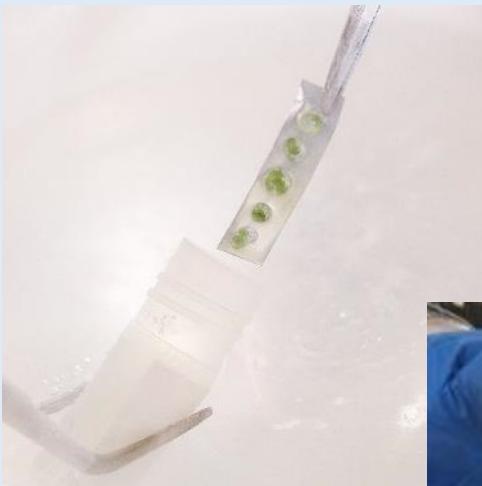
Cold Storage (-18°C)



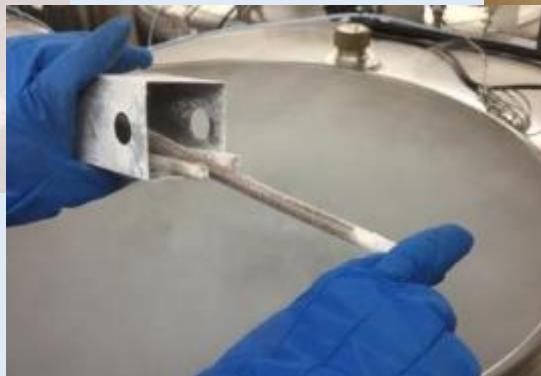
Liquid nitrogen vapor (-165 °C)

Clonal Collections

<u>Source</u>	<u>Accessions</u>
NPGS Active site clonal collections	28,863
NLGRP In vitro collections	1750 6% backed-up
NLGRP clonal cryo collections	3751 13% backed-up
NLGRP pollen cryo collections	73 <1% backed-up



Shoot meristems



Dormant buds

Svalbard Global Seed Vault



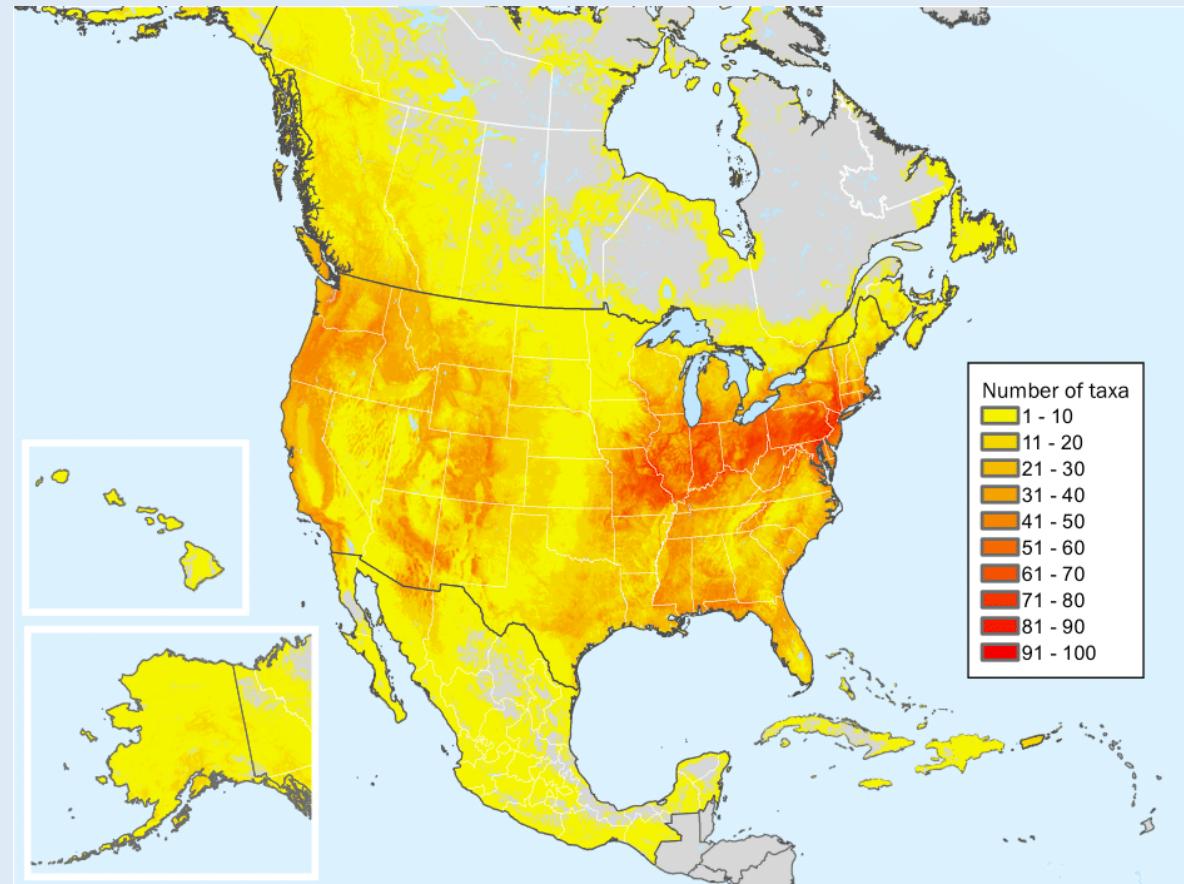
- NLGRP coordinates NPGS deposits
- Feb 23, 2020 Seed Deposit Ceremony
- > 120,000 samples



National Conservation Analysis for US CWR

- Preliminary threat assessments (IUCN Red List analysis), indicated that **7%** of taxa could be candidates for designation as critically endangered, **50%** as endangered, **28%** as vulnerable, **15%** as near threatened or of least concern

- High priority to resolve *ex situ* conservation gaps for **94%** of the wild relatives, with 82 taxa entirely absent from genebanks
- High priority to resolve *in situ* conservation gaps for **93%** of the plants



Khoury, C.K., Carver, D., Greene, S.L., Williams, K.A., Achicanoy, H.A., Schori, M., Leon, B., Wiersema, J., Frances, A. 2020. Crop wild relatives of the United States require urgent conservation action. PNAS. 117(52):33351-33357.
<https://doi.org/10.1073/pnas.2007029117>.

Training Program

Plant Genetic Resources Management and Use

- ~30% of NPGS staff will retire during the next few years
- Training in “Plant Genetic Resources Management and Use” available to students and NPGS staff/scientists
- NIFA Higher Education Challenge Program Grant: CSU, USDA, ISU
- Training materials will be freely available through new site associated with GRIN-Global: Ebooks, videos, images, virtual tours, PDFs
- Online course and possible extension courses offered through CSU



For more information contact:

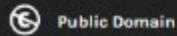
Gayle Volk: Gayle.Volk@usda.gov

Pat Byrne: Patrick.Byrne@colostate.edu

Plant Genebank Training Program Public Ebooks

Crop Wild Relatives and their Use in Plant Breeding

Gayle Volk and Patrick Byrne

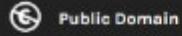


8 chapters released
10 in development

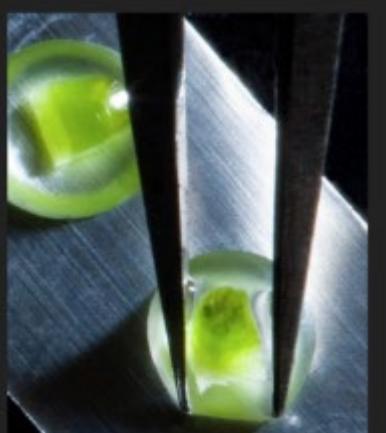
<https://colostate.pressbooks.pub/cropwildrelatives/>

Training in Plant Genetic Resources: Cryopreservation of Clonal Propagules

Gayle Volk



READ BOOK



4 chapters released
2 in development

<https://colostate.pressbooks.pub/clonalcryopreservation/>

Davis Repository Field Collections: 11 chapters in development

Thank You!

Stephanie Greene, Seed Curator
NLGRP, Fort Collins, CO
Stephanie.greene@usda.gov



The NPGS Plant Exploration/Exchange Program

Karen A. Williams
Plant Exchange Office
National Germplasm Resources Laboratory
Beltsville, Maryland
Karen.Williams@usda.gov



Overview

- ↳ fills gaps in the NPGS
- ↳ supports both explorations and exchanges
- ↳ proposals accepted yearly by NGRL- PEO for explorations the next fiscal year
- ↳ mainly supports travel
- ↳ all approved explorations cancelled in 2020
- ↳ 2021 proposals are all domestic
- ↳ proposals for 2022 due July 30, 2021
- ↳ proposal guidelines distributed to CGC Chairs
- ↳ CGCs and curators must endorse proposals

Access and Benefit Sharing for International Explorations

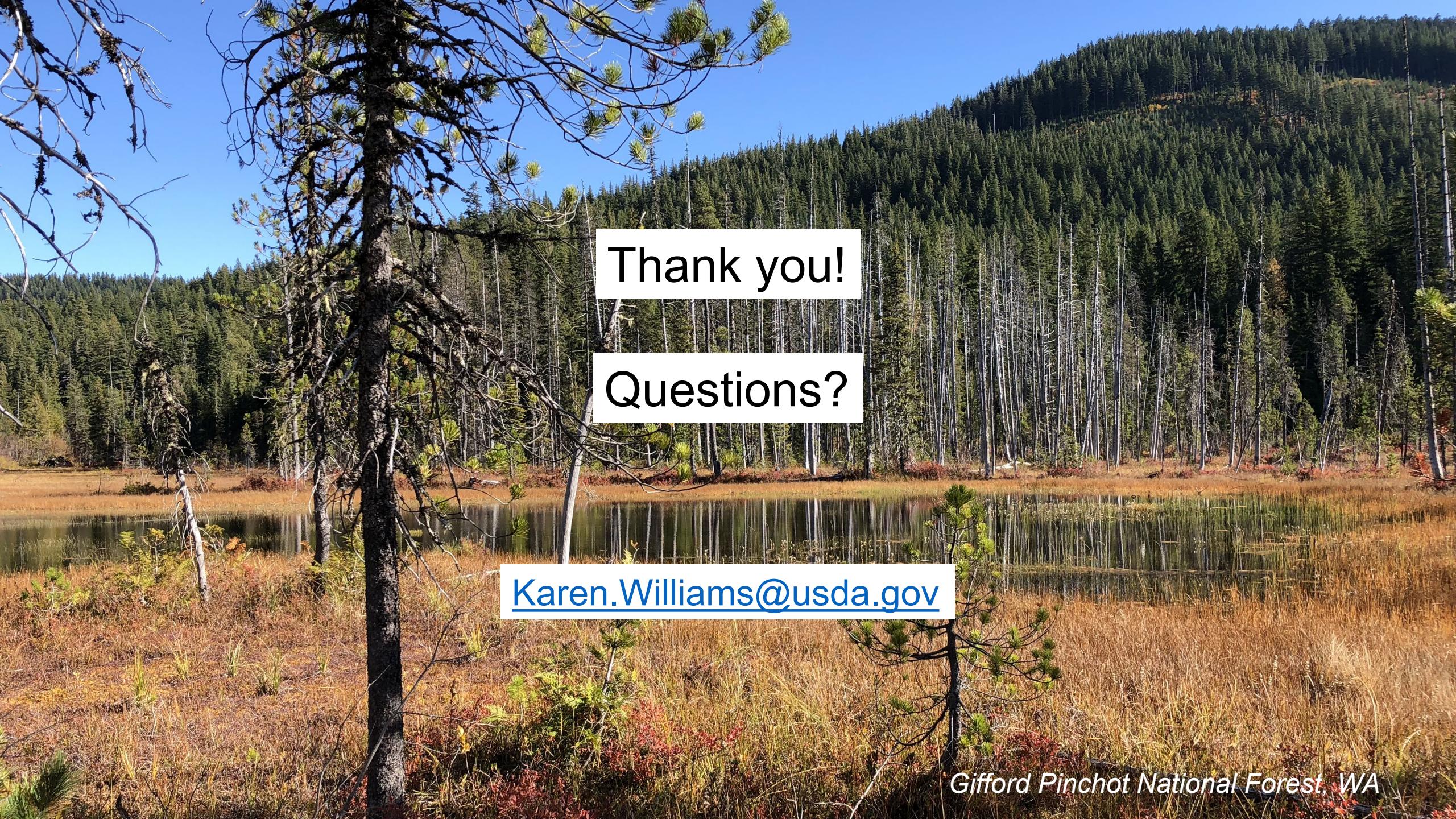
- NPGS explorations abide by the CBD* principle of national sovereignty over genetic resources
- prior informed consent (PIC) for access obtained from national authority
 - PIC may be in the form of a letter, permit, MTA, etc.
 - includes agreement on the sharing of benefits
 - acceptable benefits are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

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

Crop Wild Relatives in the US

- many opportunities for gap filling in the NPGS
- new 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

C.K. Khoury, D. Carver, S.L. Greene, K.A. Williams, H.A. Achocanoy, M. Schori, B. Leon, J.H. Wiersema, and A. Frances. *Crop wild relatives of the United States require urgent conservation action.* Proc. Natl. Acad. Sci. U.S.A., 10.1073/pnas.2007029117 (2020).

A scenic view of a forested mountain landscape. In the foreground, there's a small pond reflecting the surrounding trees. The middle ground shows a mix of living coniferous trees and many dead, standing tree trunks (snags). The background is a steep hillside covered in a dense forest of green coniferous trees under a clear blue sky.

Thank you!

Questions?

Karen.Williams@usda.gov

Gifford Pinchot National Forest, WA

Crop Wild Relative page

The screenshot shows the header of the U.S. National Plant Germplasm System website. The header features a green bar with the text "U.S. National Plant Germplasm System". Below this is a grey navigation bar with links: "Accessions", "Descriptors", "Reports", "GRIN Taxonomy", "GRIN", "Help", and "Contact Us". The "GRIN Taxonomy" link is highlighted with a green background. A dropdown menu is open under "GRIN Taxonomy", listing the following options: "Simple Query of Species Data", "Advanced Query of Species Data", "Query Families and Genera", "Crop Wild Relative Data in GRIN" (which is highlighted with a blue arrow pointing to it), "World Economic Plants in GRIN", and "About GRIN Taxonomy". The background of the page features a close-up photograph of a purple flower with yellow stamens.

Query Crop Relatives in GRIN-Global

Any or all fields can be searched.

Crop Wild Relative search

Crops

- Achira
- Ahipa
- Aji
- Alfalfa
- Almond
- Amaranth, Purple
- Annatto
- Apple

Reset Crops

Families

- Amaranthaceae
- Anacardiaceae
- Apiaceae
- Araceae
- Asparagaceae
- Asteraceae
- Brassicaceae
- Bromeliaceae

Reset Families

Genus name

e.g., *Oryza* (without author)

Crop genus Relative genus Both

Crop Wild Relative search

- Trait data added

Traits

Trait class	<input type="checkbox"/> Potential <input checked="" type="checkbox"/> Confirmed	Agronomic	Breeding trait:	Crop Quality (AG)
		Abiotic Biotic Fertility		Dwarfing (AG) Fruit/Seed Retention (AG) Growth Habit (AG)

Reset Traits

Breeding usage, e.g., Fusarium or bruchid

Crop ontology, e.g., 341:0000151

Crop Wild Relative – Results 1

Your search criteria						
Crop	Alfalfa					
Show 10 rows		Excel				
Showing 1 to 10 of 47 entries						Search: <input type="text"/>
CROP	CROP WILD RELATIVE	GENEPOOL	GRAFTSTOCK	TRAIT	ONTOLOGY	BREEDING TYPE
Alfalfa	<i>Medicago sphaerocarpos</i> Bertol.	Tertiary		Abiotic		Drought Resistance (AB)
Alfalfa	<i>Medicago sphaerocarpos</i> Bertol.	Tertiary		Biotic		Disease Resistance (B)
Alfalfa	<i>Medicago arborea</i> L.	Tertiary		Biotic		Disease Resistance (B)
Alfalfa	<i>Medicago cancellata</i> M. Bieb.	Tertiary				
Alfalfa	<i>Medicago littoralis</i> Rohde ex Loisel.	Tertiary		Biotic		Disease Resistance (B)

Crop Wild Relative – Results 2

- Crop taxa
- List of relatives
- Crop distributions
- Repositories
- Accessions
- Genepool & traits
- Distribution of selected relative
- Repositories
- Accessions
- References

The diagram illustrates a search process. On the left, a screenshot of a database interface titled "Crop Wild Relatives of Alfalfa" shows a search bar and results for "Medicago arborea L.", "Medicago cancellata M. Bieb.", and "Medicago daghestanica Rupr. ex Boiss.". A large blue arrow points from this screen to the right. On the right, a screenshot of a database interface titled "Accessions of *Medicago arborea* L." shows a table with two entries:

Accession	Name	Availability	Repository
W6 4897	27	Not Available	W6
W6 4899	28	Not Available	W6

Regulatory data

- Taxonomy regulation
 - Geography
 - Regulations
 - Websites

	Taxonomy Regulation ID	Geography	Regulation Type	Regulation Level	Description	URL 1
►	7	United States, California	Terrestrial	Level of regulation (A or 1)	Noxious Weed	http://www.cdfa.ca.gov/...
	65	United States, California	Aquatic	Level of regulation (A or 1)	Noxious Weed	http://www.cdfa.ca.gov/...
	136	United States, California	Seed	Prohibited	Interstate Shipment Prohibited by Federal Seed Act	https://www.ams.usda.g...
	229	United States, California	Seed	Restricted	Interstate Shipment Restricted by Federal Seed Act	https://www.ams.usda.g...
	259	United States, California	Terrestrial	Regulated	Plant material may be subject to additional regulations	https://nationalplantboar...

Regulatory data

- Taxonomy regulation map
 - Family or genus or species/infraspecies
 - Mapped to regulation by geography

Taxonomy Regulation Map ID	Family	Genus	Taxon	Regulation	Note	Is Exempt
1003			<i>Sorghum bicolor</i> nothosubsp. <i>drummondii</i>	Indiana TERRESTRIAL A	only shattercane	N
1004			<i>Sorghum bicolor</i>	Ohio TERRESTRIAL B	only shattercane, not other varieties	N
1005			<i>Sorghum halepense</i>	Alabama SEED RESTRICTED		N
1006			<i>Sorghum halepense</i>	Arkansas SEED RESTRICTED		N
1007			<i>Sorghum halepense</i>	Colorado TERRESTRIAL C		N
1008			<i>Sorghum halepense</i>	Florida SEED RESTRICTED		N

Regulatory data

- *Ribes nigrum*

Availability			
Form	Quantity	Note	Cart
Seed	25 count		

Restrictions
Plant material may be subject to additional regulations
https://nationalplantboard.org/wp-content/uploads/docs/summaries/delaware.pdf
<ul style="list-style-type: none">• USA – Delaware (See state regulations: Certification of Currant Plants.)
https://nationalplantboard.org/wp-content/uploads/docs/summaries/maine.pdf
<ul style="list-style-type: none">• USA – Maine (See state regulations: White Pine Blister Rust Quarantine.)



As of August 22, 2020, the U.S. National Plant Germplasm System (NPGS) has a new GRIN-Global website.

GRIN-Global U.S. National Plant Germplasm System Log out

Version: 2.0.4.0 Accessions Descriptors Reports GRIN Taxonomy▼ GRIN▼ Help Contact Us Tools▼ Your Profile▼



Select the tab for the type of search. Each tab has everything you need to do to perform that type of search.

Return up to 500 ▾

Simple Search List Search Advanced Search Results

e.g., Malus domestica

Summary Passport Taxonomy Other Pedigree IPR Observation

Summary Data

Taxonomy:	Glycine max (L.) Merr.
Top Name:	G 1853
Origin:	Collected - South Australia, Australia
Maintained:	Soybean Collection
Received by NPGS:	Aug 1979
PI Assigned:	1980
Improvement Status:	Wild material
Form Received:	Seed
Backup Location:	National Laboratory for Genetic Resources Preservation
Inventory Volume:	188
View original Plant Inventory data in pdf format	

Availability

Form	Quantity	Note	Cart
Seed	5 count		

Add to Wish List

Images (5 total. Click on image for more.)



Overview of Changes

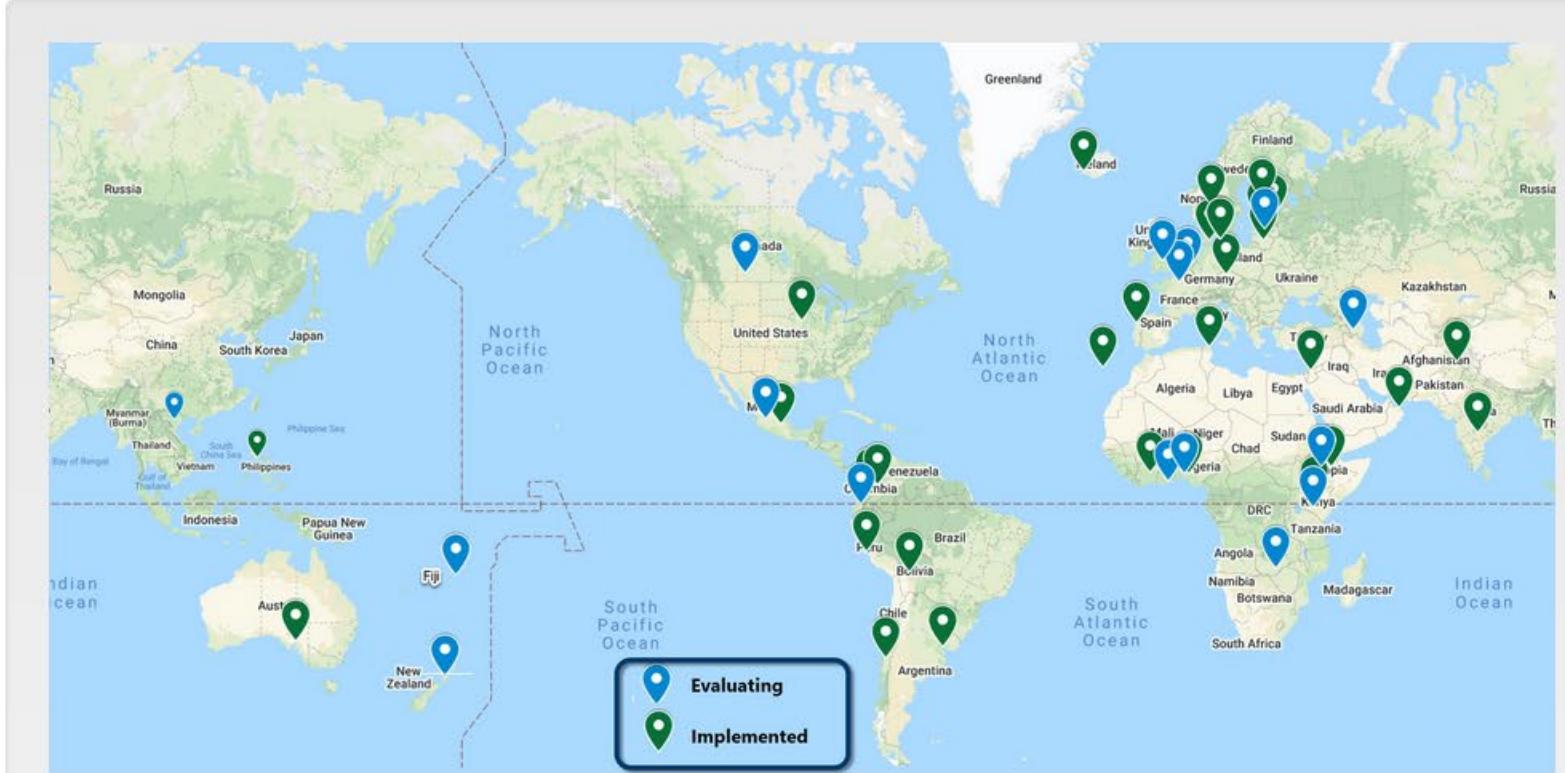
https://www.grin-global.org/docs/gg_pw2_rollout_info_sheet.pdf

For Assistance or to Schedule a Webinar for your committee, please use the menu's **Contact Us**



The GRIN-Global Project

ENHANCED BY Google



<https://www.grin-global.org/>

News & Notes

GRIN-Global International Helpdesk

eMail address: helpdesk@grin-global.org

Congratulations to the Latest GG Installation

December 3, 2020



National Genebank of Pakistan December 3, 2020

CGC Business and Operations FAQ

Where can I find more information about CGCs?

On the CGC page of GRIN at <https://www.ars-grin.gov/CGC>

How can I add a report, minutes, etc. to my CGC's section?

Email them to Gary. If you want to be really nice, note and follow the standardized file naming convention.

How can I update my committee's membership roster?

Preferred: It's a Google doc, and Marty Reisinger or Gary can give you permission to edit it. Another option: download it, update, and email back to us.

Are the rosters important?

CGCs are not official federal advisory committees, so it's not required. The centralized rosters are a tool to help manage your operations and provide continuity as members/chairs change. I encourage you to keep them updated.

Should my CGC have bylaws?

That is up to your committee, but I recommend having simple bylaws. See Small Fruits and Soybean as examples.

Can NGRL help my CGC with virtual meetings?

Yes, we have a Zoom account you can use. Contact Gary well in advance (weeks) to arrange to use it.