Apple CGC Minutes
October 15, 2021; 2:00-5:00 EDT
Teleconference hosted by Plant Genetic Resources Unit (PGRU)
Geneva, NY

Attendees: Gayle Volk (chair), Herb Aldwinckle, Peter Bretting, Susan Brown, Tami Collum; Larissa Carvalho Costa, Cummins Nursery, Dawn Dellefave, Kate Evans, Gennaro Fazio, Anne Frances, Chris Gottschalk, Ben Gutierrez, Nick Howard, Oscar Hurtado-Gonzales, John Keeton, Jason Londo, Jim Luby, Bob Martens, Jim McFerson, Tori Meakem, Zoe Migicovsky, Diane Miller, David Osborne, Cameron Peace, Greg Peck, Reece Perrin, Chris Richards, Terence Robinson, Kenong Xu

Minutes provided by: Gayle Volk

National Program Report (Bretting, see attachment for presentation PDF)
Discussion:

- The 2018 Farm Bill requested an NPGS Plan to describe backlogs for characterization and maintenance. This was completed earlier this year and is in the review process.
- The USDA-ARS NP301 (National Program for Plant Genetic Resources, Genomics, and Genetic Improvement) Retrospective Review occurred in August 2021. The value of GRIN-Global, the NPGS network, and the new Training Program (GRIN-U.org) were noted. The next NP301 Action Plan is being finalized, and then 5 year Project Plan development will occur for USDA Research Units associated with NP301.

National Genetic Resources Advisory Council Report (McFerson)
This reactivated 14 member committee reports on all National Genetic Resources programs (plant, animal, microbe) to the Secretary of Agriculture. The 14 members serve 2 year terms.

National Germplasm Resources Report (Kinard)
No report was given at the committee meeting, but a PDF report is attached to these minutes.

Plant Germplasm Quarantine Program Report (Hurtado-Gonzales)
A powerpoint was presented describing the activities of the Plant Quarantine program. There are efforts to streamline the quarantine process using sequencing technologies to detect pathogens throughout the testing and clean-up process. Ongoing efforts seek to compare incoming germplasm with existing materials in collections using fingerprinting/KASP technologies to determine if the materials are already available in the US (perhaps under a different name). About 100 accessions are in the clean-up process that will eventually be released to the apple collection in Geneva, NY. A research project to assess the effects of cryotherapy on virus eradication is apple rootstocks is underway (collaboration with Fazio and Volk).

Curator Report (Gutierrez, see attached for PDF version as well as written report)
Highlights:

- New Geneticist hired: Tori Meakem; Orchard Manager John Keeton is retiring November 29, 2021.
- Field effots: Previous concerns about waterlogged soils are being addressed by the addition of new drainage systems. A new fence is being erected that will help with deer control.

- Fire blight was a significant concern in 2020-2021 (see publication by Dougherty et al. 2021. 11, 144, https://doi.org/10.3390/agronomy11010144) and the issue has not been completely resolved. Although better than in FY 2020, there is still streptomycin resistant fireblight in the NPGS Apple Collection. As a result, distribution of dormant budwood in FY2022 will again be limited. Current control methods include including Kasumin, Blossom Protect, alternating applications of copper and Apogee every 7-14 days. In 2020, 303 trees were grafted to ensure their survival, and in 2021, 268 trees were grafted. Grafting success rate was 54%.
- Rootstock trials are in process to determine rootstock compatibility for wild *Malus* species, with the hope to improve fireblight tolerance of the orchards in the future.
- 16 cultivars were accepted as new accessions into the collection.
- Most of the W3 orchard is scheduled for removal, using tree selection/grafting plans that were developed a few years ago.
- Data in GRIN-Global: The GRIN Citation links page has been updated; this allows users to connect publications with specific accessions. There may be future opportunities to link with Greg Peck's cider resources (https://hardcider.cals.cornell.edu/). Over 300 images of accessions representing wild- and hybrid-apple taxa will soon be available on GRIN-Global.
- The Impact Statement is a work-in-progress. A draft document was circulated for comment, and there will be email follow up discussions.
- There's a need for adding Success Stories to the document, and community participation in this activity is encouraged. Gayle Volk is working with the NPGS Training Program effort to develop a Success Story template which will be shared with the Apple CGC as soon as it is available. As a sidenote, these success stories are important for all of NPGS, not just the apple collection.

Discussion topics:

- Many commercially available cultivars continue to be requested from the NPGS Apple Collection. These requests should be screened to ensure that resources are not spent on distributing these materials, and requestors should be directed to other sites. In the future, a non-NPGS website may be available to provide information about apple cultivars available from nurseries and other collections in the US.
- The Apple CGC discussed the need for fingerprinting new accessions prior to acceptance and to develop a process to decide which new accessions to accept to optimize field space. Genotyping platforms through WSU are available for fingerprinting efforts.
- It was encouraged that new image and genotype data be included in the decisions on whether trees should be grafted prior to removal in W3. Also, previously grafted accessions from W3 should be confirmed to be healthy prior to original tree removal. In many cases, trees in W3 represent PGR that are not publicly available elsewhere, and can not be re-collected in China at this time. Original seed collections may not be alive.

GRIN-U and Security back-up (Volk)

- Prior to 2021: 2052 apple accessions were backed up as dormant buds at NLGRP. In 2021, 83 accessions were cryopreserved at NLGRP and grafted in Geneva. Of these, 36 are now fully backed-up at NLGRP. 40 accessions met the 40% viability standard, but not enough material was sent for processing—additional budwood could be processed at some point. In 2022, we aim to cryopreserve 100 apple accessions as dormant buds.
- We provided images & average fruit weights for 295 accessions of wild *Malus* taxa to be uploaded to GRIN-Global for use in confirming species identities.

- GRIN-U.org was launched in July 2021. It provides online resources for training, including ebook chapters on apple shoot tip and dormant bud cryopreservation and a webinar that was provided by Ben Gutierrez in 2021. We would be happy to collaborate on developing more content.

SNP array results for the NPGS Apple collection (Howard) The 20K SNP array has been used to genotype unique cultivar (and progenitor species) the NPGS collection. This work has not yet been published. It has also revealed hybrid relationships between wild "species" accessions and domesticated cultivars.

Fruit RegisTREE & apple genotyping (Peace) Cameron Peace's lab has made SNP genotyping available for identity and pedigree determination. He's also leading a heritage apple group that is developing tools to document fruit trees in the landscape and in private and non-profit collections. He's also co-coordinating the Heritage Orchard Conference that provides monthly seminars that may be of interest (https://www.uidaho.edu/cals/sandpoint-organic-agriculture-center/conference).

Apple rootstock breeding program (Fazio) Rootstock evaluations continue in Washington, Oregon, and California (particularly for G213 and G214). In addition, clean tissue culture lines of rootstocks are being provided to nurseries. Studies are ongoing regarding the virus loads of RR Honeycrisp. Consider rootstock activities as success stories. Future interests include rooting behaviour and pest responses in the collection, replant disease evaluation. Would like to see more virus/viroid testing in the collection.

2021 Evaluation Grant Results (Gottschalk) The Apple CGC Evaluation Grant was awarded to Chris Gottschalk to perform genotyping and resequencing of *M. angustifolia* (and *M. angustifolia* and *M. coronaria* to some extent) in the NPGS Apple Collection. Seedlots that were received have low germination.

Subcommittees. The CGC agreed that these subcommittees are important and the planned efforts should continue. Ben Gutierrez has agreed to coordinate the New Core Subcommittee and Land Use Efficiency Subcommittee (perhaps also including prioritization of new materials added to the collection) activities. There will be follow-up emails regarding these efforts.

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

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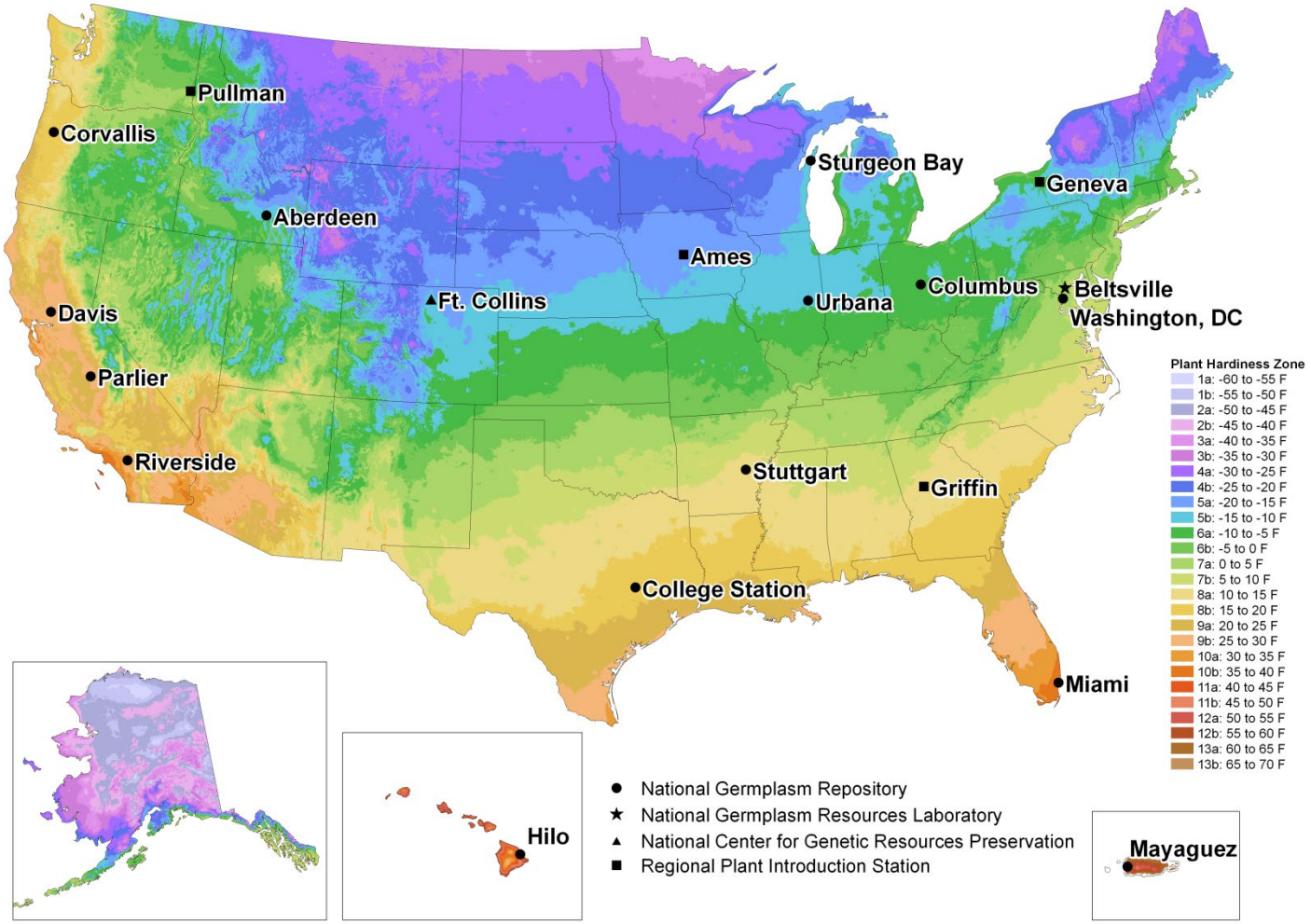
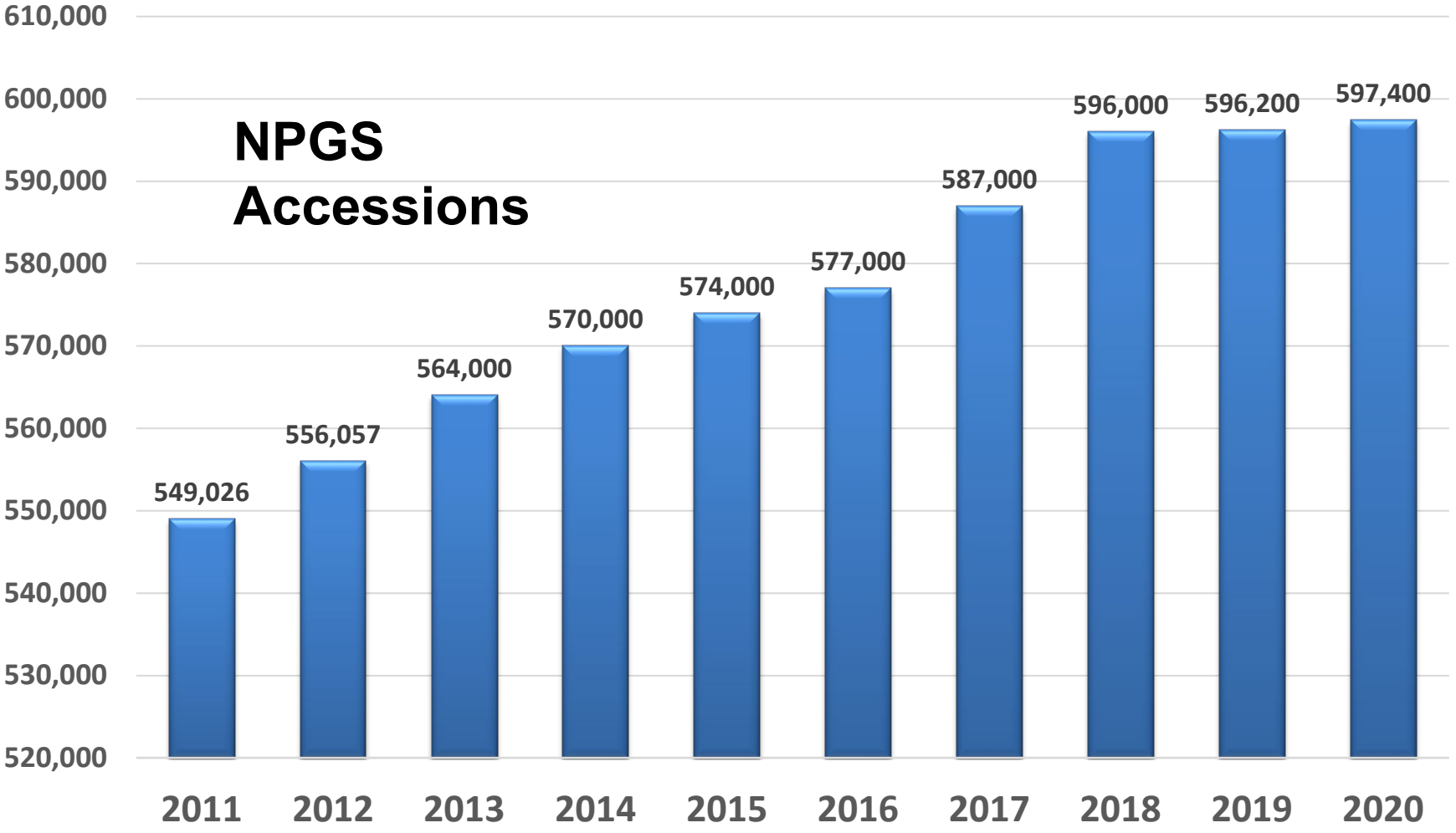
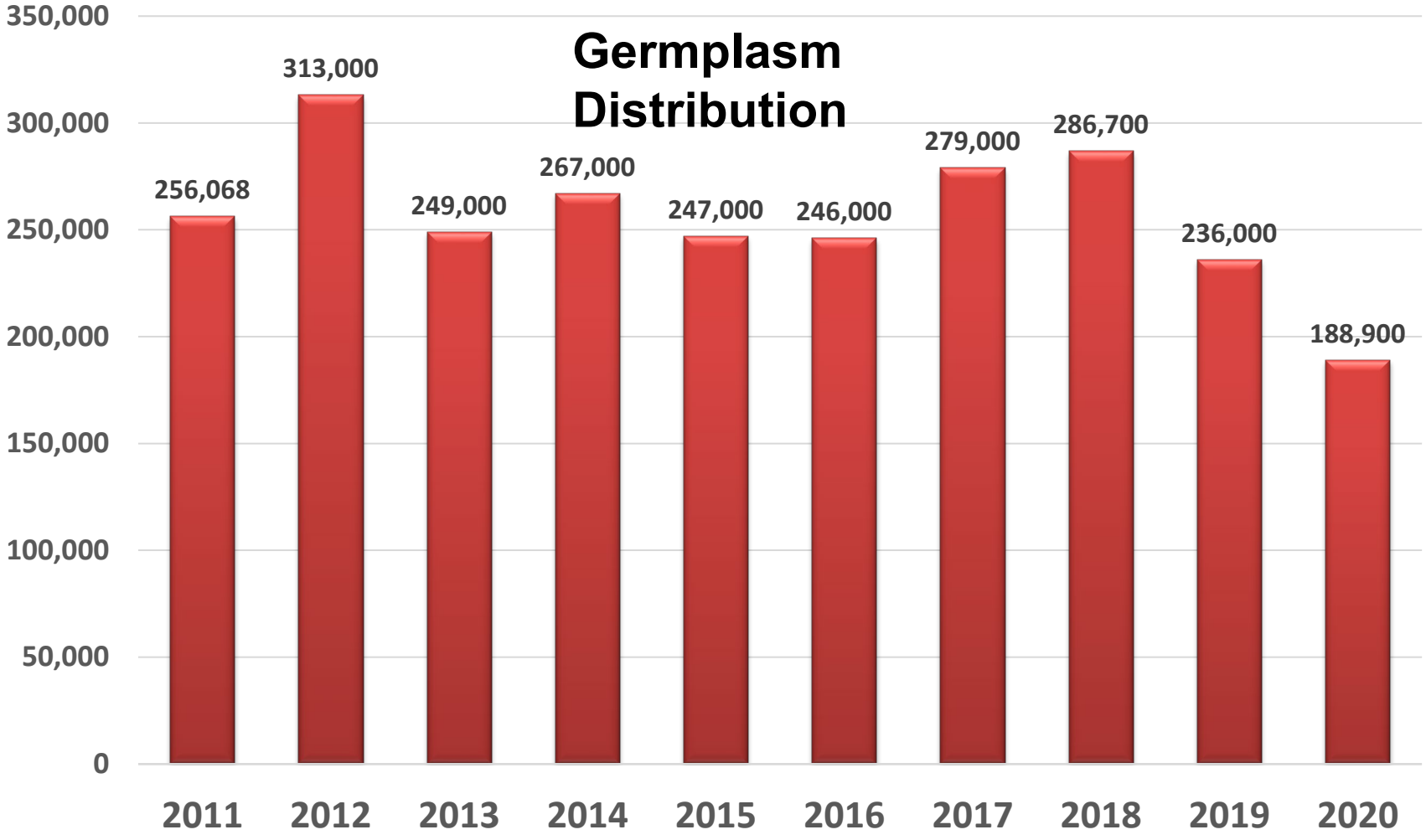
USDA National Plant Germplasm System (NPGS)



Number of NPGS Accessions 2011-2020



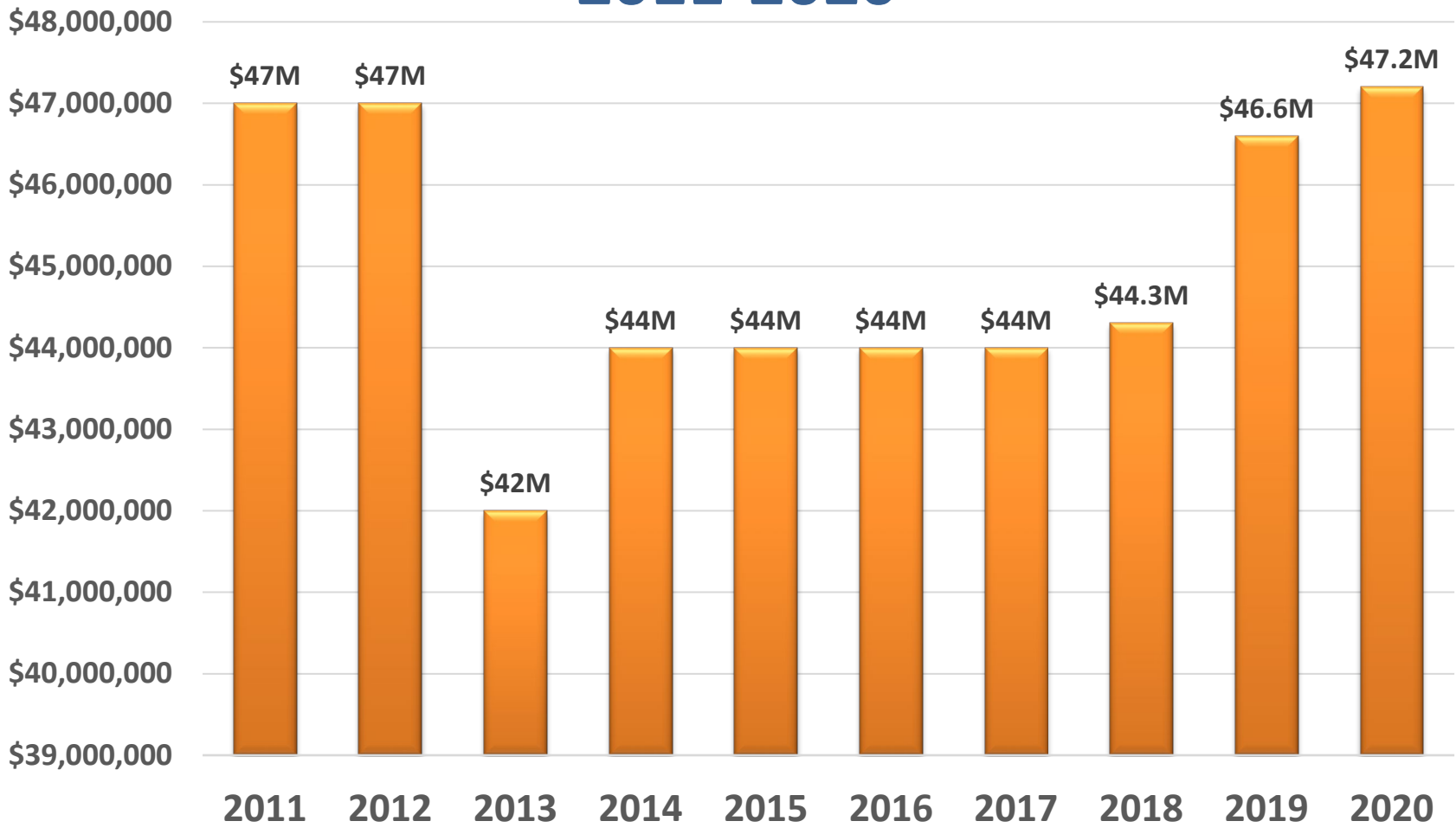
Demand for NPGS Germplasm 2011-2020



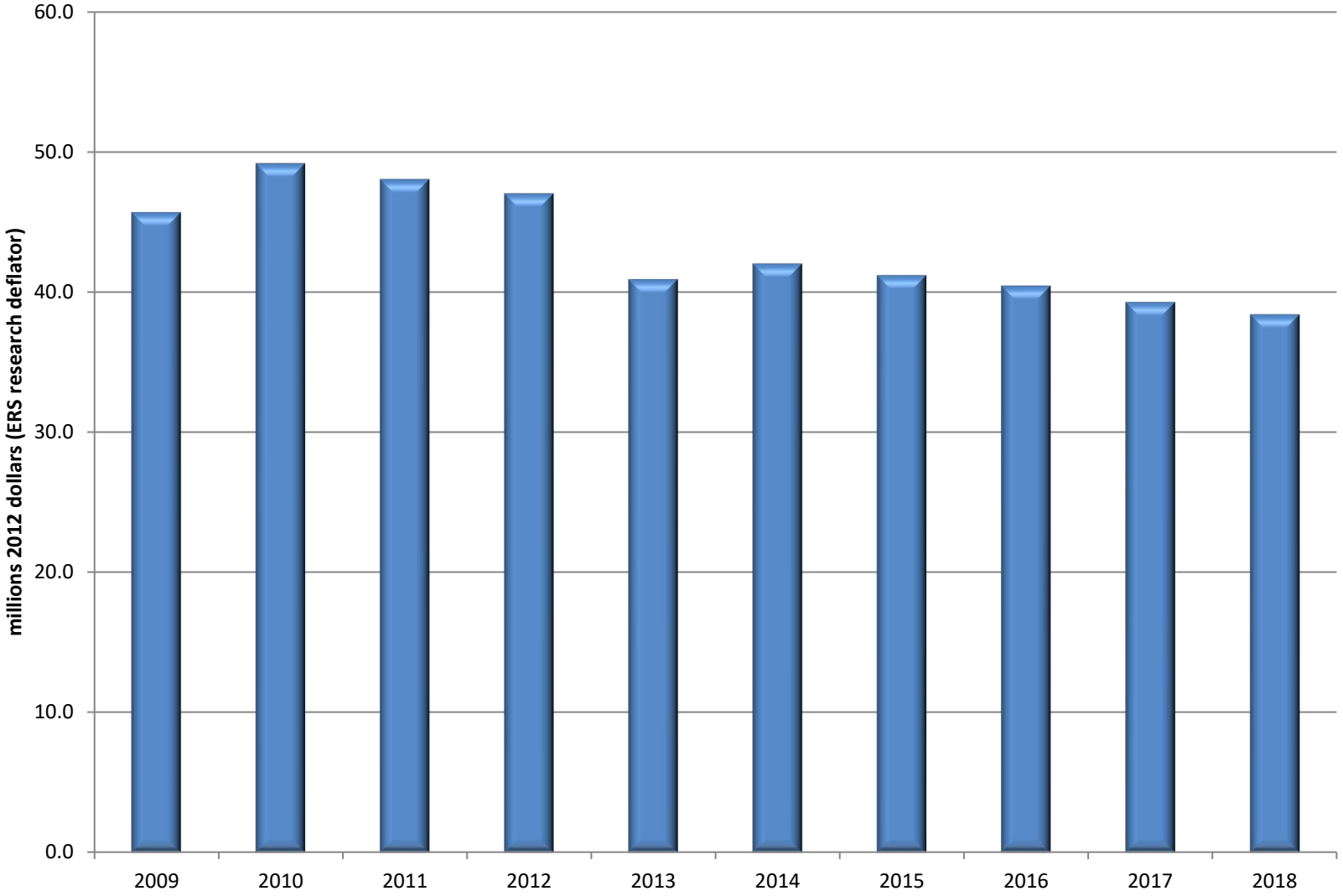
Effects of CoVID-19 as of October 2021

- **All NPGS genebanks are shipping germplasm (PGR).**
- **# of samples distributed fell by ca. 20% in 2020. The distribution rate in 2021 is slightly to significantly reduced.**
- **Operational status at genebanks ranges from fully to 50% operational. Some genebanks can hire temp (often student) labor, some can hire fewer than usual, and others cannot hire at all. Most genebanks have planted regeneration plots in the field or GH. Some cannot yet resume normal indoor laboratory or seed processing operations.**
- **During the pandemic, some genebanks accomplished more information management tasks than in prior years, whereas others didn't.**
- **GRIN-Global has functioned normally throughout.**

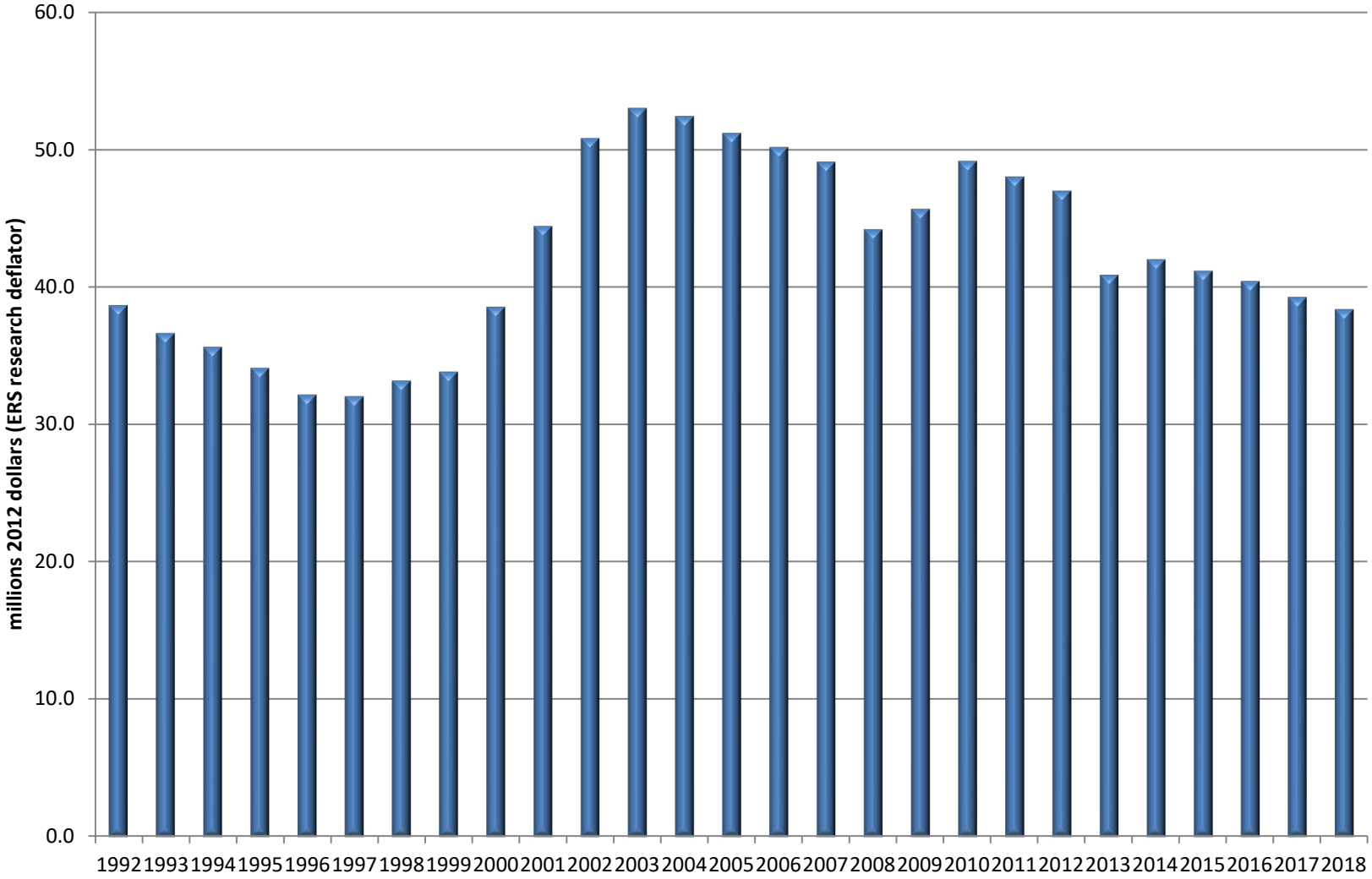
ARS National Plant Germplasm System Budget 2011-2020



ARS NPGS real (deflated) budget, 2009-2018



ARS NPGS real (deflated) budget, 1992-2018



Some key challenges for the NPGS

- **Expanding the NPGS operational capacity and infrastructure to reduce PGR management backlogs and meet increased demand for PGR 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 and some seed PGR.**
- **BMPs and procedures for managing accessions (and breeding stocks) with GE traits and the occurrence of adventitious presence (AP).**
- **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

Personnel Changes

- Farewell and best wishes to Candice Gardner, RL (ARS-Ames); John Preece, RL (ARS-Davis and Parlier); Esther Peregrine, Soybean Assistant Curator, (ARS-Urbana); Joanne Labate, Vegetable Curator (ARS-Geneva); and Max Martin, Research Program Manager (UWisconsin, Sturgeon Bay).
- Welcome and best wishes to Dave Peters, RL, and Colleen Warfield, Plant Pathologist (ARS-Ames); Jeff Gustin, Maize Genetic Stock Curator (ARS-Urbana); Adam Mahan, Soybean Curator (ARS-Urbana); Zach Stansell, Hemp and Vegetable Curator and Erin Galarneau, Grape Curator (ARS-Geneva); Madhugiri Nageswara-Rao, Tropical Ornamental Curator (ARS-Miami) and Gul Shad Ali, Tropical Crops Curator (ARS-Miami), Lauri Reinhold, Curator (ARS-Corvallis) and Anne Frances, Botanist (ARS-Beltsville).
- We are recruiting staff at Davis, CA; Hilo, HI; Pullman, WA; Riverside, CA; College Station, TX; 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.**
- **The effort has culminated in a new 1-credit Colorado State online course Plant Genetic Resources: Genomes, Genebanks, and Growers, offered for the first time in Aug.-Sept. 2021. http://pgrcourse.colostate.edu/**
- **PGR training/educational materials are freely accessible from GRIN-Global 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 20-21 ARS NPGS Budgetary Increases

- **Small grains PGR ($190,000): Aberdeen, ID.**
- ***Vaccinium* PGR ($150,000): Corvallis, OR.**
- **Hemp PGR ($1.35 million): Geneva, NY.**
- **Pecan PGR ($400,000): College Station**

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.**

USDA-ARS
National Germplasm Resources Laboratory
Beltsville, Maryland
2021 Report to PGOC, RTACs, and CGCs

The National Germplasm Resources Laboratory (NGRL) supports the acquisition, introduction, documentation, evaluation, and distribution of germplasm by the National Plant Germplasm System (NPGS) and other components of the U.S. National Genetic Resources Program (NGRP). The Laboratory is comprised of the Plant Exchange Office (PEO), the Database Management Unit (DBMU), and the Plant Disease Research Unit (PDRU).

NGRL was fortunate to onboard two new permanent employees (Program Support Assistant, Biological Science Laboratory Technician) and one temporary employee (ARS funded Postdoctoral Research Associate) during the 2020 coronavirus pandemic.

There are three permanent positions currently vacant in NGRL, including a Botanist position in the PEO that should open for applications in late January 2021.

Plant Exchange Office

Plant Exploration and Exchange Program:

- The PEO supports the collection of germplasm for the NPGS through the management of a Plant Exploration and Exchange Program. Guidelines for developing plant exploration and exchange proposals will be distributed to CGC chairs in February 2021. Proposals must be endorsed by the appropriate CGC or other crop experts.
- The deadline for submitting proposals for explorations or exchanges to be conducted in FY 2022 is July 30, 2021.
- All foreign explorations supported by PEO comply with the principles in the Convention on Biological Diversity covering access and benefit sharing related to genetic resources. Prior informed consent to collect genetic resources is obtained from the host country before the exploration. The PEO is involved in most requests to foreign governments for permission to collect and negotiates the terms of agreements when necessary.
- All explorations originally scheduled for FY 2020 were postponed because of the pandemic. They will be rescheduled when conditions are considered safe. Proposals for two domestic explorations, *Helianthus.* spp. in California and *Lupinus polyphyllus* in Washington, were submitted mid-year and supported.

Collaboration on Crop Wild Relatives in the U.S.:

Borderland Restoration Network, the U.S. Forest Service (USFS) and the NGRL continued collaboration on documentation and collection of germplasm of crop wild relatives (CWR) in the Wild Chile Botanical Area (WCBA) in the Coronado National Forest, AZ and surrounding areas. In 2020, germplasm was collected of nine taxa of CWR. Additional collections are planned for

2021. In addition to collection and conservation of germplasm, the project is documenting the occurrence and status of many CWR in the WCBA, which is a candidate for designation as an *in situ* reserve for CWR under the USFS/ARS Strategic Framework on the Conservation and use of Native CWR in the U.S.

GRIN Taxonomy for Plants:

- GRIN Taxonomy, available through GRIN-Global (https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomyquery.aspx), provides online current and accurate scientific names and other taxonomic data for the NPGS and other worldwide users. This standard set of plant names is essential for effective management of ARS plant germplasm collections, which now represent ca. 16,000 taxa. A broad range of economically important plants is supported by GRIN nomenclature, including food, spice, timber, fiber, drug, forage, soil-building or erosion-control, genetic resource, poisonous, weedy, and ornamental plants.
- GRIN Taxonomy includes scientific names for 27,660 genera (14,502 accepted) and 1,422 infra-genera (1,360 accepted) and 121,730 species or infra-species (66,764 accepted), with over 67,614 common names, geographical distributions for 60,495 taxa, 486,031 literature references, and 32,996 economic importance records. These numbers increase regularly.
- Since 2008, a project to provide thorough coverage of wild relatives of all major and minor crops in GRIN Taxonomy has been underway. We have completed our initial work on 241 major and minor crops from 120 genera, and CWR from 4013 taxa have been mapped to these crops and others under progress. An interface to query these data is available (https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearchcwr.aspx). We invite feedback from NPGS curators and CGC members for those CWR classifications already developed. A new CWR page was released in 2020 to allow users to search for trait class and breeding type data contributed by the Global Crop Diversity Trust.

Facilitation of Germplasm Exchange:

The PEO helps expedite the distribution of germplasm from the NPGS to foreign scientists and international genebanks through a long-standing collaboration with USDA-APHIS at Building 580, BARC-East in Beltsville. The past year presented many challenges for distributions, including country closures due to the pandemic, lack of a full-time APHIS inspector for much of the time, and changes in the regulations for germplasm importation to E.U. countries.

In 2020, 568 public orders containing a total of 44,803 samples of NPGS accessions were shipped from Beltsville to individuals in 63 countries around the world for research and education. In addition, PEO facilitated the agricultural inspection of arriving germplasm shipments containing accessions from numerous foreign countries for researchers and curators at NPGS sites.

Crop Germplasm Committees:

- The two separate Alfalfa and Clover/Specialty Legume CGCs merged in June 2020 to form a single committee, Forage Legumes CGC.

- Most committees continue to meet regularly and are active, although the pandemic created a challenging situation in 2020 especially for committees that typically meet in person. Committees are particularly urged to update their Crop Vulnerability Statements and several CGCs recently completed new versions.
- A virtual meeting/web conference for CGC Chairs will occur February 22, 2021. A CGC Chairs meeting was not held in 2020.
- NGRL has a Zoom conferencing account that is available to the CGCs to use for hosting virtual meetings.
- Please send updates to the individual crop committees of the CGC page on GRIN (https://www.ars-grin.gov/CGC) to Gary Kinard.

Database Management Unit

GRIN and GRIN-Global:

- At the time of this report, the GRIN-Global plant database included the following:

  597,615 active accessions representing 16,156 species and 2,549 genera
  3,423,201 inventory records
  2,084,799 germination records
  8,552,139 characteristic/evaluation records
  1,298,174 digitized images and other attachment records

Many of these numbers increase almost daily.

- The entire GRIN platform (all databases and informational pages) were migrated from in-house servers to the Microsoft Azure cloud in September 2019. At that time, the GRIN home page (www.ars-grin.gov) was totally redesigned with new navigation for the ARS genetic resource collection informational pages, the Crop Germplasm Committee pages and the content for the National Genetic Resources Advisory Council.
- A new version of the NPGS public facing GRIN-Global website was released in August 2020. It features revised approaches and display pages for accession and descriptor searches and results. Some revisions to GRIN Taxonomy were also published, including new Simple Query and Crop Wild Relatives pages. Additional improvements in GRIN Taxonomy are slated for 2021.
- Current information about the project, including user documentation and release notes from each version of the software, can be found on the project website at https://www.grin-global.org/.

Plant Disease Research Unit

The PDRU conducts research on pathogens that infect clonally propagated prohibited genus (i.e., quarantine) plant germplasm, including their etiology, detection, and elimination by therapeutic procedures. This project provides direct support to the APHIS Plant Germplasm Quarantine Program and helps facilitate the safe introduction, conservation, and international exchange of

valuable plant germplasm. PDRU also collaborates on virus related problems with NPGS germplasm repositories, state departments of agriculture, and university scientists. Additional updates will be provided for those committees whose crops are within the scope this project's research.

Key NGRL Contacts

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PLANT GENETIC RESOURCES UNIT REPORT TO THE APPLE CGC

October 15, 2021

Ben Gutierrez, Tori Meakem, John Keeton, Dawn Dellefave, and Gan-Yuan Zhong

OPERATIONS

The PGRU Clonal team operates with Gan-Yuan Zhong (lead scientist), Erin Galarneau (*Vitis* curator), Ben Gutierrez (Apple/Tart Cherry curator), Dawn Dellefave (program support/database manager), Tori Meakem (Molecular Biologist), John Keeton (farm manager), and four permanent field technicians, with USDA-ARS PGRU and NE9 funding. PGRU field team has one incoming field technician, Scott Hoffmann. PGRU hosted three interns in 2021 who worked on russeting in apple, sieboldin in apple, tart cherry characterization, and developing the Impact Statements for PGRU crops. John Keeton announced his retirement, effective November 29, 2021. We are communicating with Cornell leadership to announce and fill this position.

Currently, PGRU is still operating through maximized telework to comply with national and statewide measures to decrease the spread of Covid-19. Current guidance accommodates 25% capacity in USDA buildings, but field work is fully permitted. Phased return for the USDA is expected to start on January 1, 2022.

FIELD PROJECTS

To improve drainage on PGRU farms, close to 5000ft of drainage tile was installed/repaired on the Wellington (Vegetable) and McCarthy (Clonal) farms and the grass waterway was extended from the apple collection. Though the main goal was to improve land for the Vegetable and Hemp projects, this will significantly improve part of the apple orchard which is waterlogged throughout the summer. PGRU will next initiate a drainage project on the McCarthy farm (E7 block, rows 13-16) to improve growing conditions for apple near the T-ditch.

To reduce deer damage and improve security of the farms, PGRU is working with Cornell leadership to install 10,560 lineal feet of 8’ deer fencing. Removal of hedge rows and existing fence is underway, and the new fence will be installed November 2021.

FIRE BLIGHT

The vulnerability of the USDA NPGS Apple Collection was evident during an outbreak of fire blight in 2020. Fire blight is caused by the bacterium *Erwinia amylovora*, and trees are typically treated with the antibiotic streptomycin during infection periods. After observing mild to severe fire blight symptoms throughout the collection despite chemical treatments, a streptomycin-resistant strain of *E. amylovora* was identified. Apples vary in their response to fire blight ranging from highly susceptible to disease resistant, and we observed a broad phenotypic response to the 2020 outbreak. By June 2020, fire blight severity ranged from 0 to 85.7% with an average severity of 17.4%. These evaluations were described by Dougherty et al. (2021) and will be uploaded to GRIN-Global.

In collaboration with fire blight specialists at Cornell University, we modified our management program for apple to account for streptomycin-resistance, including Kasumin, Blossom Protect, alternating applications of copper and Apogee every 7-14 days. We conservatively propagated 268 accessions in 2020 and 303 accession in 2021 which had severe infection or were heavily pruned. Of the

268 selected in 2020, 152 accessions were changed from SICK to AVAILABLE (healthy) in 2021, suggesting many trees had survived and outgrew infection. Accession success rate in 2020 was 54%.

ROOTSTOCK EVALUATION

PGRU and the Apple CGC have discussed the potential conversion of the USDA NPGS Apple Collection to a superior rootstock. Since the early 2000s, PGRU has used 'EMLA7 rootstocks which have moderate resistance to fire blight but produces many root suckers that require annual maintenance including chemical control and pruning. Recently, PGRU has trialed G.210 and G.890, semi-dwarf rootstocks with high fire blight resistance. Field staff has reported poor anchorage with G.210 grafted trees and compatibility issues with G.890. However, no thorough evaluation was conducted.

PGRU grafting success rates are determined as the number of surviving trees compared to the number total number of grafted trees. PGRU accession success rates are determined as the percentage of accessions with at least one surviving tree, although this may be updated to at least two surviving trees. Accession and grafting success rates low and highly variable each year (Table 1). In contrast to commercial nurseries, our grafting effort focus on weak or diseased trees, and we anticipate a lower success rate compared to industry standards. However, we seek to improve and stabilize our propagation efforts where possible.

Table 1. USDA-ARS Plant Genetic Resources 1st year nursery data for *Malus* propagation across five years. Success rate is the percentage of surviving trees/number of total grafted trees. Accession success rate is the percentage of accessions with at least one tree successfully propagated.

Year	Rootstock	No. Trees Grafted	No. Trees Survived	Grafting Success Rate	No. Accessions Grafted	No. Accessions Survived	Accession Success Rate
2021	EMLA7	780	261	33%	268	144	54%
2020	EMLA7	654	364	56%	218	169	46%
	G.890	81	74	91%	27	27	100%
2019	EMLA7	247	135	55%	70	49	70%
	G.890	29	16	55%	15	10	66%
2017	EMLA7	14	11	79%	14	11	79%
	G.210	184	80	43%	59	38	33%
2016	EMLA7	140	39	28%	60	24	40%
	G.210	739	360	49%	181	137	76%

Maintenance and disease and pest management are a primary concern, but PGRU is also exploring ways to save field space and increase replication within the collection. The following are aspects in which a superior rootstock could enhance the USDA Apple collection:

- Improved tolerance to biotic and abiotic stress
- Improved grafting success rate and tree survivability during repropagation
- Reduced root suckering to decrease annual maintenance
- Reduced tree size to accommodate two trees per accession, while reducing the space between accessions

PGRU will systematically test multiple candidate rootstocks against a diverse panel of apple cultivars and wild *Malus* accessions to determine the best management practices for apple propagation and

preservation**.** We will pursue this project using PGRU base funds with insight from Dr. Gennaro Fazio; Dr. Oscar Hurtado-Gonzales; Dr. Susan Brown; and Dr. Awais Khan.

NEW ACCESSIONS

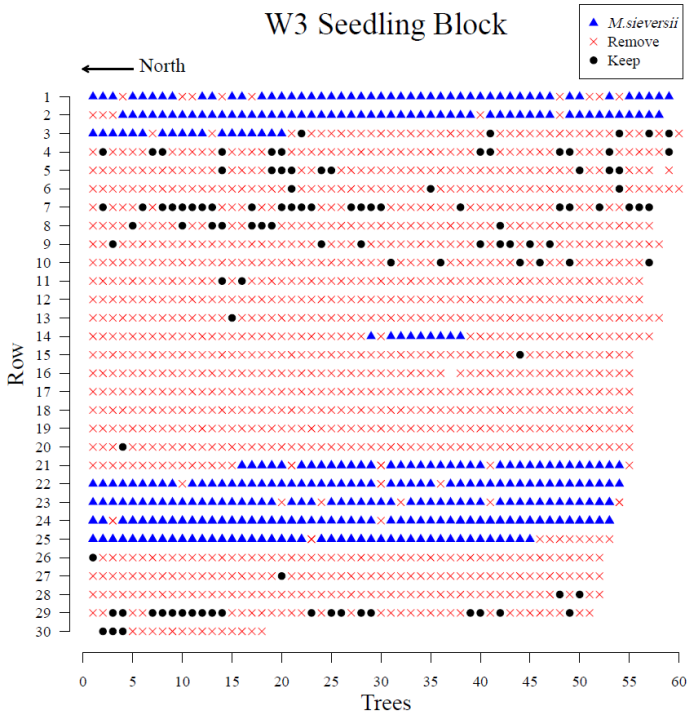
We received 16 new accessions from Joseph Postman and the Lost Apple Project listed below. GMAL numbers assigned and will be entered into GRIN once established.

Airlie Red Flesh	Kings Valley Russeted Seedling	Newtown	Sary Sinap
Bietigheimer	Knobbed Russet	Porter's Perfection	Sheepnose
Bills Red Flesh	Duchess Of Oldenburg	Russet Pearmain	Tompkin's King
Colorado Orange	Ginger Gold	Scarlet Surprise	Zabergau Reinnette

STATUS OF W3 BLOCK

We are moving forward on partial removal of the W3 seedling block this fall/winter 2021. Of the 1,633 trees, we have made 245 selections and are propagating those trees for permanent maintenance. This summer we planted 115 into the permanent orchard, but still have 106 selections to propagate. SNP data was generated for the *M. sieversii* (n=394), and we will make further selection. We are planning to remove 1,171 trees (see figure 1), while preserving our remaining targets and the *M. sieversii*. This will drastically reduce the maintenance burden and hopefully improve the health of the remainingW3 trees so we can more easily propagate them. In addition, we have 158 of the original 260 seed lots, and 114 of them have > 50 seeds, though viability is uncertain. Based on the repropagation and remaining seed lots, we are confident we will not lose valuable genetic resources by removing this block.

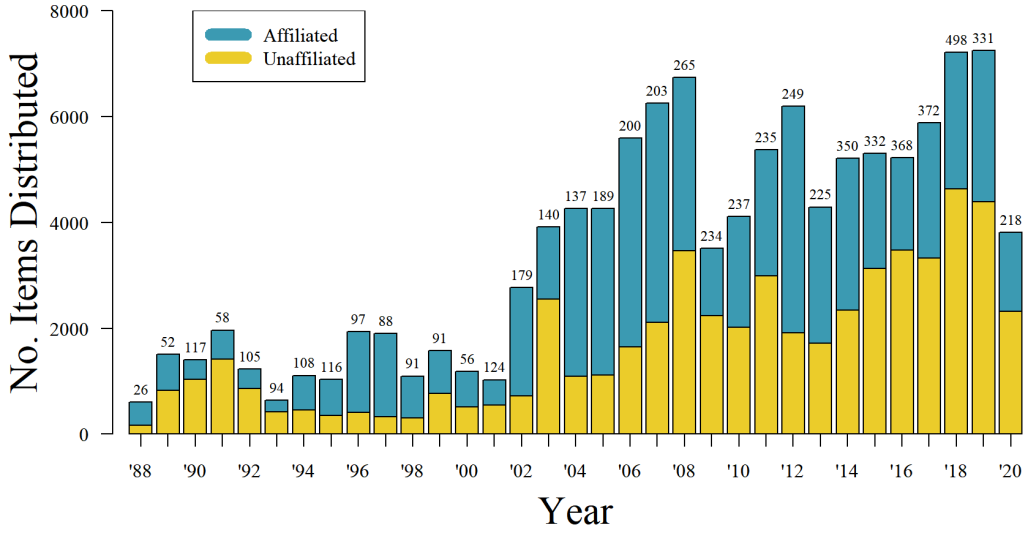
Figure 1. Schematic of W3 seedling block, with indicators for which trees to keep (black dot), remove (red Xs), and the *M. sieversii* seedlings to evaluate (blue triangle).



GERMPLASM REQUESTS AND DISTRIBUTION

In response to the fire blight outbreak, distribution of apple germplasm was significantly reduced (figure 2). Over the past five years, PGRU distributed an average of 6,176 items to 380 requestors annually. In 2020, only 218 orders were completed, and 3,537 items were distributed. The number of germplasm requests soared in 2020 across all NPGS sites. The number of web requests was 1,052 in 2020, a significant increase from 2019's 651 web requests. The DBMU developed a Non-Research Request (NRR) tool to flag and uniformly handle germplasm requests that are not legitimate requests according to the mission of the National Plant Germplasm System (NPGS). This will hopefully reduce the burden of NRRs on NPGS staff.

Figure 2. Number of items distributed from the *Malus* collection from 1988 to 2020 separated by Research (blue) and Unaffiliated (yellow) recipients. Total number of requests indicated above bar



CHARACTERIZATION

Fruit quality was significantly reduced this season due to heavy use of copper, Apogee, and sulfur to better manage fire blight. Heavy russeting, spotting, and smaller than typical fruit was observed on most accessions. As such, PGRU did not do routine fruit characterization. With Gayle Volk, we collected fruit weights and images of 367 accessions from wild and hybrid species to fill gaps in documentation and aid in future taxonomic identification. These will be uploaded to GRIN-Global soon.

GRIN-GLOBAL and PUBLICATIONS

Publications featuring the USDA NPGS Apple collection can be documented in GRIN-Global under the crop citation page, including links to accessions utilized. This is a useful resource for replicating studies and enhanced utilization of apple germplasm, but severely lacking for apple. PGRU is trying to improve citation page for apple but is challenging to track many do not report back on their use of the collection and is not something that is always searchable in the literature. One example is the famous apple genome paper by Velasco et al. (2010), which used PGRU germplasm, but the accession info is

buried in supplemental data. Here are some examples of how these GRIN-Global citations can link the literature with the accessions:

- **Dougherty L, Zhu Y, Xu K.** 2016. Assessing the allelotypic effect of two aminocyclopropane carboxylic acid synthase-encoding genes MdACS1 and MdACS3a on fruit ethylene production and softening in *Malus*. Hort. Res. 3:16024
  DOI: https://doi.org/10.1038/hortres.2016.24. **Note:** ISSN 2052-7276 (online) **Number of accession(s) cited:** 951

Even phenotypic data on the from publications can be incorporated into GRIN-Global. See the Cider.Apple.Classification.Peck.2021 dataset associated with the following citation.

- **Kumar SK, Wojtyna N, Dougherty L, Xu K, Peck G.** 2021. Classifying cider apple germplasm using genetic markers for fruit acidity. J. Amer. Soc. Hort. Sci.
  DOI: https://doi.org/10.21273/JASHS05056-21. **Number of accession(s) cited:** 217

PGRU WEBSITE

PGRU hosted a virtual intern, whose primary task was to improve PGRU's website and develop content about our collections. We added a Diversity Collections tab to our landing page so the public could more easily find more information about our crops. Additionally, we included links to GRIN-Global pages that are sometimes difficult to find.

https://www.ars.usda.gov/northeast-area/geneva-ny/plant-genetic-resources-unit-pgru/

IMPACT STATEMENT

PGRU distributed a new draft of the Apple Impact Statement. For now, the goal is to include the information PGRU's website, under the apple crop page. Please review and contribute to any weak or missing parts. The statement is lacking some relevant impacts by the breeding and research community. Narratives about how the material from the collection has benefited your research or contributed to the apple industry would substantially improve our statement.

Cryopreservation of Apple Dormant Buds

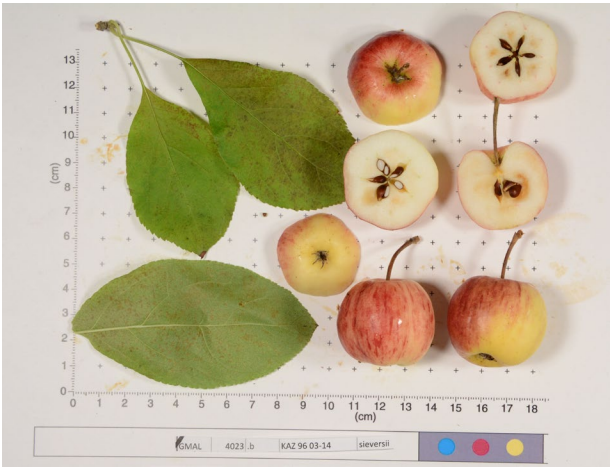
Prior to 2021: 2052 apple accessions were backed up as dormant buds at NLGRP

2021: 83 accessions were cryopreserved at NLGRP and grafted in Geneva

- 36 are now fully backed-up at NLGRP
- 40 met the 40% viability standard, but not enough material was sent for processing—additional could be processed at some point

2022: aim to cryopreserve 100 apple accessions as dormant buds

- Provided images & average fruit weights for 295 accessions of wild *Malus* taxa to be uploaded to GRIN-Global
- For use in confirming species identities



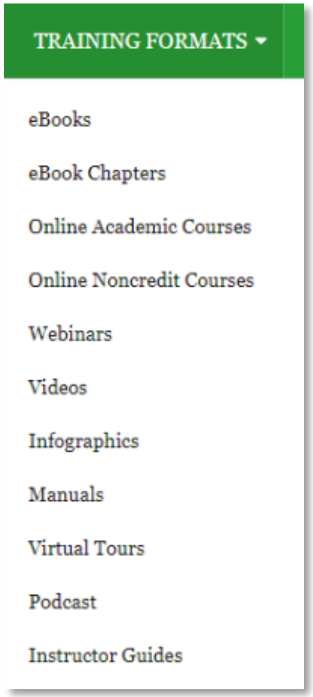
Malus sieversii

Online Learning:
Plant Genetic Resources Management and Use

- Three 1 credit online courses offered through Colorado State Univ, Fall 2022
- GRIN.U.Education YouTube site
- Training materials are freely available through GRIN-U.org

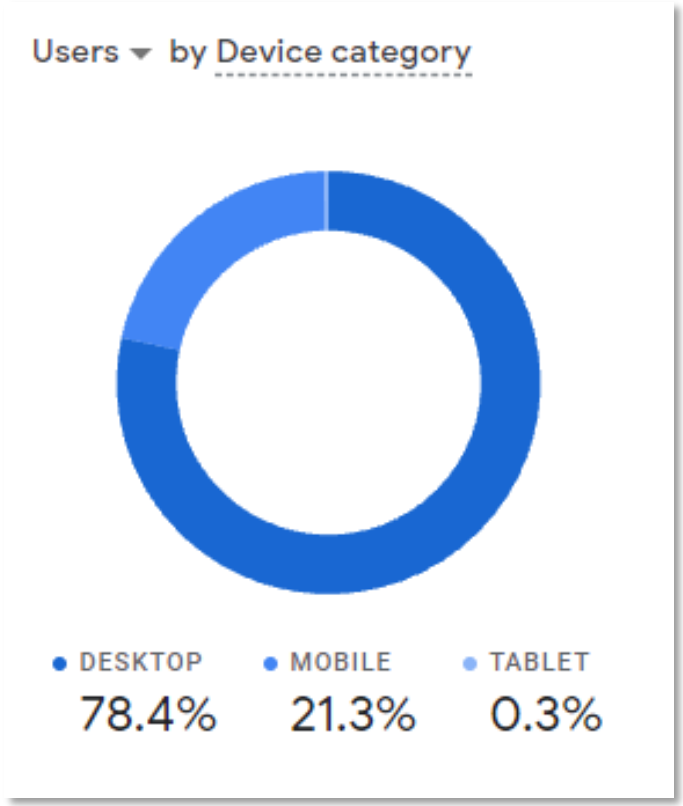
GRIN-U.org

- Launched July 2021
- 88 searchable items to date

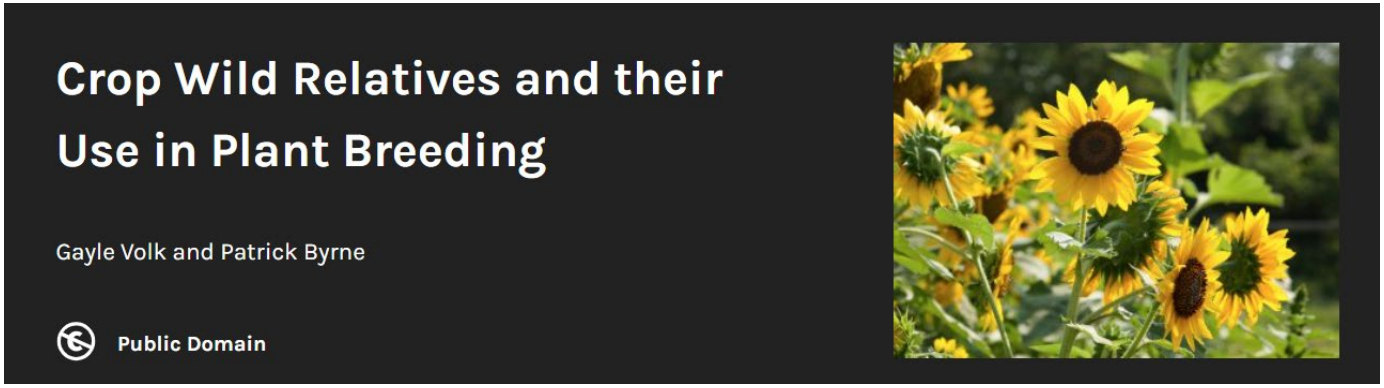


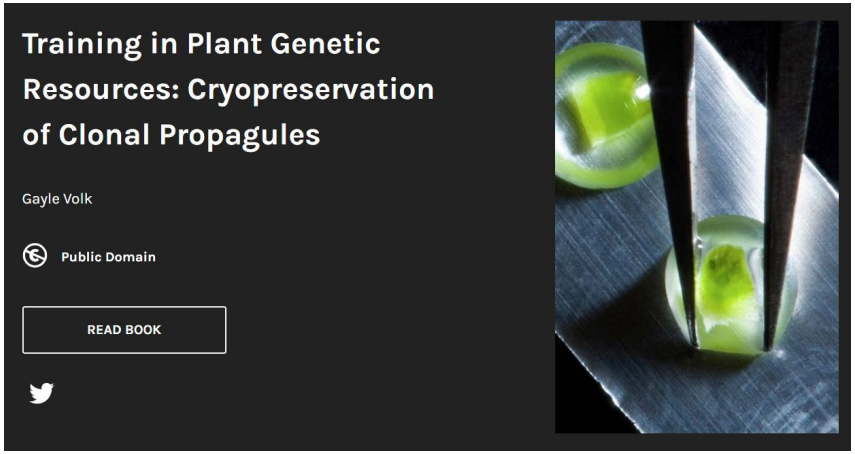
- 300 unique users to date

COUNTRY	USERS
United States	194
China	29
Canada	9
India	6
Brazil	5
Japan	5
Spain	5



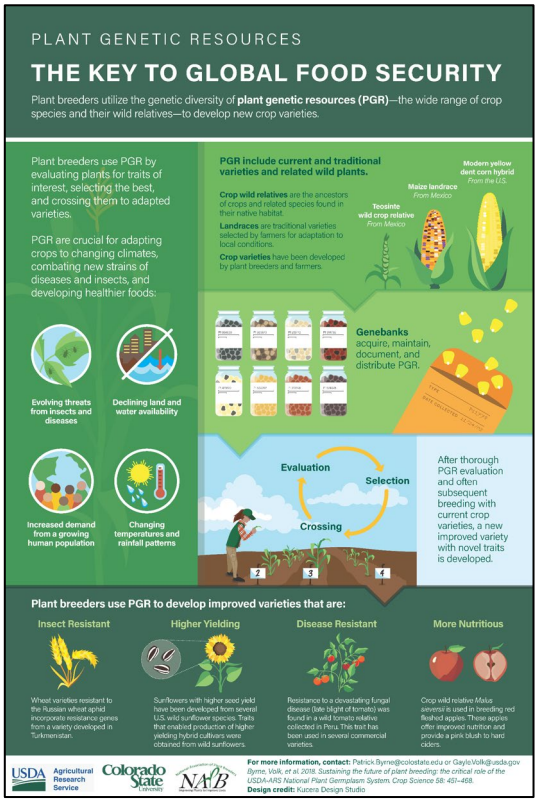
Public Ebooks

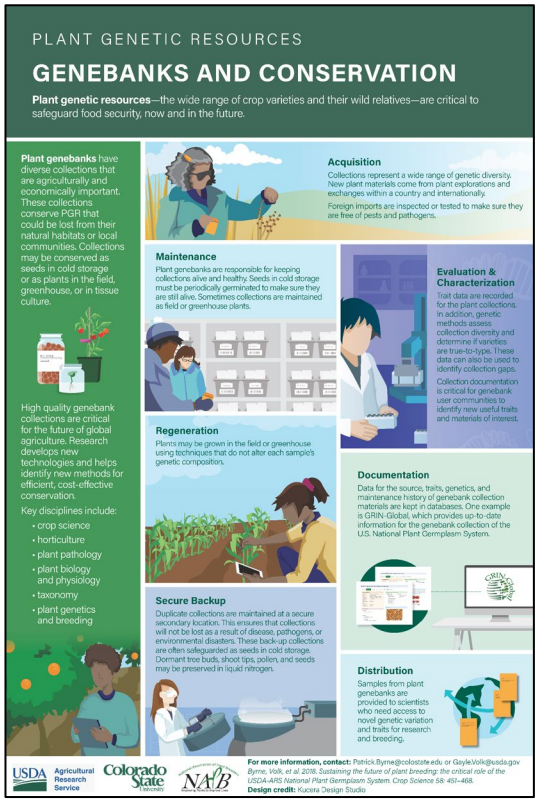


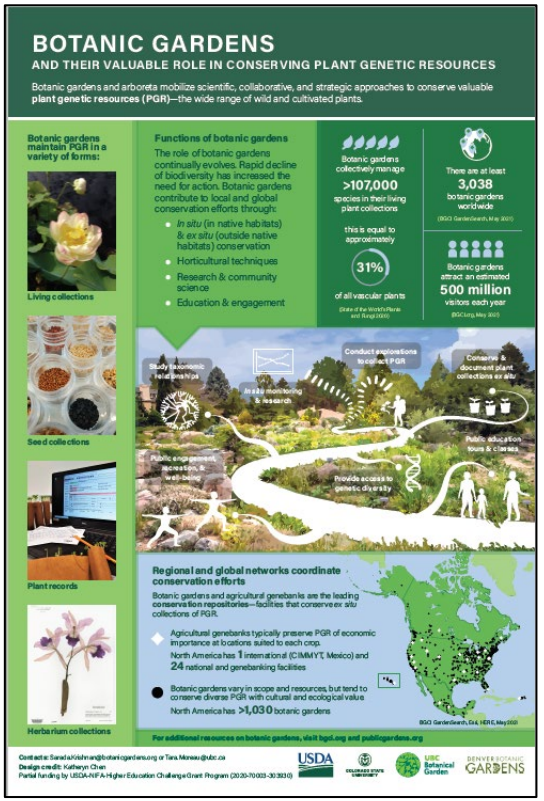


- Apple dormant bud and shoot tip cryopreservation
- Webinar about the Apple collection by Ben G.

Infographics







Future infographic: PGR and the NPGS