2018 PRUNUS CGC MEETING - MINUTES
June 6, 2018
National Clonal Germplasm Repository
Davis, CA

- **8:00 am (PST)** – **Call to Order** – Ksenija Gasic
    - **Roll Call –** Ksenija Gasic, John Preece, T. Gradziel, A. Iezzoni, Carolyn DeBuse, C. Peace, C. Chen, M. Pooler, J. Foster, T. Chao, M. Worthington, Malli Aradhaya
    - P. Bretting, G. Kinard, G. Volk excused
- **Introductions**
- **Formal election of new committee members and information update** – Ksenija Gasic – Chair until 2018,
    - *K. Gasic nominated Chunxian Chen for a Secretary of the Prunus CGC*
    - *Elected unanimously*
    - *Still need to elect Vice –Chair – decision was made to wait till next year, elect Secretary and then the full roster will be in place. K. Gasic will stay in the Chair role until 2020 annual meeting when Chen will take over as a Chair.*
    - *M. Worthington is willing to be nominated for a Secretary next year and join the executive.*
- **Acceptance of the Minutes from 2017 annual meeting –** *after correcting Chen's name minutes accepted unanimously*
- **Office of National Programs Report** – Peter Bretting
    - *P. Bretting provided report and J. Preece presented it in Peter's absence. Location of the GeneBanks with superimposed cold hardiness map; Collection growth from 2008 – 2017, number of accessions are growing across whole system; germplasm distribution after initial increase flattened due to change in policy to distribute the material only to a scientific community and not general public; budget is flat, operating budget is decreasing due to reallocation of the money to address cost of living budgets.* ***Key challenges****: accession acquisition, budget decreasing or flat, many of curators retiring in the next 5-10 years, cryopreservation of the clonal material collections, no reliable system; no genetically engineered accession in the Davis collection; acquiring and conserving additional germplasm especially crop wild relatives, real challenge for Prunus; priority list heat map in order of importance, acquisition – not actively seeking new acquisitions but still receiving material; maintenance -*

becoming a challenge because of reduced resources, more in Davis report; ***personnel changes*** *– retirements: R. Percy from College Station, TX, R. Nelson from Urbana, IL, and G. Pederson Plant introduction Station in Griffin GA, expectation is that this trend will continue. M. Harrison promoted to RL and taking over G. Peterson position (Griffin); farewell for M. Spinks GRIN Global information management from Griffin; and welcome to M. Schori new plant taxonomist for GRIN Taxonomy at NGRL, Beltsville; 1/3 of NPGS PGR managers could retire within 5 years; meeting at Ft. Collins G. Volk and P. Byrne to discuss how to design and develop distance training program for PGR management;*

- **National Germplasm Resources Laboratory Report** – *Gary Kinard report given by J. Preece, also shared with the membership via email*
    - *NGRL supports gene banks and is in charge of the fllwoing: plant exchange, Davis collection/Prunus CGC recognize the value of increasing wild relative germplasm of Prunus but there is no space in Davis collection to put new material therefore no collecting trip are planned in the near future; there are still accessions in the pipeline (quarantine) that are coming out yearly and those are accommodated in the collection (J. Preece comment). Information about exploration and exchange of material provided in the report; collaboration on crop wild relatives in the US; discovery and documentation of historical plant introductions; GRIN Taxonomy for plants; GRIN Global test link provided and comments welcomed; facilitation of the germplasm exchange and agricultural inspection; CGC section in GRIN underwent a minor face lift, updates to the individual crop CGC section should be sent to Gary Kinard ; NGRL has a WebEx conferencing account that is available to CGCs to host virtual meetings (teleconference and/or webinar). K. Gasic – we need to work on updating crop vulnerability statement to mirror the structure required; CGC chair meeting held in January 2018; information on Plant Disease Research Unit (PDRU) and key NGRL contacts were provided.*

- **NCGR-Davis Report** – John Preece and Carolyn DeBuse
    - *JPreece, streamlined the report to showcase the research that is going on, active research grants, and publications. Stable on the permanent staff, no longer has 2 student positions due to a budget shortage; loosing student position at Wolfskill in September 2018 due to budget; service reduced with not servicing request from general public; allows better communication with the researchers; most of the orders were domestic, 15 international; $35 phytosanitary fee for all orders is cutting in the discretionary budget; A, Iezzoni do the phytosanitary reports ever report anything? Carolyn not really because the pathogens they are looking for are not present or the material is pre-selected to be healthy. Biggest group that received the orders were US individuals (e.g. University researchers, U.S> federal agencies. Order can be from 2 to over 400 items. Internationally INRA and Bordeaux are the major requestors of the material; fruit orders, seed and*

pollen sent for cryo; increase in the number of orders and items shared. Awareness of the importance of the collection is growing. Increase the number of accessions due to a release through quarantine and material form UC Davis collection that was removed; 34 new accessions from 10 species obtained in 2017/2018, collected in 2007/2008; number of accession does not reflect the number of trees, usually 10 seeds under the seedling accession # that are all planted in the collection and evaluated. Major challenges are for collection maintenance and propagation; in 2017 plum. Cherry and almond block mechanically hedged, apricot block hand pruned and peach collection has not been pruned due to a lack of money; re-propagated almond collection due to Armillaria killing the trees, no land to plant it together so they are planted in two areas; Deer browsing is beginning to be a problem with establishing new Prunus. Armillaria is becoming to be the problem for collection;

- *Carolyn DeBuse presented current state of the Prunus collection; seedlings come bare rooted in groups of 10 from quarantine and are temporarily very closely, some tolerate it well some don't; they are evaluated and final 5 selected to keep in the collection.727 seedling families with 1,533 trees planted, space left for 250 trees; GRIN Global does not reflect how many seedlings exist under the accession umber; the new material is not yet in GRIN because there is need to figure out how to enter them in the GRIN to have access to the information for the individual trees. Solution for this is a top priority. There is no land to move the trees from the temporary place to permanent so the temporary space is becoming permanent; order number decreased but the item # per der is increasing; Carolyn is the one that collects material so sometimes that creates the problem because labor shortage means that she is not able to answer each request; maintenance of the collection: 4,930 trees at Wolfskill plus a 1,000 in pots in Davis; trees in pots used to be a backup but now represent the only copy f the declining trees in the field; a lot of potted trees are main resource of the tree that declined in the field and died; ~100 different taxa; re-propagation of collection – peach done; working on re-propagation of apricot collection; started re-propagation of almond collection – no land to plant them so almonds were planted in the persimmon orchard; 97 accession that are re-propagated but there is not room to plant them were planted in mulberry collection in the empty space with one tree each due to a lack of space; persimmons need to be re-propagated as well; hedging used for plum block (both sides), cherries and almond (only one side); once hedged they will need to be controlled by hedging which might be a problem. 2016 and 2017 peaches were hand pruned, unfortunately 2018 there was no money to prune peaches and limbs are braking under the excess weight of fruit (Fig. 1);*

Fig. 1 Limb breaking in not pruned peach orchard in 2018 due to a lack of funds to hedge the collection

- *Carolyn pruned apricot collection and planted almond block and there was no labor to allocate to peach block pruning. There needs to be plan on how to deal with these collections to not jeopardize its survival. T. Gradziel hedging at the bloom time can help with the flower removal as well; J. Preece shrinking budget is the main problem and unless something happens this will be the case every year and will endanger the survival collection; Maybe start using small hedger for apricot during summer;*

Fig. 2 Severely hedged olive trees

- *One of the solution would be to severely hedge the trees (Fig. 2), might cause long term issues, and data collection is lost for a year; K. Gasic hedges peach seedlings in her breeding program in winter and summer; type of the hedger is important to be efficient for green and hard wood; potential to help is to include*

the line of funding in proposals for maintenance of trees in the collection to ensure that there are funds available for labor or even the equipment; J. Preece there is a labor available in the area surrounding collection we just need to have the funding to pay for using it; this is the crises that will not go away and we need to have a plan in place to prevent from it happening ever again

- *Big thank you for the excellent care Carolyn and Davis staff is providing to the collection under the budgetary constraints. There needs to be a plan on how to permanently solve this problem; T. Gradziel – it's come to the point that we are looking into how to save collection;*
- *K. Gasic will prepare the one-pag report on the urgency of the situation and propose to establish one time or short term funding line for clonal collections to improve equipment and/or acquire additional land. Researchers are asked to provide the success stories and showcase how material from germplasm collections was pivotal in solving the industry, and we are dealing with survival of the collection.*

- **NCGR-Geneva Report** – Thomas Chao
  - *Three things to report: cryo preservation of cherry samples in Ft. Collings; received cryo preserved wood to test in grafting; low viability of the receive material. No activity this year on this will be continued next year. About 200 request for tart cherry more than 7,000 for whole collection at Geneva. 3% of samples distributed are tart cherry; personnel changes - supervisor retirement after 40 years of service; there are about 1,600 vacancies in the entire USDA-ARS, partial permission to fill those position 1,762 positions ARS is trying to fill during this fiscal year until September, please spread the word. Ow is the health of the trees in the collection? Fine, trees are healthy no issues in Prunus. Difficulty and challenges in Geneva are similar to Davis with personnel retirements in the future.*
- **Cryopreservation of Prunus –** Maria Jenderek/Gayle Volk given by Carolyn DeBuse
  - *One way of preserving the collection, is to cryopreserve pollen. Cryo preservation of shoots from cherry is working very well; successfully cryo preserved almond peach and cherry seed; pollen adjusted for moisture content and put in the LN; pollen sent to K. Gasic to make crosses and test the viability after cryo; few trees selfed to test feasibility of using seeds to preserve the collection (how well seeds represent the source tree); K/ Gasic performed crosses with the cryo pollen, 6 different pollen vials received; about 100 flowers were pollinated per pollen vial, spring conditions in the spring reduced the fruit set so there are not many fruits, will repeat the pollination next year.*
- **APHIS Report** – Joseph Foster – APHIS report

- *In charge of the quarantine lab in Beltsville; hired scientist to work on using NGS in fruit trees for pathogen detection procedure; no report answers questions: fruit trees from Canada do not come through the quarantine. J. Preece – insn't there sharka in Canada? Would this free exchange be a risk? J. Foster - Canadian service is testing the same way as US and the material from the sharka affected regions are not distributed. K. Gasic received trees from quarantine for accessions collected in China in 2006 and planted in Clemson. Will follow up with the report to J. Foster the trees.*

- **State Reports:**
  - *K. Gasic (SC) – finally have crop; majority of the state is ok ~80%; still some issues with cold temperatures during the bloom caused low fruit set, low bee activity; insufficient chilling in previous years is a suspected to cause low fruit set on high chilling material this; tree die back due to a stress rom bacterial canker and Cytospora; Armillaria is a big problem in SC for replant orchards; awarded planning grant from USDA to work on developing a grant to combat Armillaria issue in Prunus;*
  - *Chen Chunxian (GA) –similar situation as in SC but with worse consequences flowering looked good but low fruit set, 45% of crop reported.*
  - *Tom Gradziel (CA) –good crop; climate change, loss of pollinizers, loss of fumigants, labor issue is creating a flux where solutions will have to be found in the collection; emphasizing our dependence on the germplasm and the need to preserve and main the collection, e.g. self-compatibility in almond changed the industry.*
  - *Amy Iezzoni (MI) – no frost at flowering stage, bad news the prices will probably be low. Pollination with pollen from potential sources of Armillaria resistance that Carolyn sent to K. Gasic and she shared with A. Iezzoni were not successful. K Gasic also used the pollen on peach with low success. Compatibility might be an issue between the P. ceraifera with tart cherry, peach and plum. C. DeBuse offered to send the budwood of the resistant accessions to both K. Gasic and A. Iezzoni so they ca have the copies in their collection. T. Gradziel some of the plum pollen is sterile so it should be checked for viability.*
  - *Cameron. Peace (WA) – decent crop for cherry, no problems, season is progressing well. Season started few days earlier than normal. Drosophila suzuki is becoming a problem and is also a nightmare in MI. New sweet cherry breeder hired Per McCord at WSU; will be focusing on mildew resistance and fruit quality; K. Gasic will include him in the Prunus CGC mailing list; new tool to understand the ancestry across the genome of any individual and also visualize the trait alleles that they are carrying; moving on to reconstructing the pedigrees of all cherry cultivars; genotyping whole P. cerasus and P. avium collection (~200 individuals) housed at Davis. Carolyn was helping with the material*

collection and collected the material that is not yet in GRIN – an example of collaboration with the researchers to make sure all of the material from the collection is included in the genotyping effort. K. Gasic re-doing genotyping of peach collection for new material; carotenoid data received from Israel for repository material (90 accessions); T. Gradziel – is any South African materials included in the carotenoid study? It is unique genetically and for carotenoid content. K. Gasic – not sure because the material was selected based on the flesh color using phenotypic data. If it is not included T. Gradziel can send additional fruit

- *Margaret Worthington (AR) – Late spring freeze, not many issues with crop load; bacterial spot, bacterial canker issues; visited repository in February and performed crosses with late blooming material;*

- **Evaluation Funding Report –** Ksenija Gasic
  - *Prunus CGC got funding last year for $22K for project "Evaluation of peach NCGR germplasm for fruitlet freeze tolerance", submitted by JC Melgar and K. Gasic from Clemson. We will not be considered for funding this year due to changed policy of USDA to increase funding by awarding double amount of money and provide funding every other year. Prunus CGC will be eligible in 2019 funding cycle.*
  - *Supply of the material for research is jeopardized because of the personnel shortage at repository so US Davis researchers helped with the fruit collection*
  - *Call for Exploration and exchange went out, submitted proposals if selected will be funded for trips in 2019. Need to re-visit collecting of wild Prunus relatives in China. With Rosaceae Genomic Conference being organized in Nanjing in few weeks, C. Chen, C. Peace and K. Gasic will be there and can open the talks with Chinese colleagues about possible material exchange. J. Preece visited China in July 2017, borders are closed for free exchange of material; T. Chao – agrees, current Chinese policy is that wild relatives of crop species are not allowed out of China; for Malus list of cultivated material is available for share, started collection of wild Malus species and trying to get the pollen exchange – not sure if that will happen, but not budwood. We can do a lot of basic research with Chinese scientist where material is not exchanged but information is, that might be a first step in opening collaborations.*

- **Prunus Vulnerability Statement** – Ksenija Gasic
  - *A single slide crop vulnerability update for Prunus sent to USDA; vulnerabilities and threats, genetic research and breeding, NPGS PGR status and impacts and priority issues; below are* ***priority issues*** *Prunus CGC identified and shared with USDA:*

- ***Additional budgetary support crucial for expanding NPGS PGR management capacity: more land for orchards, handling high demand for PGR, comprehensive genetic characterizations (SSRs, SNPs), evaluations for priority traits.***
- ***Collections must be backed-up.***
- ***Acquire strategically CWR from forests in China, C. Asia, Europe, N. America.***
- ***Expand quarantine capacity &remove obstacles to faster processing of imported PGR.***
- ***Additional budgetary support for expanded public-sector breeding for overall diversity, host-plant resistance to diseases & pests, longer storage, adaptation to broader environmental variation, & tree traits for new production systems.***
- *Need to work on preparation of Prunus CVS to mimic apple CVS paper. Not easy with many species under Prunus; C. Peace we can summarize issues in tables; K. Gasic will create google doc and share the access with the membership so we can start working on it.*
- *This system combination of web meeting with onsite meeting worked well so we can continue using it to allow membership to participate in the CGC activities. We should also consider having half-year meeting using web.*

- **Additional Items**
  - **TreeSnap** *app info provided by Crocker, Ellen**,** University of Kentucky for collecting data in the field. Potential for Prunus CGC to use the app and UK group to adjust it for our needs.*

- **Discussion of time and location of next meeting**
  - *The next in person meeting will be June 5-7 2019 at the Repository in Davis, CA*
- **Adjourn at (11:30am PST)**
- *Minutes taken by K.Gasic*

The National Plant Germplasm System: 2018 Status, Prospects, and Challenges

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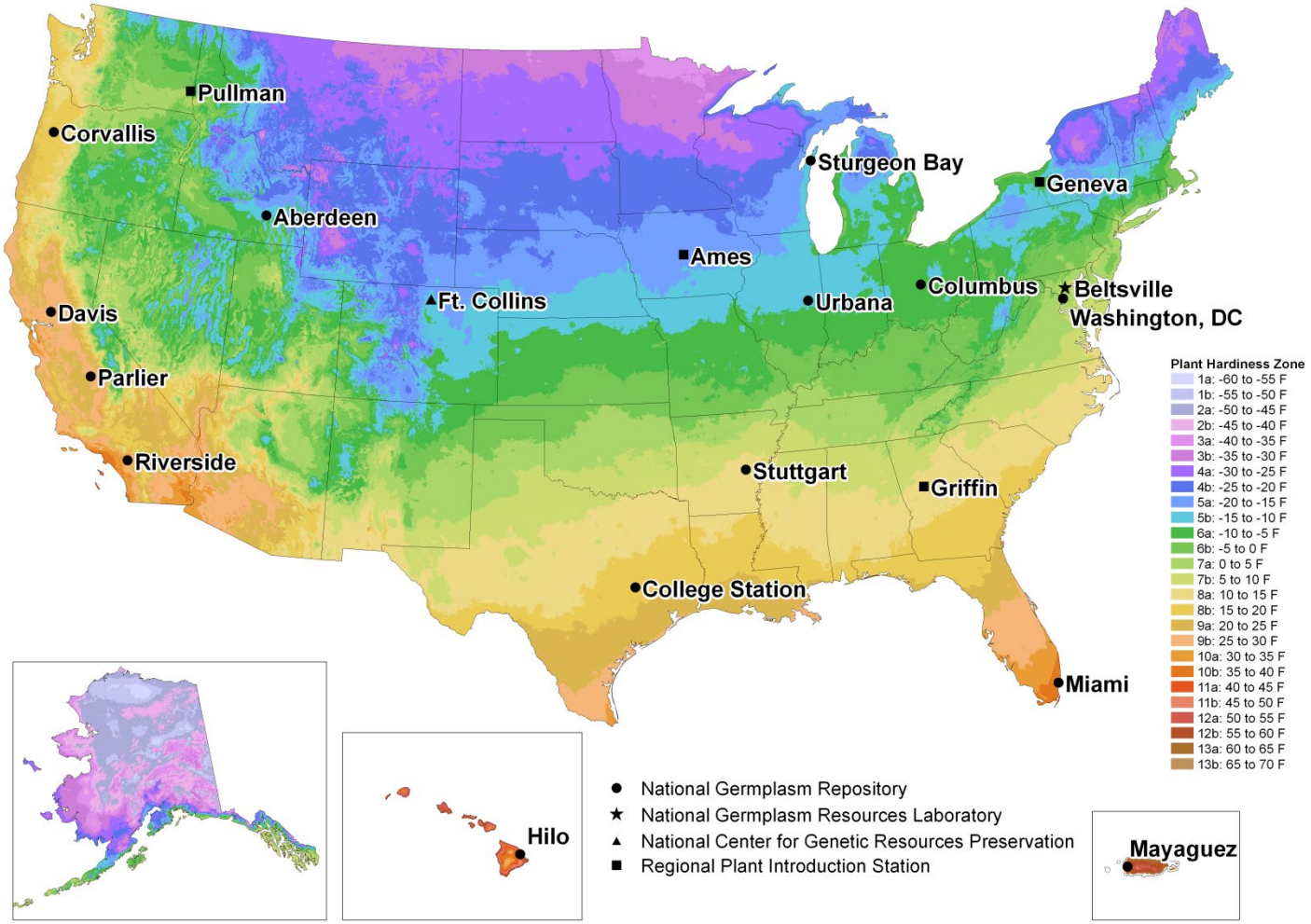
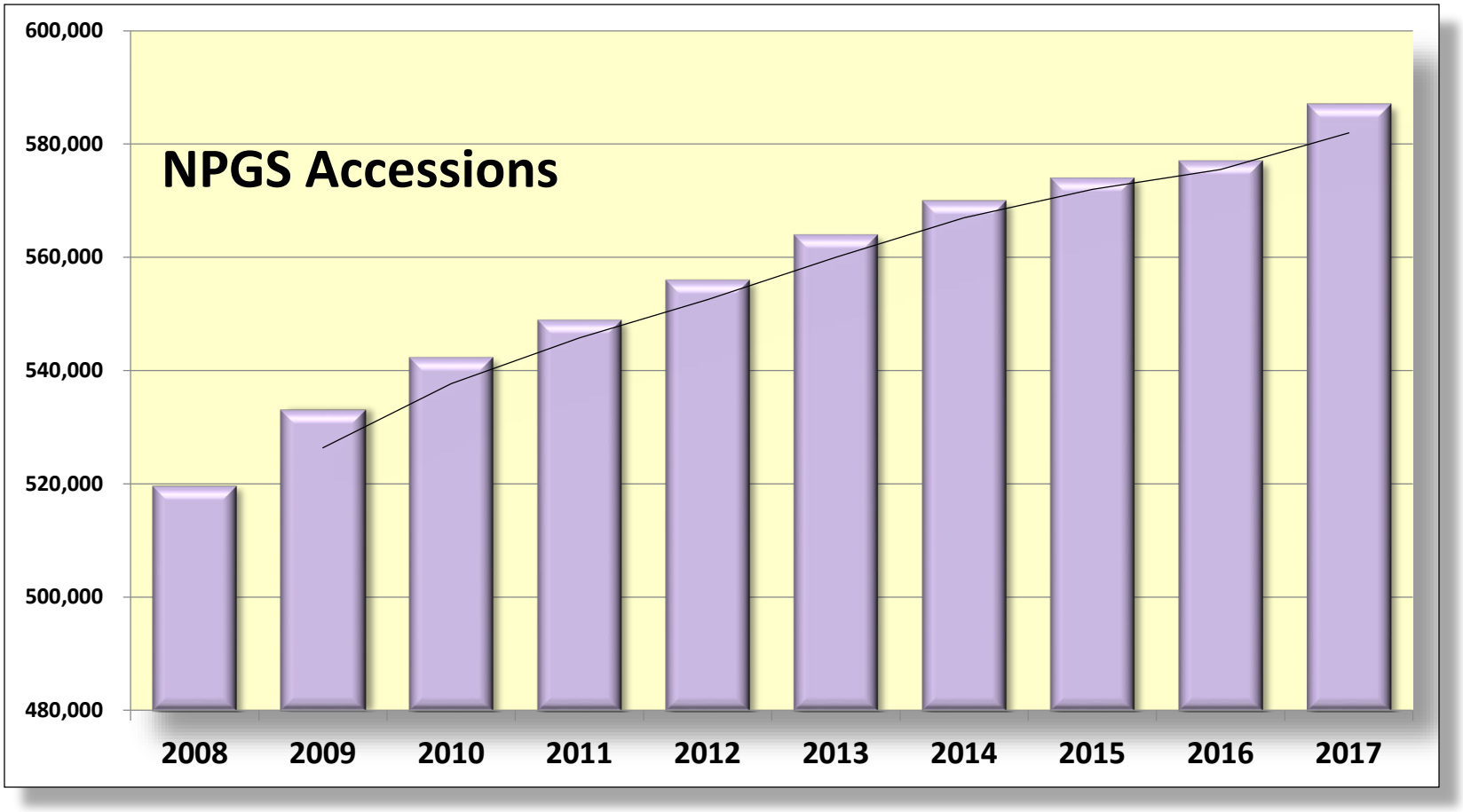
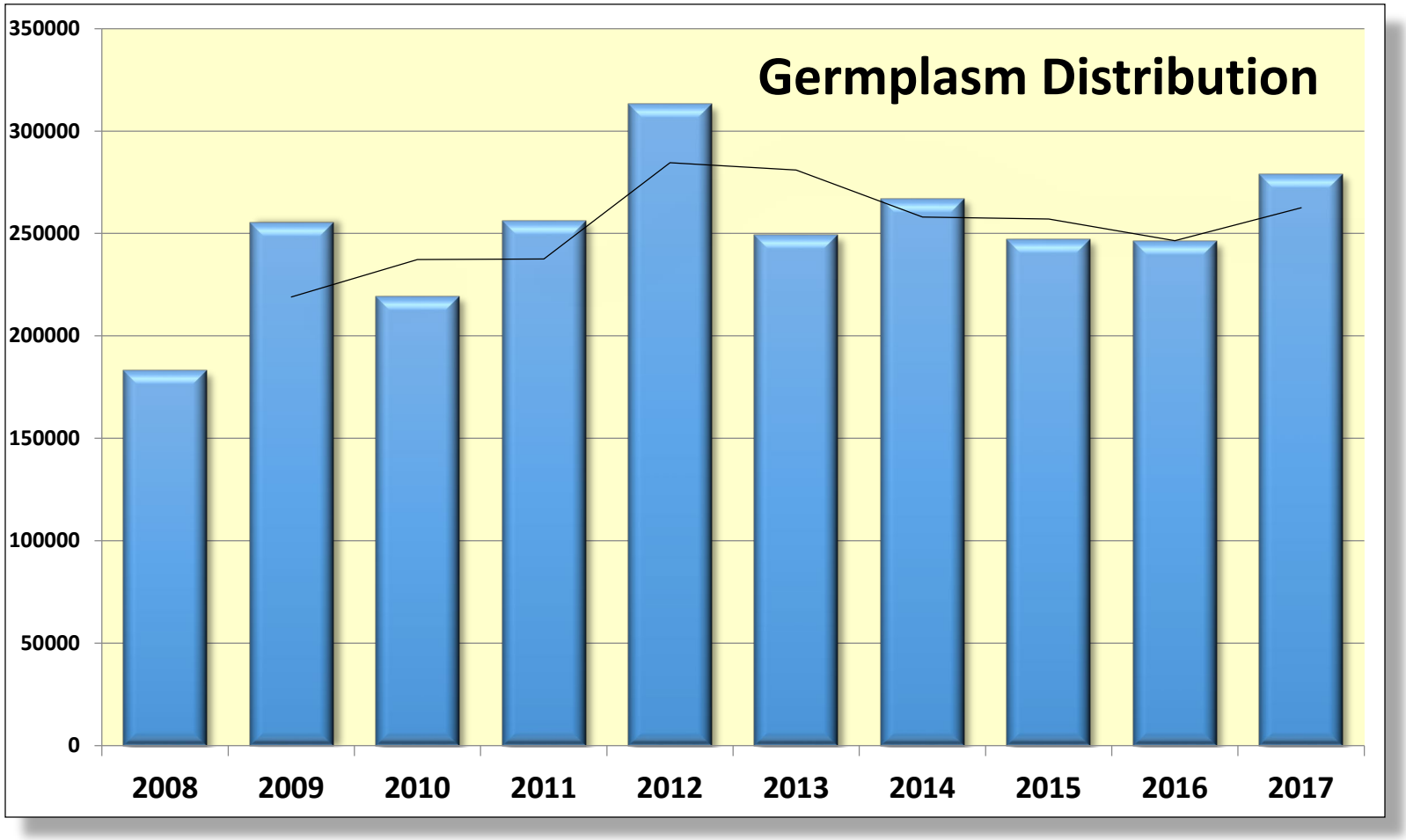
USDA National Plant Germplasm System (NPGS)



Number of NPGS Accessions 2008-2017



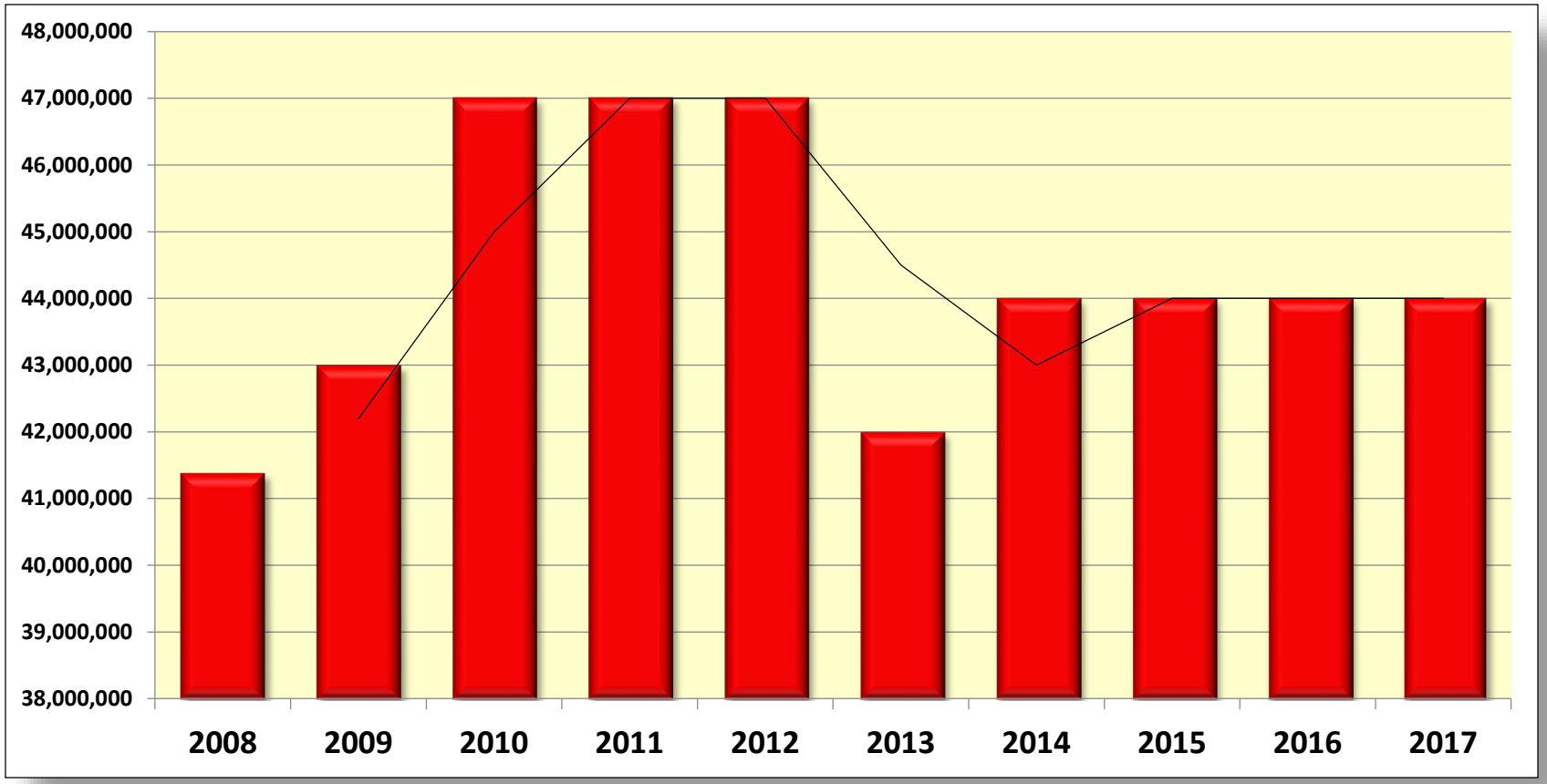
Demand for NPGS Germplasm 2008-2017



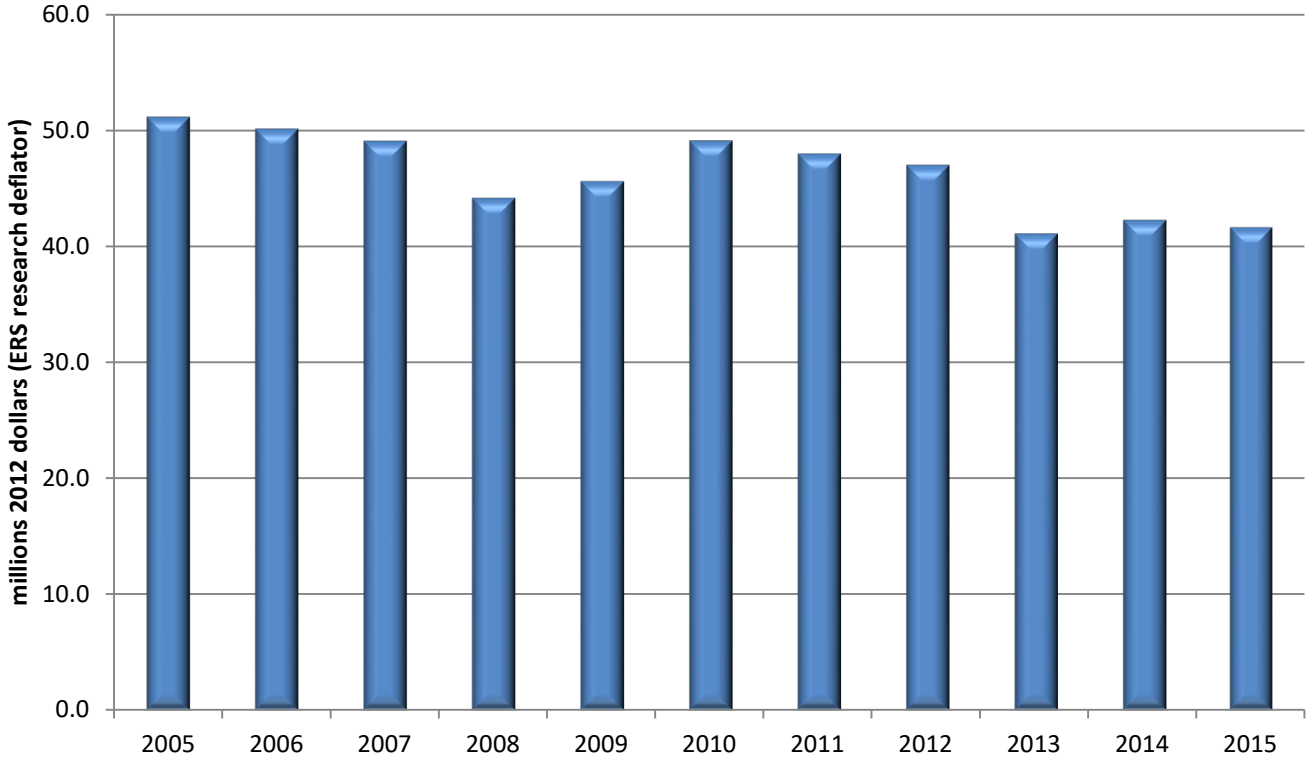
ARS National Plant Germplasm System

BUDGET

2008-2017



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



Note: Deflator for 2015 is preliminary

Some key challenges for the NPGS

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

Genetic Resource Management Priorities

- Acquisition
- Maintenance
- Regeneration
- Documentation and Data Management
- Distribution

- Characterization
- Evaluation
- Enhancement
- Research in support of the preceding priorities

Personnel Changes

- **Farewell and best wishes to RLs Richard Percy (ARS-College Station), Randy Nelson (ARS-Urbana) and Gary Pederson (ARS-SRPIS, Griffin) for their retirements.**
- **Congratulations to Melanie Harrison (ARS-SRPIS, Griffin) for her promotion to RL.**
- **Farewell and best wishes to Merrelyn Spinks (ARS-SRPIS, Griffin; GRIN-Global, information management).**
- **Welcome and best wishes to Melanie Schori, new plant taxonomist for GRIN Taxonomy at NGRL, Beltsville.**

Plant Genetic Resource (PGR) Management Training Initiative

- **At least 1/3 of NPGS PGR managers could (likely will) retire within 5 years.**
- **Currently, no formal, comprehensive programexists for training new PGR managers.**
- **G. Volk (ARS-Ft. Collins) and P. Byrne (CSU-Ft. C.) secured a USDA/NIFA grant for a workshop at Ft. C. 24-26 April 2018 that discussed designing and developing a training program for a PGR management to be delivered primarily through distance-learning.**

USDA-ARS
National Germplasm Resources Laboratory
Beltsville, Maryland
2018 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).

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 January 2018. 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 2019 is July 20, 2018.
- All foreign explorations supported by PEO comply with the Convention on Biological Diversity on 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.

FY 2017 NPGS Plant Explorations:

Target Crop	Country	Principal Contacts
Phalaris spp.	France	R.C. Johnson, A. Boutet
Wild apple	Austria, Romania	G. Volk, A. Cornille, T. Kirisit, A. Roman, T-M. Ursu
Herbaceous ornamentals	Georgia	M. Eristavi, T. Kurdadze
Wild raspberry	Canada	M. Dossett
Wild blueberry	United States (FL)	P. Lyrene
Wild sweetpotato	United States (FL)	L. Eserman
Wild apple	United States (IA, IL, MI, MO, PA)	T. Chao

Wild potato	United States (AZ)	J. Bamberg, C. Fernandez, A. del Rio, I. Bamberg
Wild bean	United States (AL, AR, MS, LA)	A. Egan
Blue ash	United States (KY, OH, TN)	J. Carstens

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

In 2016, ARS and the U.S. Forest Service established a new agreement to foster collaboration on conservation of crop wild relatives on U.S. National Forests. A pilot project on complementary (*in situ* and *ex situ*) conservation of CWR of the genetic resources of wild cranberry (*Vaccinium macrocarpon* and *V. oxycoccos*) in National Forests is underway. In 2017, leaves and germplasm of *V. oxycoccos* were collected from wild populations in National Forests in Oregon and Washington. Germplasm was sent to the National Clonal Germplasm Repository in Corvallis, Oregon. Leaf samples were sent to the ARS Vegetable Crops Research Unit at the University of Wisconsin for genetic analysis. This analysis and other factors will be used to determine which sites should be designated as *in situ* reserves.

Discovery and Documentation of Historical Plant Introductions:

A project to identify historical plant introductions (PIs) that are not in the NPGS continues.
In 2017, 35 historical PIs were located at the former Cheyenne (Wyoming) Horticultural Station. The information on the PIs was distributed to curators for their input on the need to acquire samples of the germplasm.

GRIN Taxonomy for Plants:

- GRIN Taxonomy, now 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. 16,150 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 27,329 genera (14,386 accepted) and 1,414 infra-genera (1,352 accepted) and 109,733 species or infra-species (63,695 accepted), with over 64,717 common names, geographical distributions for 56,225 taxa, 468,112 literature references, and 31,958 economic impacts. 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 190 major and minor crops from 111 genera, and an interface to query these data in various ways will be available as part of the first 2018 update of the GRIN-Global public website (test version at https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearchcwr.aspx).

We invite feedback from NPGS curators and CGC members for those CWR classifications already developed.

Facilitation of Germplasm Exchange:

The PEO helps expedite the distribution of germplasm from the NPGS to foreign scientists and other international genebanks through a long-standing collaboration with USDA-APHIS at Building 580, BARC-East. In 2017, 640 public orders containing a total of 55,912 samples of NPGS accessions were shipped from Beltsville to individuals in 69 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 CGC section in GRIN (https://www.ars-grin.gov/npgs/cgcweb.html) was given a minor facelift in the transition to GRIN-Global.
- Please send updates to the individual crop CGC sections to Gary Kinard.
- Most committees continue to meet regularly and are active. Committees are particularly urged to update their Crop Vulnerability Statements and several CGCs recently completed new versions.
- A virtual meeting/web conference was held for CGC Chairs on December 1, 2016. Updates were provided on the activities of ARS and the NPGS, international issues related to plant genetic resource exploration and exchange, GRIN-Global, and the activities of the CGCs. The next meeting is scheduled for January 25, 2018.
- NGRL also has a WebEx conferencing account that is available to the CGCs to host virtual meetings (teleconference and/or webinar).

Database Management Unit

GRIN and GRIN-Global:

- At the beginning of 2018, the GRIN-Global plant database included the following:

  584,449 active accessions representing 15,720 species and 2,533 genera
  3,023,069 inventory records
  1,973,427 germination records
  8,192,598 characteristic/evaluation records
  410,476 digitized images

  These numbers increase almost daily.

- The U.S. NPGS made the transition from GRIN for plants to GRIN-Global on November 30, 2015. The GRIN-Global Development Team initiated improvements and enhancements to both the Curator Tool and Public Website, and corrected any bugs that were reported in 2017. 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/.
- Comments and suggestions about GRIN-Global can be sent to the entire development team at feedback@ars-grin.gov.

Economic Research Service Survey of NPGS Germplasm Recipients:

NGRL collaborated with the USDA Economic Research Service (ERS) to conduct a survey of more than 5300 recent global recipients of barley, beans, cotton, maize, potatoes, rice, sorghum, soybean, squash, and wheat from the NPGS. The survey closed on December 31, 2017. ERS will be analyzing the results over the next several months and preparing a report/publication on the findings.

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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Annual Report of the USDA National Clonal Germplasm Repository (NCGR), Davis, CA 2018

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INTRODUCTION

The National Clonal Germplasm Repository (NCGR) at Davis, receives, collects, preserves, evaluates, and distributes genetic resources of Mediterranean fruit and nut crops. These irreplaceable resources are maintained on a long-term basis to support domestic and international research efforts on germplasm enhancement, cultivar development, molecular biology, and other related research. The Repository operates in cooperation with the Plant Sciences, the Viticulture & Enology Departments, and Foundation Plant Services (FPS) at the University of California, Davis.

Permanent/Term Federal Staff at NCGR-Davis

John Preece, Research Leader
Malli Aradhya, Geneticist
Bernie Prins, Horticulturist (*Vitis*)
Carolyn DeBuse, Horticulturist (*Prunus*)
Jenny Smith, Biological Science Technician
Jeff Moersfelder, Nursery Manager
Howard Garrison, Field Manager
Salvador Rivas, Biological Science Technician
Mary Parker, Secretary (Program Support Assistant)
Gloria (Patty) Diaz-Britz, Biological Science Technician
Sergio De La Cruz, Pathways Technician

UC Affiliates – Assistant Specialists

Judy Yang
Franklin Lewis

Graduate Students

Dianne Velasco
Emily Johnson

Personnel Changes

There are no vacant positions.

Service

Distributions of NCGR germplasm are primarily winter collected, dormant cuttings or scionwood; although the NCGR also distributes leaves, summer cuttings, pollen, fruit and other plant parts as requested. Almost no seeds are distributed. Because dormant cuttings are primarily distributed, nearly all orders are shipped in late winter/early spring.

Each item shipped is 3-5 cuttings/item (accession) (Fig. 1). Number of orders and items shipped dropped greatly in 2016 because the NCGR discontinued sending material to the general public. This change has been a benefit to the NCGR and those who receive material. With a manageable

number of orders and items, the Repository can work with and better respond to those who require the genetics in the collection for their research.

Most distributions (94.2%) are to domestic customers (Fig. 2) with number of order items similarly proportioned and about 10 items were sent to each customer (Fig. 3). Of those domestic orders, 45.5% were to individuals, with the remainder shipped to federal and state agencies, colleges and universities, nonprofits, and commercial companies (Figs. 4,5).

The *Prunus* distribution has increased in the 2018 with a10% increase in orders and the numbers of items collected increased by 28%. (Fig. 6)

Vitis accessions that were propagated from virus indexed plants from the UCDavis Foundation Plant Services (FPS), and grown under protection in a micromesh screen house were distributed. We have no plant pathologist on staff, so do not advertise these 226 accessions as virus indexed. This amounts to approximately 20% of our grape distributions. This is a silent upgrade to our distributions. With ancient clonal crops, viruses are often present in the propagules being distributed.

Figure 1. Total orders shipped from 2004 – 2017 (NCGR-Davis). There are 3-5 cuttings/item shipped.

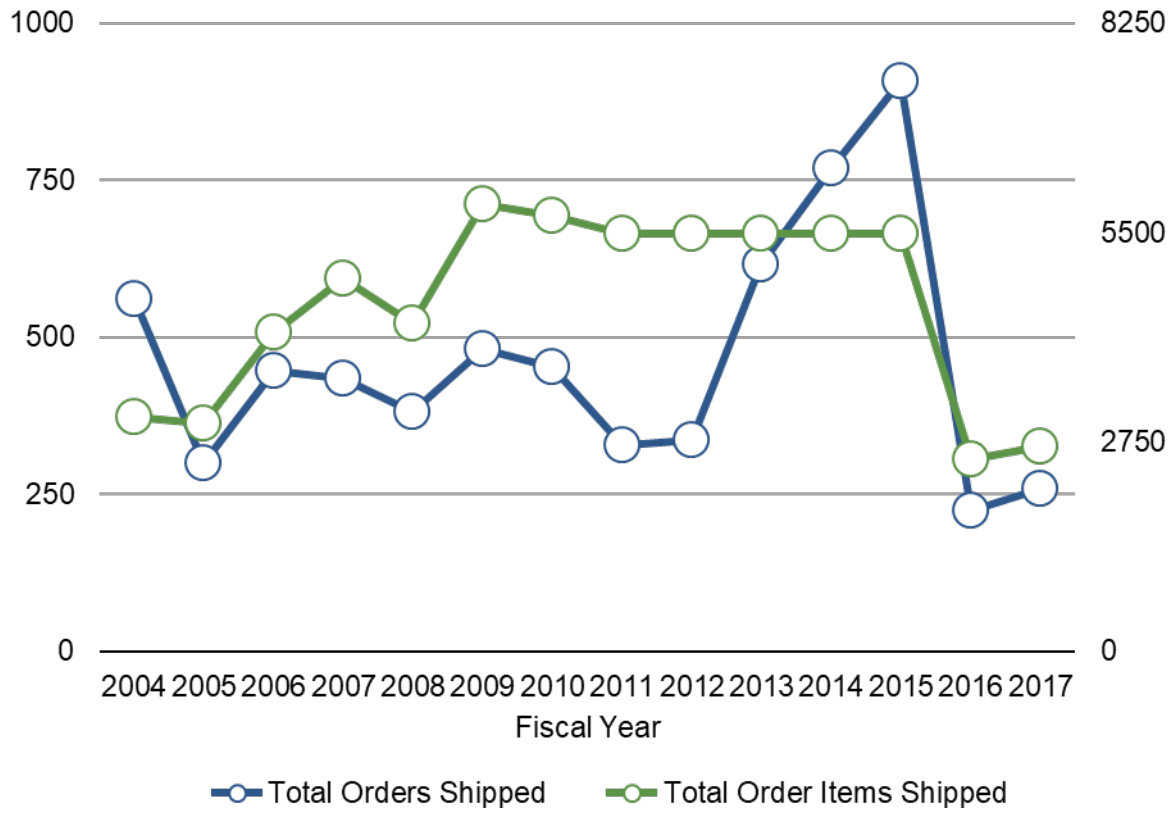

Figure 2. Orders distributed to domestic and international customers during 2017.

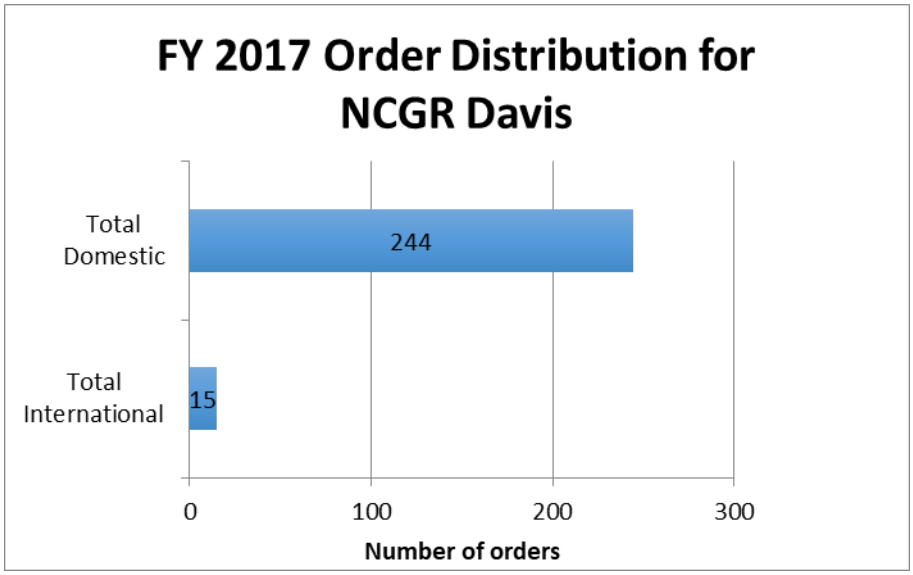

Figure 3. Number of items (cuttings, seed, pollen, etc.) distributed domestically and internationally during 2017

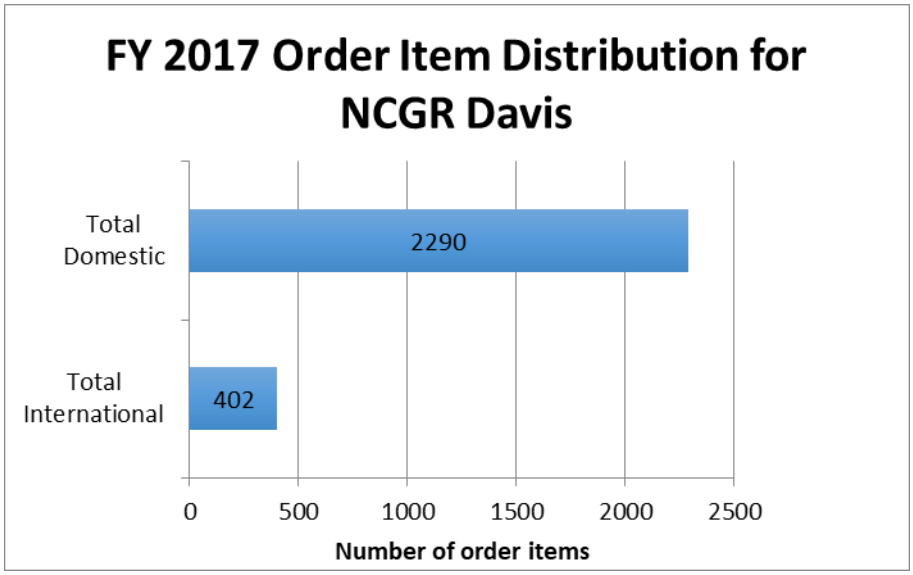

Figure 4. Order distributions to domestic customers during 2017

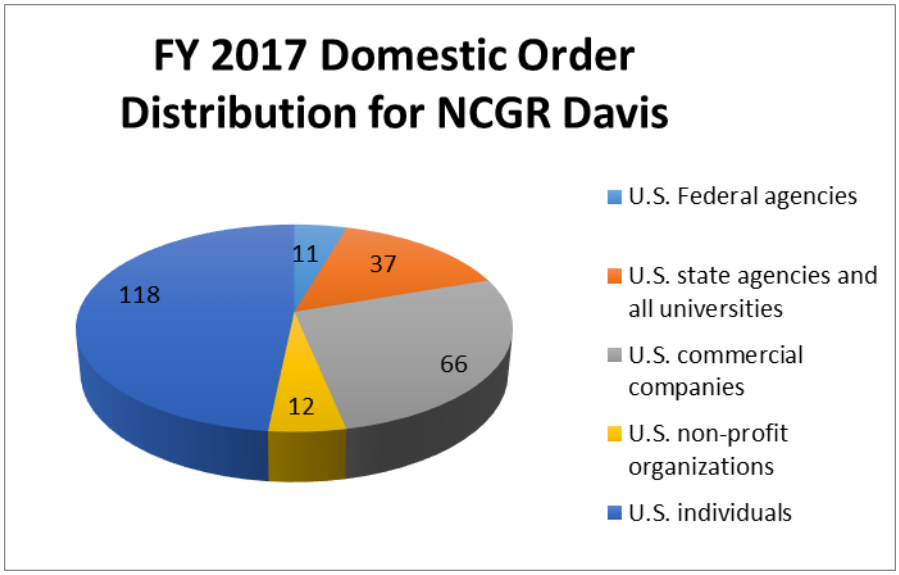

Figure 5. Number of items distributed to domestic customers during 2017.

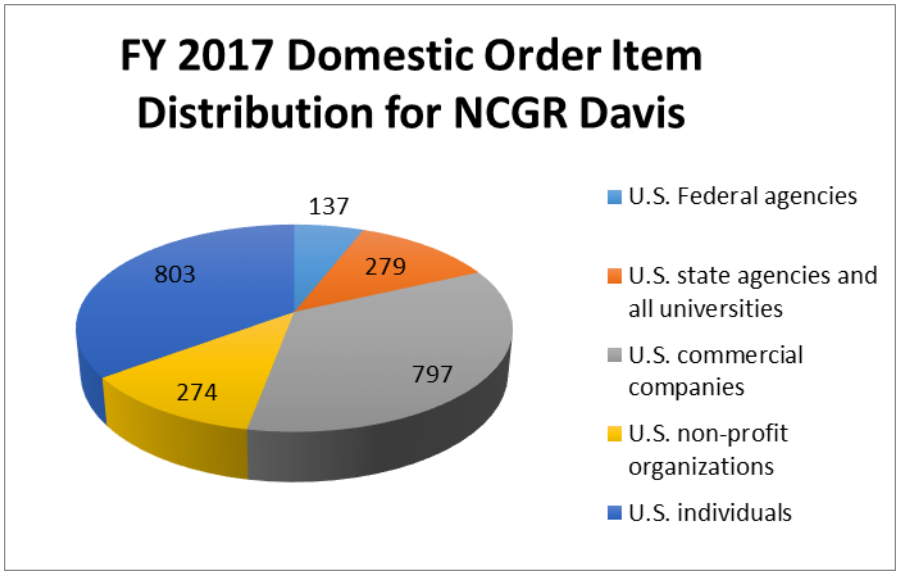

Figure 6.

Summary of Distribution of Prunus, 2018

	number of orders	number items collected
Budwood		
Winter- January	54	281
Spring- June	7	115
Fall- August	1	2
totals	**62**	**398**
Leaves/shoot tips	**4**	**414**
Fruit/seed	3	172
Seed for Cryo	1	16
totals	**4**	**188**
Pollen	4	20
Pollen for Cryo	1	15
	5	**35**

Compared Years	number of orders	number items collected
2016	55	393
2017	67	742
2018	75	1035

The NCGR hosted 3 tasting events at Wolfskill. Multiple tours of the NCGR were provided to domestic and international individuals and groups.

Acquisitions

New Acquisitions

Plant explorations are coordinated with the Plant Exchange Office (PEO), National Germplasm Resources Laboratory (NGRL), National Plant Germplasm Quarantine Center (NPGQC), and crop germplasm committees (CGCs). The PEO identifies foreign collaborators in host countries, prepares appropriate bilateral agreements and provides funding for plant explorations. The NPGQC provides proper import permits and inspect and/or quarantine plant materials depending on the species and threat. After completely or provisionally clearing quarantine, materials are shipped to the NCGR. Of the genera in the NCGR collections, *Prunus* and *Vitis* have the strictest phytosanitary standards and these species require therapy if clonal (meristemming and thermotherapy) and seeds must be germinated and grown to make sure that the plants are free from serious pests and pathogens before being shipped to the NCGR.

In recent years, explorations were conducted in the Caucasus and Central Asian centers of diversity to fill gaps, especially in crop wild relatives. This new germplasm is clearing quarantine and will add significant diversity annually for the next 5 years and beyond.

The NCGR has been highly successful filling gaps and growing the collection, especially with crop wild relatives. As a result, the collection has grown 25% from 7,000 to 8,732 accessions over the last 5 years. With necessary repropagations of collections and with these new

accessions, available land is becoming scarce. Without new land to accommodate a larger number of new accessions, trees would need to be planted much more closely following collection repropagations. That strategy has seemed unwise from a disease and repropagation frequency perspective because close spacing creates management challenges to maintain a vigorous collection that produces sufficient scionwood for distribution. Therefore, the NCGR must be strategic to bring in unavailable genetics and remain able to accommodate them. For example, a priority need is for an increase in the southern California black walnut (*Juglans californica*) collection. Because of disease and other problems, this species has been decimated and must be recollected with the goal of germinating some seeds and cryopreserving others from the same seed lot.

During the past year, 32 new *Prunus* accessions were received from APHIS. These include 10 species collected from 6 countries (Table 1).

Table 1. *Prunus* accessions obtained in 2017/2018.

Prunus Acquisitions

Year	Origin	Species	Number of accessions	Type of Material Received	Received from	Collector or Donor
2017/2018						
	Armenia	Prunus armeniaca	1	Budwood	PGQC	Stover
	Azerbaijan	Prunus armeniaca	2	Budwood	PGQC	Aradhya
		Prunus armeniaca	7	Seedling trees	PGQC	Aradhya
		Prunus domestica	2	Budwood	PGQC	Aradhya
		Prunus naxicivanica	1	Seedling trees	PGQC	Aradhya
		Prunus fenzliana	1	Budwood	PGQC	Aradhya
	Kyrgyzstan	Prunus armeniaca	8	Seedling trees	PGQC	Aradhya
		Prunus Hybrid (apricot x peach)	1	Seedling trees	PGQC	Aradhya
	Republic of Georgia	Prunus domestica	1	seedling trees	PGQC	Aradhya
		Prunus cerasifera	1	Budwood	PGQC	Postman & Stover
		Prunus persica	2	Budwood	PGQC	Aradhya
		Prunus avium	1	Budwood	PGQC	Aradhya
	Turkmenistan	Prunus dulcis	1	Grafted trees	PGQC	Aradhya
		Prunus spp. (plum)	1	Grafted trees	PGQC	Aradhya
	Ukraine	Prunus armeniaca	4	Budwood	PGQC	Aradhya
Totals	**6 Countries**	**10 Species**	**34 new accesssions**			

Collection maintenance and propagation

The NCGR is actively repropagating *Prunus* and other crops that are in peril or in need of renewal. This year at least one copy of each accession in the almond collection has been repropropaged because of an Armillaria infestation in the older, existing planting. Propagation of the last apricots is still ongoing.

In the summer of 2017, the plum, cherry, and almond block were machine hedged. The new apricot block was pruned at the beginning of 2018, the second growing season. The peach collection was not pruned in 2017/2018 due to lack of labor and is badly in need of pruning.

There is no available land for the whole of the re-propagated almond orchard at this time so the new almond trees were planted in two areas. Deer browsing is beginning to be a problem with establishing new *Prunus.* Prevention methods have not been found yet.

Evaluation and Research

Grants focused on the collections at the NCGR-Davis: California Fig Institute, $1,000 (Fig Cultivar Trial, 2018); California Pistachio Board, $ 105,695 (genotyping and phenotyping *P. atlantica* x *P. integerrima* UCB1 rootstock, 2018), $62,093 (Development of New, Reliable, Vigorous, Clonal Rootstocks, 2018), and $20,697 (Is pistachio Bushy top syndrome a variant that occurred in tissue culture? 2018, California Almond Board, $200,000 (breeding disease-resistant almond rootstock, 2018), California Pistachio Board, $100,000(breeding pistachio rootstock.

Publications in 2017-18 (NCGR staff bolded)

Al Rwahnih, M., A. Rowhani, N. Westrick, K. Stevens, A. Diaz-Lara, F.P. Trouillas, **J. Preece**, C. Kallsen, K. Farrar, and D. Golino. (2018). Discovery of viruses and virus-like pathogens in pistachio using high throughput sequencing. Plant Disease. https://doi.org/10.1094/PDIS-12-17-1988-RE

Aradhya, M., D. Velasco, Z. Ibrahimov, B. Toktoraliev, D. Maghradze, M. Musayev, Z. Bobokashvili, and **J.E. Preece**. (2017). Genetic and ecological insights into glacial refugia of walnut (Juglans regia L.). PloS ONE, 12(10), p. e0185974.

Aradhya, M., Preece, J., and Velasco, D. (2017). Multivariate analysis of molecular and morphological diversity in fig (Ficus carica L.). Acta Hortic. 1173:23-28.

Chater, J., D. Merhaut, Jia, Z., P. Mauk, and **J. E. Preece**. (2018). Fruit quality traits of ten California-grown pomegranate cultivars harvested over three months. Scientia Hortic. 237(2018): 11-19.

Chater, J.M., L.S. Santiago, D.J. Merhaut, Z. Jia, P.A. Mauk, **J.E. Preece**. (2018). Orchard establishment, precocity, and eco-physiological traits of several pomegranate cultivars. Scientia Hortic. 235: 221-227.

Chater, J.M., Merhaut, D.J., **Preece, J.E**. and Blythe, E.K. (2017). Rooting and vegetative growth of hardwood cuttings of 12 pomegranate (Punica granatum L.) cultivars. Sci. Hortic. 221:68-72.

Crisosto, C., Ferguson, L., **Preece, J**., Michailides, T., Haug, M., Lopez Corrales, M. and Crisosto, G. (2017). Developing the California fresh fig industry. Acta Hortic. 1173:285-292.

Giancaspro A, Mazzeo A, Giove LS, Zito D, Marcotuli I, Gallotta A, Colasuonno P, Nigro D, Blanco A, **Aradhya M**, Gadaleta A. (2017). Exploiting DNA-based molecular tools to assess genetic diversity in pomegranate (Punica granatum L.) selections and cultivars. Fruits, 72(5).

Guzmán, F. A., Segura, S., **Aradhya, M.**, & Potter, D. (2018). Evaluation of the genetic structure present in natural populations of four subspecies of black cherry (*Prunus serotina* Ehrh.) from North America using SSR markers. Scientia Horticulturae, 232, 206-215.

Knap, T., **Aradhya, M**., Arbeiter, A. B., Hladnik, M., & Bandelj, D. (2018). DNA profiling of figs (Ficus carica L.) from Slovenia and Californian USDA collection revealed the uniqueness of some North Adriatic varieties. Genetic resources and crop evolution, 65(5), 1503-1516.

Migicovsky Z, Sawler J, Gardner KM, **Aradhya MK, Prins BH**, Schwaninger HR, Bustamante CD, Buckler ES, Zhong GY, Brown PJ, Myles S. (2017). Patterns of genomic and phenomic diversity in wine and table grapes. Horticulture research, 4:17035.

Milczarek, R.R., Woods, R.D., LaFond, S.I., Breksa, A.P., **Preece, J.E., Smith, J.L**., Sedej, I., Olsen, C.W. and Vilches, A.M. (2018).Synthesis of descriptive sensory attributes and hedonic rankings of dried persimmon (Diospyros kaki sp.). Food Sci. Nutr. 6(1):124-136.

Salazar JA, Pacheco I, Shinya P, Zapata P, Silva C, **Aradhya M**, Velasco D, Ruiz D, Martínez-Gómez P, Infante R. (2017). Genotyping by sequencing for SNP-based linkage analysis and identification of QTLs linked to fruit quality traits in Japanese plum (Prunus salicina Lindl.). Frontiers in plant science, 8:476.

Volo, P., **Preece, J.E.,** and Caruso, T. (2017). The effect of explant cut and cytokinin type on micropropagation of fig (Ficus carica L.) 'Brown Turkey.' Acta Hortic. 1173:227-230.

Gayle Volk report:

Shoot tip cryopreservation of sweet cherry is working very well for the accessions we have in culture. We now have peaches and almonds in culture and will be testing the method for those crops.

We have successfully cryopreserved almond, peach, cherry, and plum seeds. We have a lot of bacterial contamination during the germination process when we cryopreserve seeds without the shells (after lots of surface sterilization), but we have had great success with cryopreserving seeds in the shells and stratifying/germinating in sterile vermiculite.

This spring, Carolyn sent pollen from 15 Prunus accessions for a long-term cryopreservation experiment. Pollen was adjusted to 3 moisture contents and put into the in the LN tanks. All 3 moisture contents adjustments result in +LN viabilities very similar to –LN viabilities.

Pollen from last year's peach cryopreservation was sent to Ksenija to make crosses on a tree, to make sure it successfully fertilizes.

A few peach trees were bagged in Davis to collect self-pollinated seeds to determine if we can capture the alleles of the tree in the progeny without significant genetic shifts—for backing up wild and landrace peaches.

Hopefully this fall I can work with Carolyn and John to develop back-up strategies for the Prunus collection based on the available techniques—and we can pursue the implementation of those plans next spring (pollen, crosses for seeds, tree bagging, putting accessions into tissue culture, etc).

Prunus Collection

USDA National Clonal Germplasm Repository

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Seedlings coming in as families

- collected internationally
- quarantined at NPGQC –APHIS
- arrive in Davis every year as bareroot trees
- Each family has ~10 trees each

Planted in three small blocks

- 727 accessions (seedling families)
- 1,533 trees
- space for about 250 trees left or one year

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Cryopreservation of pollen and seed

Maintenance of the Collection

- 4,930 Total *Prunus* trees at Wolfskill
- 1,000 plus in pots at Davis
- ~ 100 different taxon

Re-Propagation of Collection

- continue to finish apricot propagation

- re propagated almond collection
  - planted 2.5 rows that will remain permanent
  - planted 97 accessions at close planting one tree each
  - continuing to propagate ones that were not successful

- additional re propagation of persimmon orchard

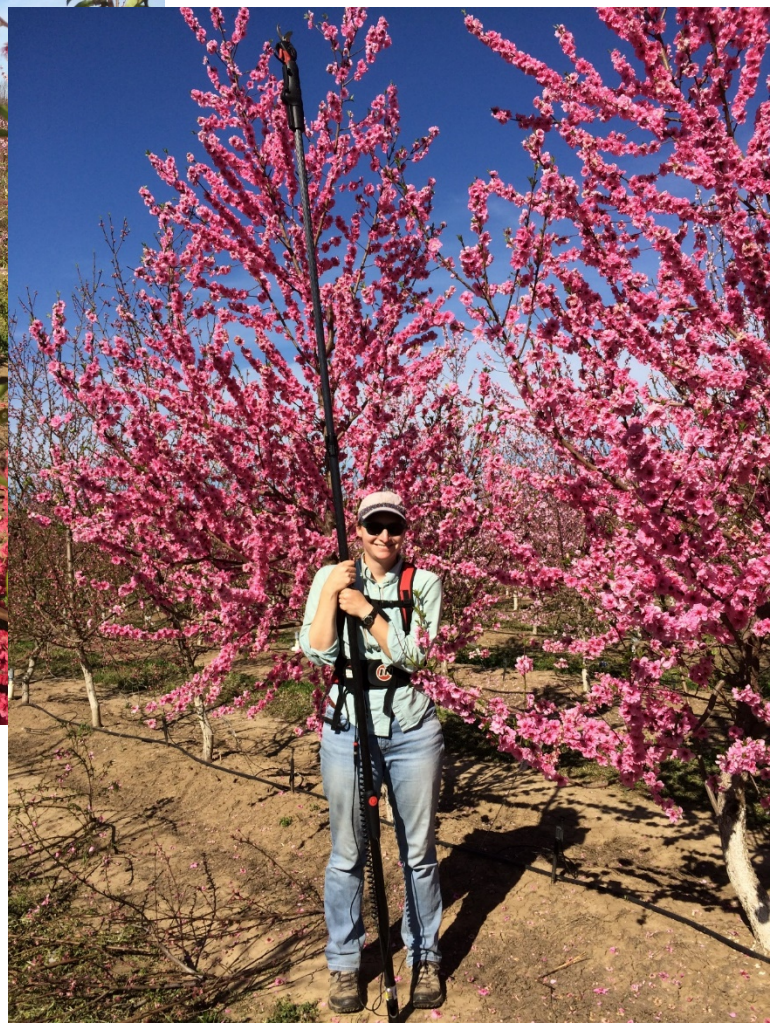

800-675-6075


800-675-6075

Hedging 2017- Plum Block (sides and top)

Cherries and almonds- one side only

Hand Pruning Peaches 2016 and 2017



No pruning 2018

Hand pruned, painted, staked- 2018

Possible solution to hand pruning would be to severely machine hedge

- But are there unknown bad consequences?
- Cost?

Thoughts?