

Crop Germplasm Committee Chairs

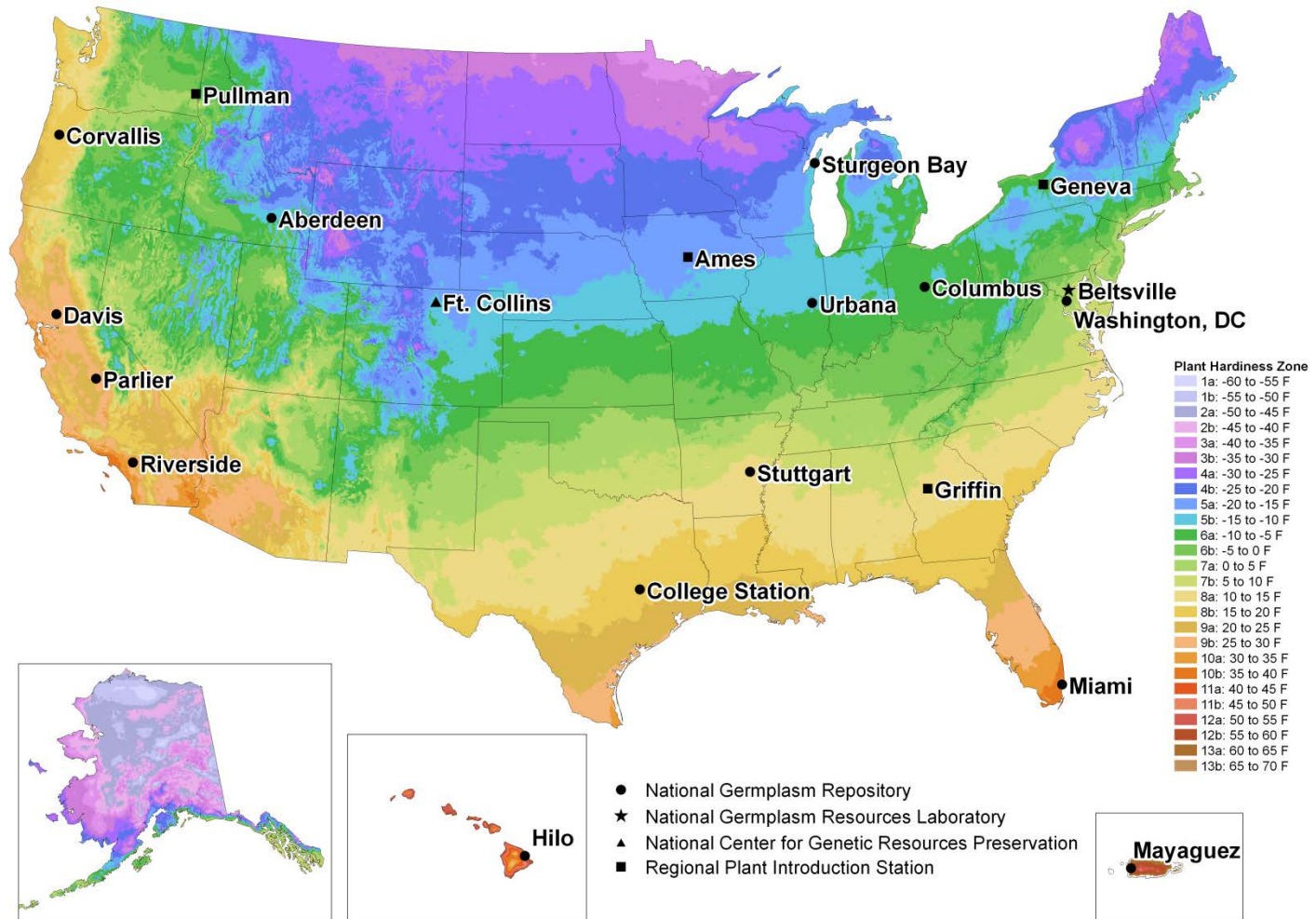
Webinar

January 25, 2018

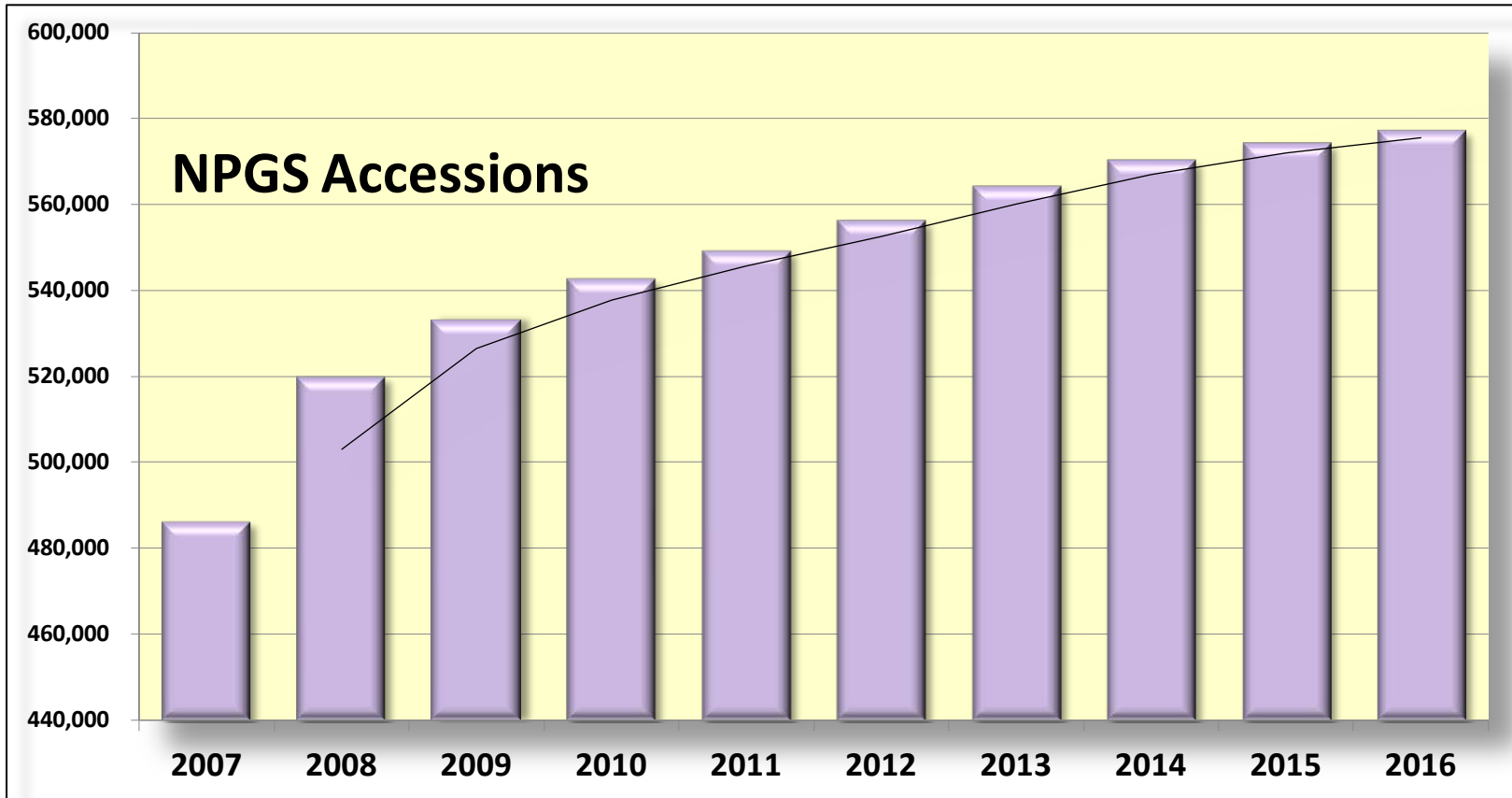
The National Plant Germplasm System: 2018 Status, Prospects, and Challenges

Peter Bretting
USDA/ARS Office of National Programs
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1.301.504.5541

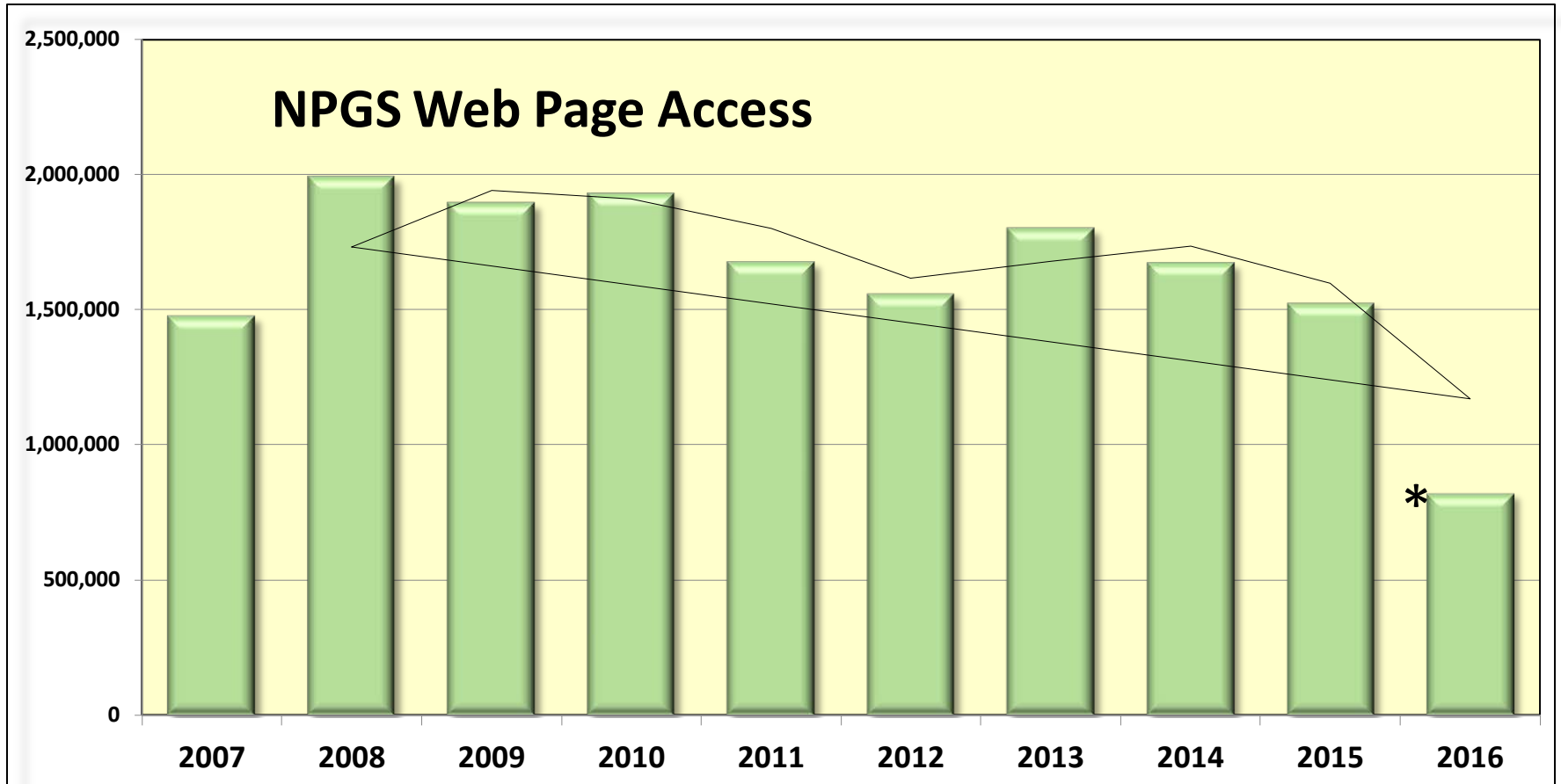
USDA National Plant Germplasm System (NPGS)



NUMBER OF NPGS ACCESSIONS 2007-2016

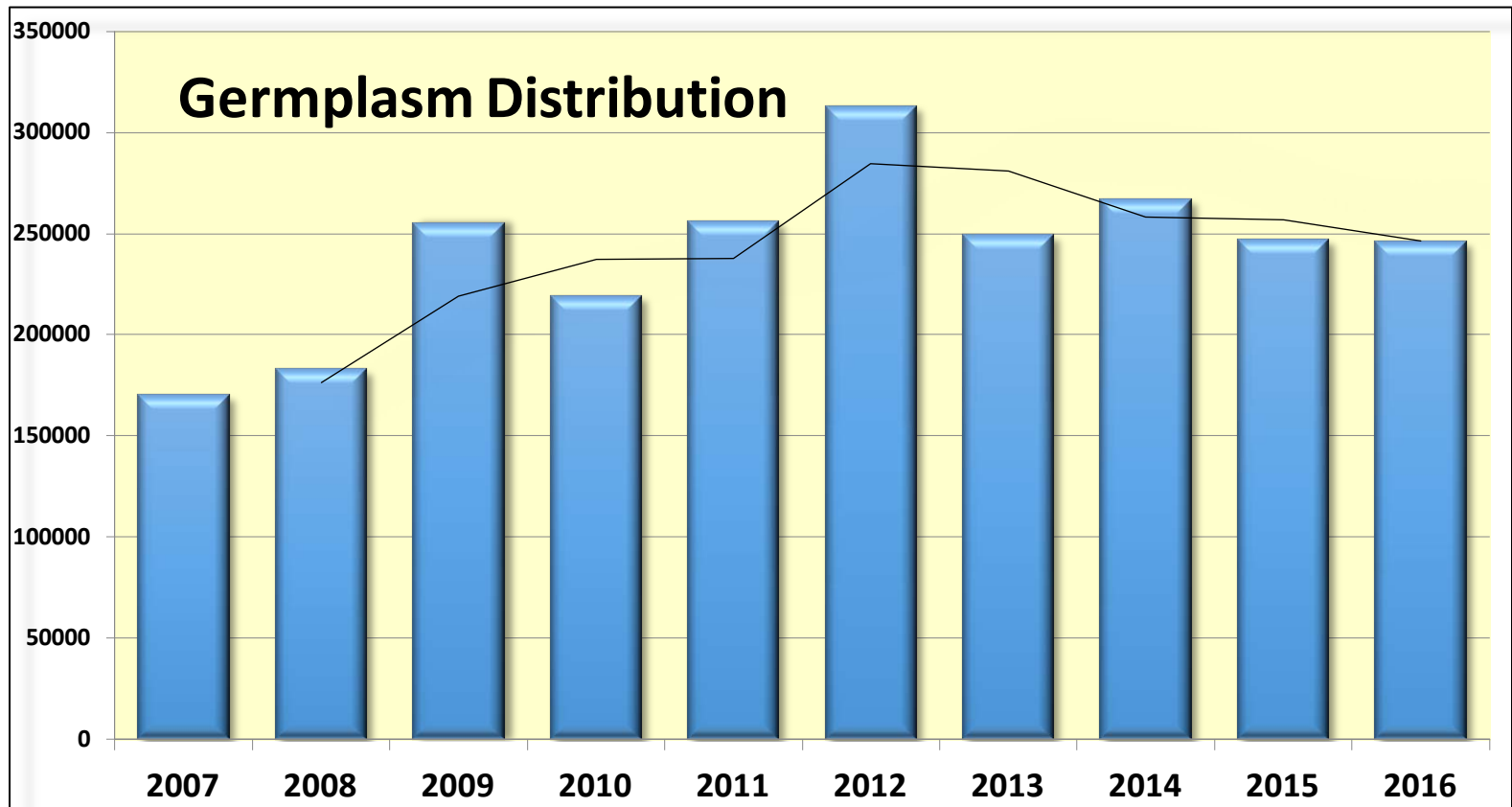


DEMAND FOR NPGS INFORMATION 2007-2016

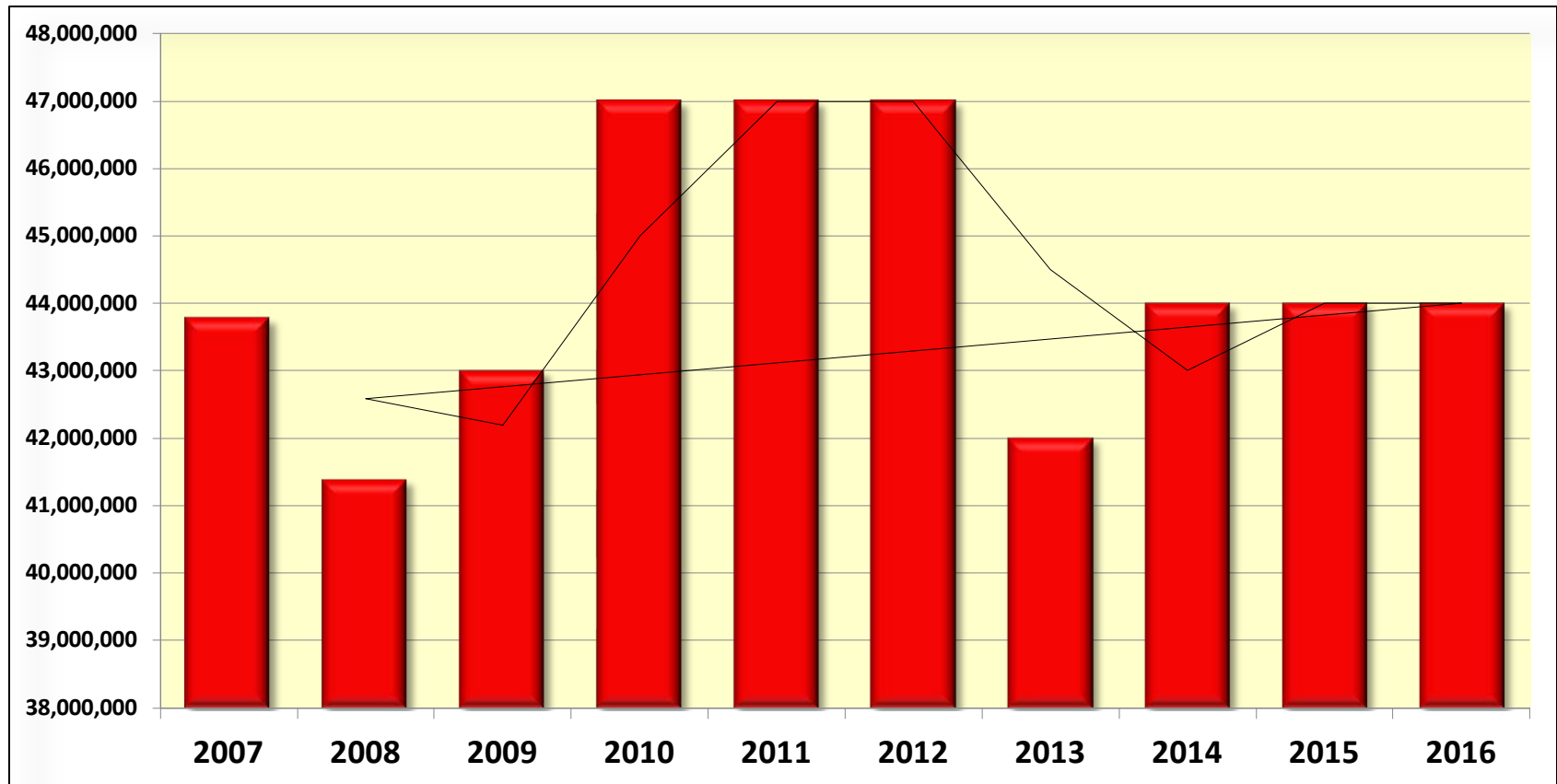


* New GRIN-Global measuring method instituted

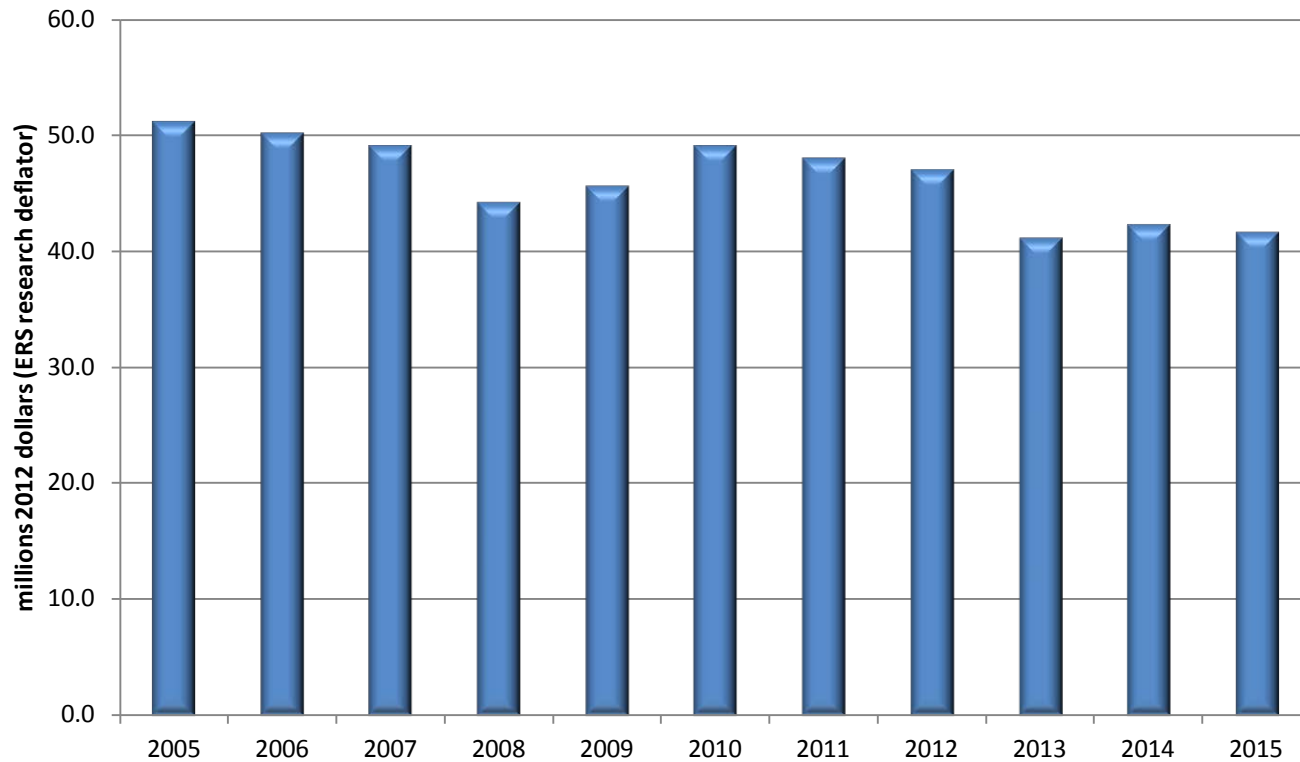
DEMAND FOR NPGS GERMPLASM 2007-2016



ARS NATIONAL PLANT GERMPLASM SYSTEM BUDGET 2007-2016



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 curriculum exists for training new PGR managers.**
- **G. Volk (ARS-Ft. Collins) and P. Byrne (CSU-Ft. Collins) secured a USDA/NIFA grant for a meeting at Ft. C. in April 2018 to discuss designing and developing a curriculum for a PGR management training to be delivered primarily through distance-learning.**

Results of 2017 NPGS Project Plan Reviews

- **Prospective reviews of five-year project plans for 2018-2022 by anonymous external reviewers.**
- **Thanks to the anonymous reviewers!**
- **More than 2/3 of the NPGS project plans scored in the highest quality category. Every plan passed review during the first round.**
- **Many valuable suggestions from review panels, some of which follow.**

Results of 2017 NPGS Project Plan Reviews

- **Clonal PGR:**
 - Standardize methodology for trait evaluation
 - Similar ages of field plantings when possible
 - Health of field plantings
 - Clonal accessions represented by one or two plants in one field
- **Data management:**
 - Kudos for GRIN-Global development
 - Genomic data in G-G? Avoid duplicating data in G-G and genomic databases, without links.
 - Concern about development of local databases seemingly unassociated with G-G
 - Continue to intensify efforts to incorporate legacy data into G-G

Results of 2017 NPGS Project Plan Reviews

- **Infrastructure and operational capacity concerns: PGR storage capacity, land, greenhouses, screenhouses, personnel vacancies, funding.**
- **CGCs: positive interactions with NPGS staff, concern that some CGCs were inactive.**
- **Acquisition: what are the overall strategies/priorities? Incorporation of crop wild relatives should be carefully assessed, because CWR are expensive to manage.**
- **Deaccessioning: are policies/procedures up-to-date and understood?**
- **Distribution: home gardeners?**
- **Safety duplications: devote more effort for some crops.**
- **Quality and coordination of seed viability testing.**

Results of 2017 NPGS Project Plan Reviews

- **SMTAs and Digital Object Identifiers (DOIs).**
- **Digital images are valuable.**
- **Continue BMP implementation for GE PGR.**
- **When possible, develop and use standard sets of SNP markers for PGR characterization.**
- **When possible, evaluate more PGR for nutritional value and other end-use traits.**

National Laboratory for Genetic Resources Preservation



Agricultural
Research
Service

Dr. Stephanie Greene, Seed Curator
stephanie.greene@ars.usda.gov
(970-492-7531)

NLGRP- three programs organized into two ARS Units:

Plant and Animal Genetic Resources Preservation Unit

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

Plant Germplasm Preservation Research

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

Plant Preservation 5-year Project Plan

Objective 1: Preserve and back-up

- NPGS base seed collection
- designated non-NPGS seed collections
- cryopreserved NPGS clonal accessions
- microbial collections

Objective 2:

- With NPGS cooperators, develop and implement effective long-term maintenance and preservation methods
- Record and disseminate data (viability and protocol data)

Objective 3: Conduct “gap analyses” of the ecogeographical distribution of 250 high priority U.S. native crop wild relatives, to guide their strategic acquisition and conservation *in situ* and in the NPGS.

Number of unique plant and microbial accessions secured at NLGRP

Germplasm	Accessions/isolates
Seed	
NPGS Base collection	420,300
Non-NPGS-PVP/JPR	10,587
Non-NPGS (Black box)	352,262
Clonal	
NPGS-cryopreservation	4812
Non-NPGS (PVP)	350
Microbes	
Non-NPGS	111,066
	<hr/>
	899,377

84% of NPGS seed accessions are backed up

15.5% of clonal collections are backed up as cryopreserved samples

Seed Storage



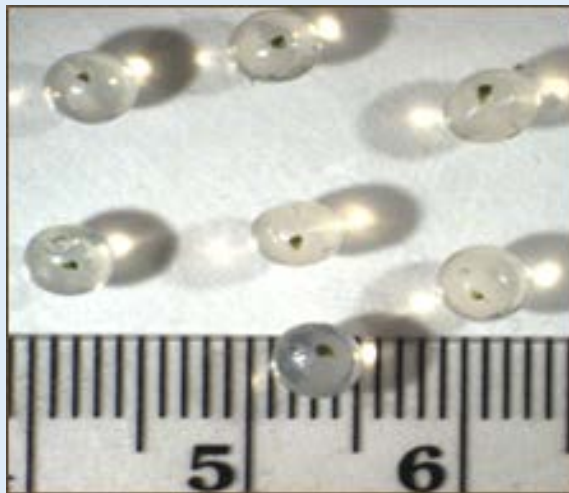
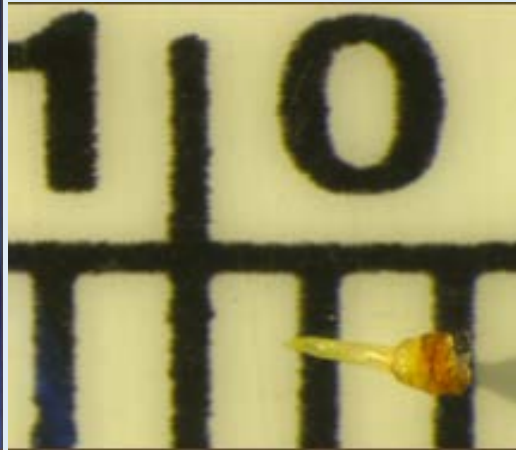
Conventional Cold Storage (-18°C)



Liquid nitrogen vapor (-165 °C)

Cryopreservation of clonal crops

Shoot meristems

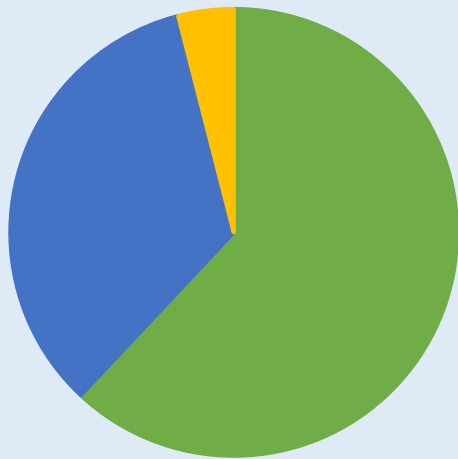


Dormant buds



Activities in 2017

- Received and processed 12,291 new samples



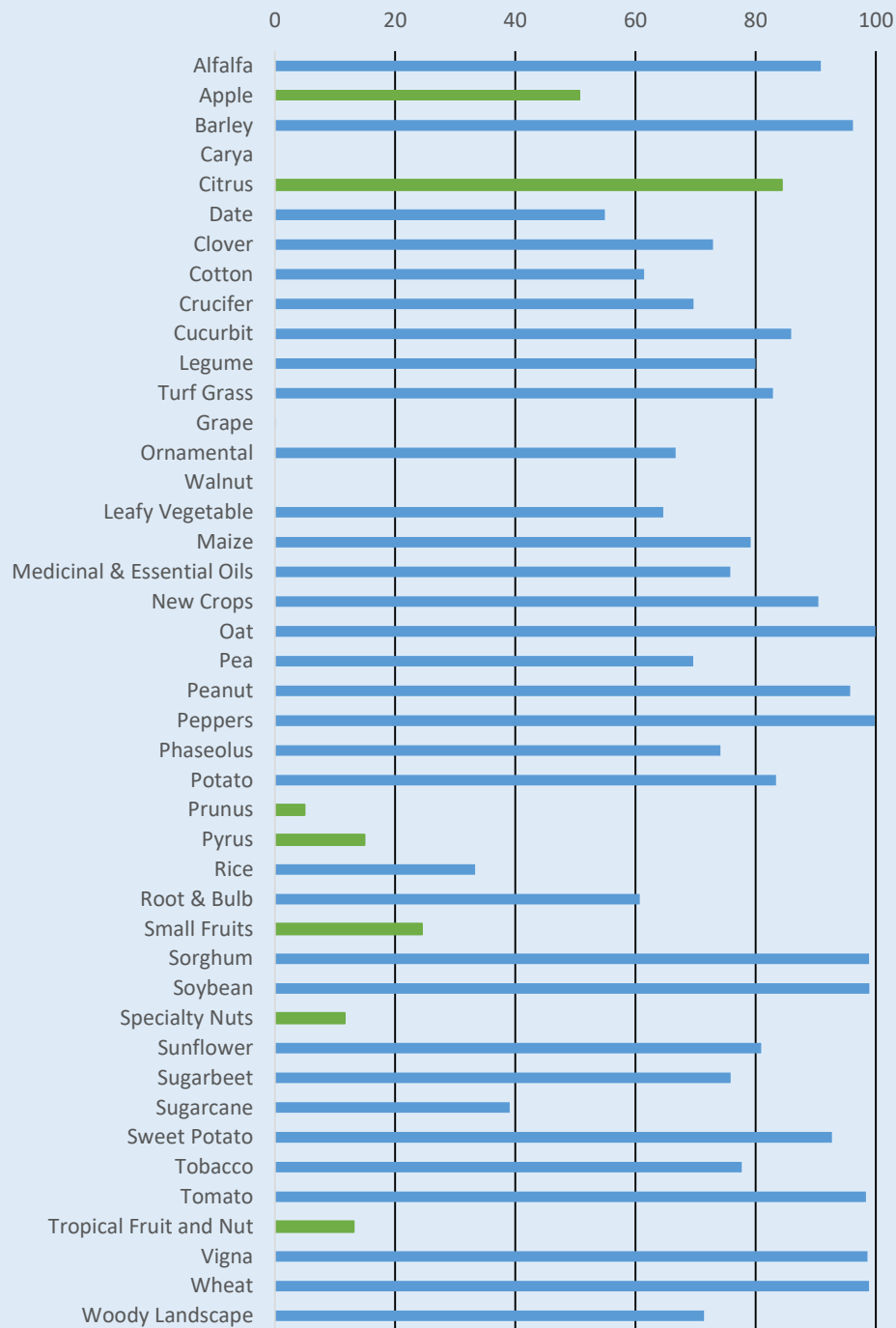
■ NPGS Backup ■ Black Box ■ PVP/JPR

- Conducted ~ 8000 germination tests
- Prepared 12,000 NPGS accessions for shipment to Svalbard Global Seed Vault. NPGS now has 20% of the collection secured at Svalbard
- Completed *North American Crop Wild Relatives: Conservation and Use*- 31 contributed chapters



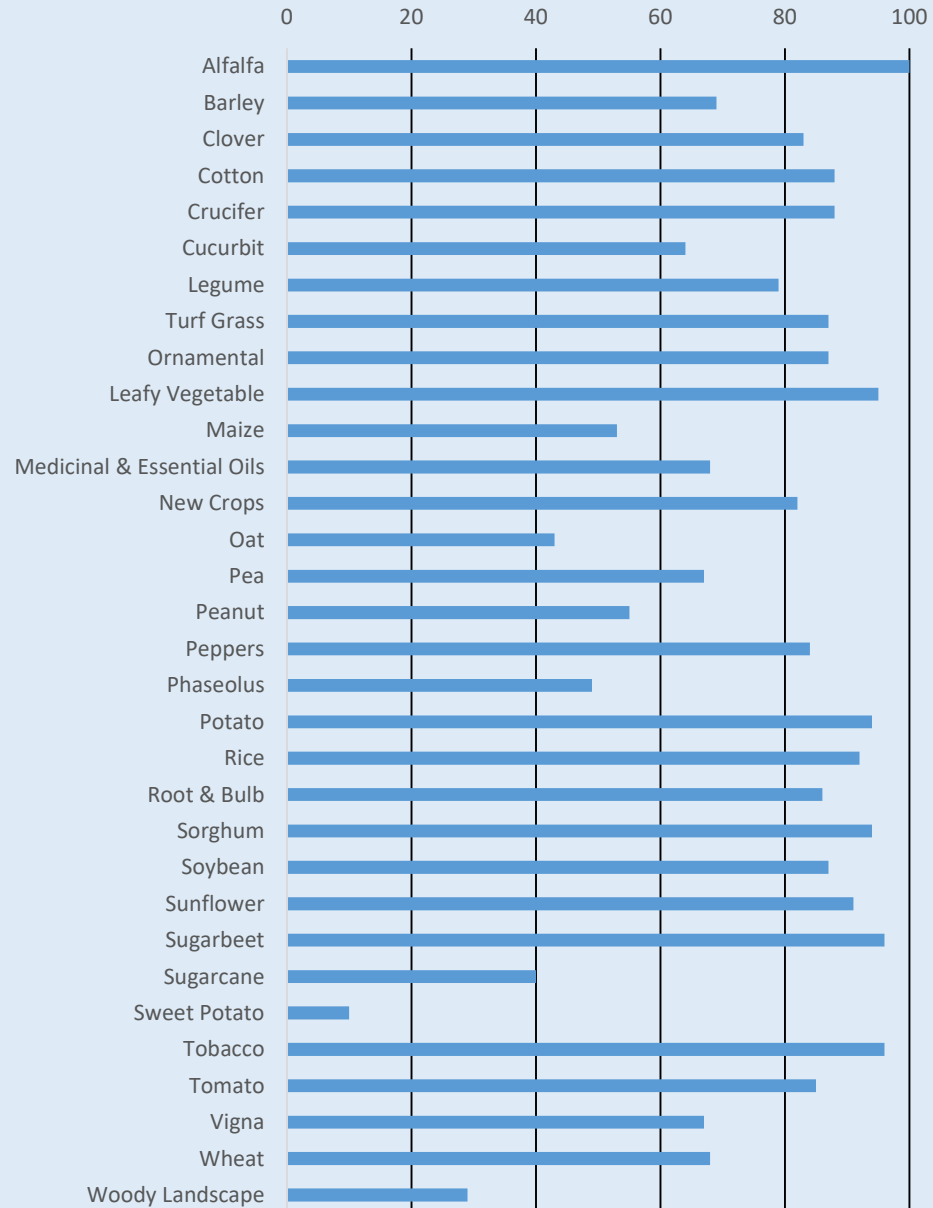
Backup status by CGC

% accessions



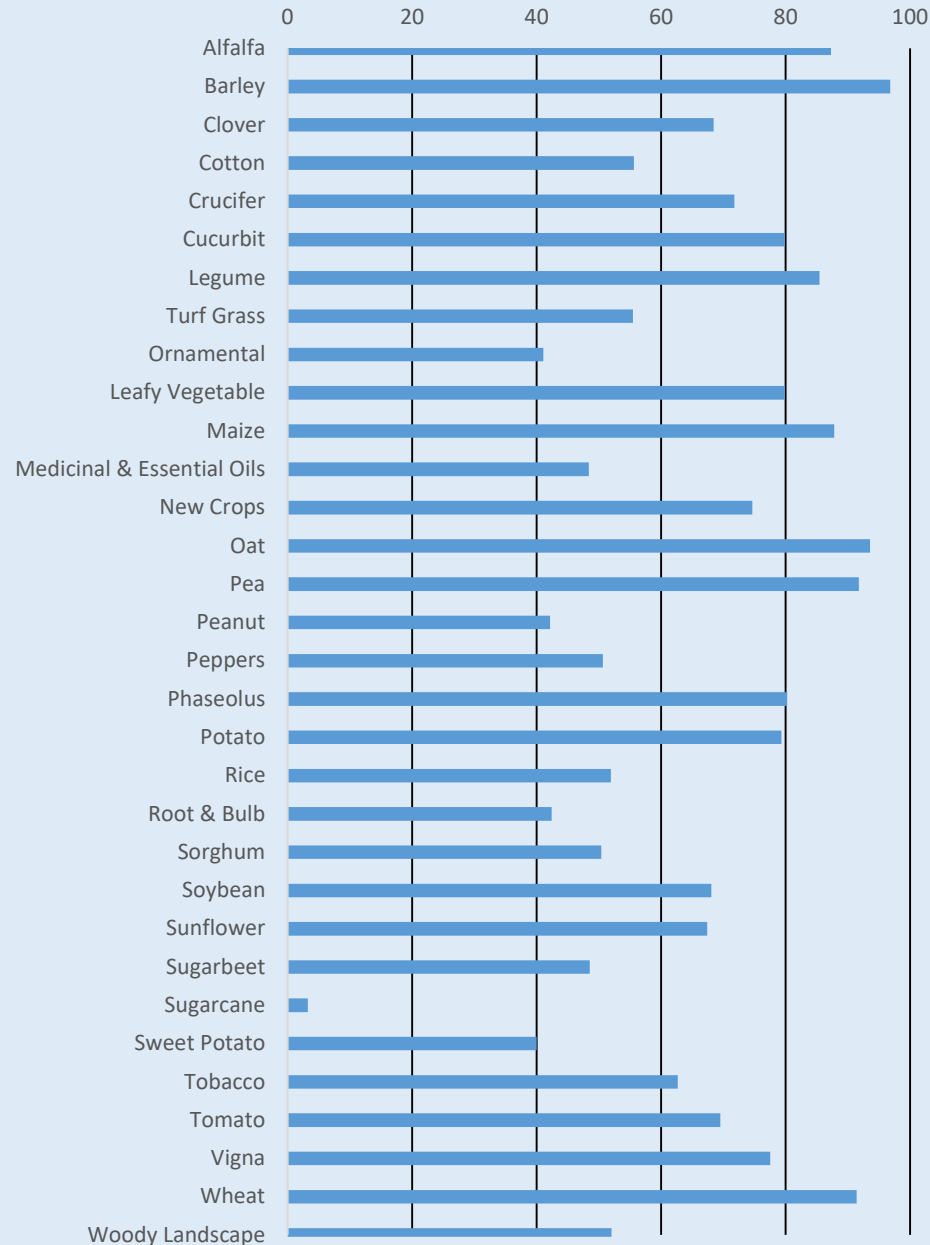
Backup status by CGC

% backup samples with \geq 550 seeds



Backup status by CGC

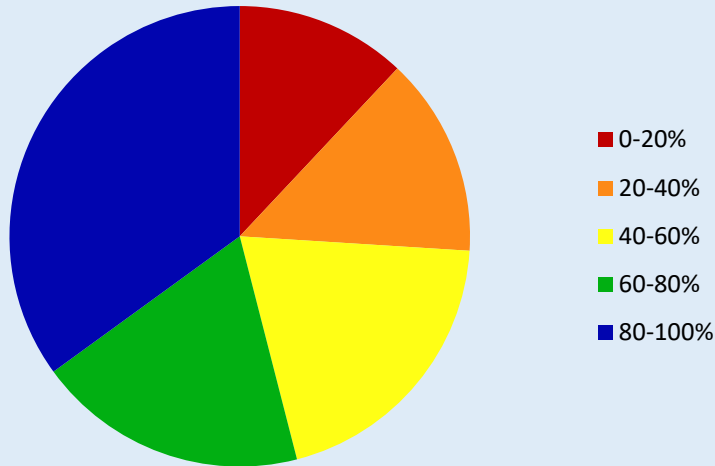
% backup samples with \geq 85% viability (based on last test)



Monitoring the base collection

Since 2014 we have conducted 8000 monitor tests on “high priority” samples

- Relatively short-lived species (seed longevity < 60 years)
- Initial germination > 65%,
- In storage for > 20 yr without a monitor test



The chart illustrates that even among relatively short lived species, we need to prioritize more frequent monitoring intervals for some species (i.e those falling into red and orange classes) then other species (i.e. those falling into green and blue).

Genera could be classed into 3 categories:

- Viability consistently stable (i.e. *Melilotus*, *Phleum* and *Agrostis*)
- Viability consistently declined (i.e. *Brassica*, *Bromus*, *Capsicum*),
- Inconsistent behaviour (i.e. *Arachis*, *Lactuca*, *Solanum*).

Our results support other reports that suggest that the most efficient monitoring strategies should be based on knowledge of species longevity. Knowing longevity, an appropriate interval can be determined to better track decline in storage.

Conclusion

Based on our recent monitor tests, it's evident that we need to begin to initiate a routine program that ensures declining back-up samples are replaced with new samples. We will be working with active sites and curators to determine the best, most cost effective way to do this.

Questions?

Plant Explorations\Exchanges
Plant Exchange Office
National Germplasm Resources Laboratory
Beltsville, Maryland

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



The NPGS Plant Exploration/Exchange Program

- fills gaps in the NPGS
- proposals accepted yearly by NGRL- PEO for explorations the next fiscal year
- proposals for 2018 being reviewed by NPS
- proposals for 2019 due July 20, 2018
- guidelines distributed to CGC Chairs
- supports both explorations and exchanges
- CGCs and curators must endorse proposals



2017 Plant Explorations

Reed canarygrass	France
Ornamentals (<i>Lilium</i> , <i>Viola</i> spp.)	Georgia
Wild apple	Austria, Romania
Wild raspberry	Canada
Wild blueberry	United States (FL)
Wild sweetpotato	United States (FL)
Wild apple	United States (IA, IL, MI, MO, PA)
Wild bean	United States (AL, AR, MI, LA)
Wild potato	United States (CO, NM)
Blue ash	United States (KY, OH, TN)

Postponed explorations in Italy and Spain will be conducted in 2018

2017 Plant Explorations



Access and Benefit Sharing for International Explorations

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

Identification of Historical Plant Introductions Cheyenne, Wyoming (Ned Garvey, collaborator)

- Former USDA Horticultural Field Station established ~1930 to evaluate fruit, vegetable, ornamental, and shelterbelts plants adapted to the conditions of the semiarid and dry regions of the US
- Now the High Plains Grasslands Research Station



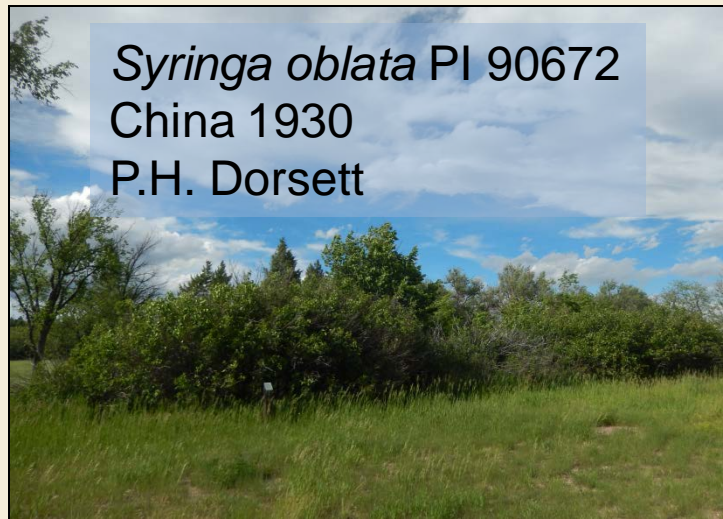
Summary of PIs Documented Cheyenne, Wyoming

- 46 unique PIs identified
- none are in the NPGS
- woody ornamentals and fruits (*Acer*, *Crataegus*, *Malus*, *Prunus*, *Syringa*, etc.) collected between 1911 and 1938

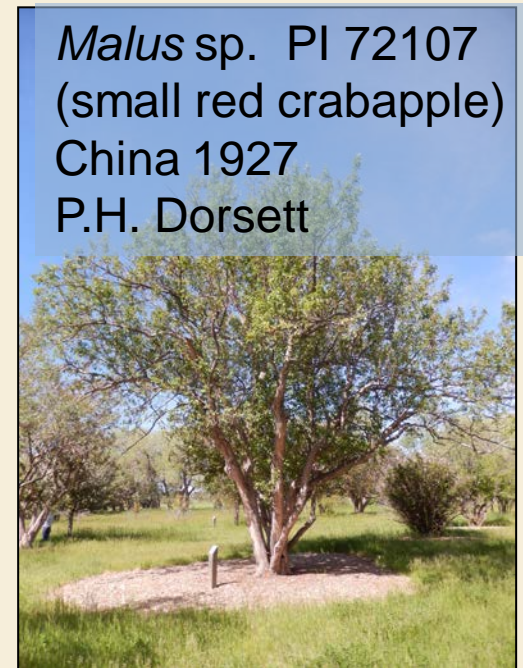
Crataegus ambigua
PI 30294
Russia 1911



Syringa oblata PI 90672
China 1930
P.H. Dorsett



Malus sp. PI 72107
(small red crabapple)
China 1927
P.H. Dorsett



Taxonomists' Update

- Melanie Schori
- John Wiersema



Choose Report:

Taxonomy - List Nomenclature changes ▼



Report Description:

List Nomenclature changes between a start and end date or if dates are blank in the last 5 months. To see all sites use % for site. Date format is mm/dd/yyyy.

Enter Parameter Value(s):

Name	Value
site	<input type="text"/>
begin_date	<input type="text"/>
end_date	<input type="text"/>

Limit:

[Generate Report](#)

Crop Genera (111) Treated (210 crops)

Cereal: *Avena, Cenchrus, Echinochloa, Eleusine, Eragrostis, Hordeum, Oryza, Panicum, Secale, Sorghum, Triticum, Zea, Zizania*

Culinary Herb: *Brassica, Carum, Elettaria, Humulus, Mentha, Piper, Sinapis, Vanilla, Zingiber*

Fiber: *Gossypium, Linum*

Forage: *Lotus, Medicago, Trifolium*

Fruit/Nut: *Actinidia, Ananas, Annona, Artocarpus, Carica, Carya, Castanea, Citrus, Citrullus, Corylus, Diospyros, Durio, Eriobotrya, Fragaria, Garcinia, Juglans, Macadamia, Malus, Mangifera, Musa, Olea, Persea, Phoenix, Physalis, Pistacia, Prunus, Psidium, Pyrus, Ribes, Rubus, Solanum, Theobroma, Vaccinium, Vitis*

Oilseed: *Brassica, Carthamus, Crambe, Guizotia, Helianthus, Olea*

Pseudocereal: *Amaranthus, Chenopodium, Fagopyrum*

Pulse: *Arachis, Cajanus, Canavalia, Cicer, Glycine, Lens, Lupinus*


Vegetable: *Abelmoschus, Allium, Alocasia, Arracacia, Asparagus, Beta, Brassica, Cajanus, Capsicum, Cichorium, Colocasia, Cucumis, Cucurbita, Cynara, Daucus, Dioscorea, Eruca, Ipomoea, Lactuca, Pachyrhizus, Pastinaca, Phaseolus, Pisum, Raphanus, Rheum, Sechium, Solanum, Spinacia, Tropaeolum, Xanthosoma, Vicia, Vigna*

Other: *Camellia, Coffea, Manihot, Nicotiana, Saccharum, Simmondsia*

Citrus Ad Hoc Committee

- 22 scientists and stakeholders from 7 countries
- Classification for approximately 25 species
- Four ancestral species involved in most cultivated hybrids
- More than 300 names to synonymize

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 No items in cart



Development 1.10.1.5 **Testing only, do not create orders here. Use <https://npgsweb.ars-grin.gov>**

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[Advanced Query of Species Data](#)

[Families and Genera Query](#)

[World Economic Plants in GRIN](#)

[Crop Wild Relative Data in GRIN](#)

[About GRIN Taxonomy for Plants](#)

Families and Genera in GRIN TAXONOMY

Any or all fields can be searched

Include miscellaneous patterns

Include pteridophytes

Include gymnosperms

Include angiosperms

Family name: (Family list:)

Exclude infrafamilial names

Genus name: (e.g. *Zizania*)

Exclude infrageneric names

Restrict to just accepted names

Query Crop Relatives in GRIN-Global

Any or all fields can be searched. Wild cards (*) are accepted. Multiple values could be selected from list boxes by using shift or control key.

Search

Clear All

Crop:

- ALL
- AHIPA – Pachyrhizus ahipa
- AJI – Capsicum baccatum var. pendulum
- ALFALFA – Medicago sativa subsp. sativa
- ALMOND – Prunus dulcis
- AMARANTH, PURPLE – Amaranthus cruentus
- APPLE – Malus domestica
- APRICOT – Prunus armeniaca
- ARRACACHA – Arracacia xanthorrhiza
- ARTICHOKE – Cynara cardunculus

Reset Crops

Genus name: (e.g. Oryza [without author])

Genetic relative status: primary secondary tertiary graftstock

Family:

- ALL FAMILIES
- Actinidiaceae
- Amaranthaceae
- Amaryllidaceae
- Anacardiaceae
- Annonaceae
- Apiaceae
- Araceae
- Areaceae
- Asparagaceae

Reset Families

Native distribution: Continental Area: ALL CONTINENTS

Region: ALL REGIONS

Country:

- ALL COUNTRIES
- Afghanistan
- Albania
- Algeria
- American Samoa
- Andorra
- Angola
- Anguilla
- Antarctica
- Antigua and Barbuda

State/Province: (e.g. Alabama)

Reset Countries

Include non-native distribution

Restrict to crops maintained at these NPGS repositories:

- ALL
- Natl. Germplasm Repository - Brownwood - BRW
- Natl. Germplasm Repository - Corvallis - COR
- Cotton Collection - COT
- Natl. Germplasm Repository - Davis - DAV
- Desert Legume Program - DLEG
- Natl. Germplasm Repository - Geneva - GEN
- Rice Genetic Stock Center - GSOR
- Pea Genetic Stock Collection - GSPI
- Maize Genetic Stock Center - GSZE

Reset Repositories

Restrict to crop wild relatives with germplasm in GRIN

Restrict to crop wild relatives without germplasm in GRIN

Search

Clear All

Crop: KIWIFRUIT

(Compiled by Dr. Blanca León)

Crop taxon:

1. *Actinidia deliciosa* (A. Chev.) C. F. Liang & A. R. Ferguson - kiwifruit

Crop wild relatives:**Primary**

1. *Actinidia chinensis* Planch. - [Reference]
2. *Actinidia deliciosa* (A. Chev.) C. F. Liang & A. R. Ferguson - [Reference]

Secondary

1. *Actinidia arguta* (Siebold & Zucc.) Planch. ex Miq. - [Reference]
2. *Actinidia arguta* (Siebold & Zucc.) Planch. ex Miq. var. *arguta* - [Reference]
3. *Actinidia callosa* Lindl. - [Reference]
4. *Actinidia callosa* Lindl. var. *discolor* C. F. Liang - [Reference]
5. *Actinidia callosa* Lindl. var. *henryi* Maxim. - [Reference]
6. *Actinidia callosa* Lindl. var. *striatillosa* C. F. Liang - [Reference]
7. *Actinidia chengkouensis* C. Yung Chang - [Reference]
8. *Actinidia chrysantha* C. F. Liang - [Reference]
9. *Actinidia cylindrica* C. F. Liang - [Reference]
10. *Actinidia cylindrica* C. F. Liang var. *reticulata* C. F. Liang - [Reference]
11. *Actinidia fortunatii* Finet & Gagnep. - [Reference]
12. *Actinidia grandiflora* C. F. Liang - [Reference]
13. *Actinidia indochinensis* Merr. - [Reference]
14. *Actinidia kolomikta* (Maxim. & Rupr.) Maxim. - [Reference]
15. *Actinidia macrosperma* C. F. Liang - [Reference]
16. *Actinidia macrosperma* C. F. Liang var. *macrosperma* - [Reference]
17. *Actinidia macrosperma* C. F. Liang var. *mumoides* C. F. Liang - [Reference]
18. *Actinidia melanandra* Franch. - [Reference]
19. *Actinidia melanandra* Franch. var. *melanandra* - [Reference]
20. *Actinidia rubricaulis* Dunn - [Reference]
21. *Actinidia rubricaulis* Dunn var. *rubricaulis* - [Reference]
22. *Actinidia stellatopilosa* C. Yung Chang - [Reference]
23. *Actinidia tinchoyina* Franch. - [Reference]
24. *Actinidia valvata* Dunn - [Reference]

Tertiary

1. *Actinidia arguta* (Siebold & Zucc.) Planch. ex Miq. var. *hypoleuca* (Nakai) Kitam. - [Reference]
2. *Actinidia callosa* Lindl. var. *callosa* - [Reference]
3. *Actinidia eriantha* Benth. - [Reference]
4. *Actinidia farinosa* C. F. Liang - [Reference]
5. *Actinidia fulvicoma* Hance - [Reference]
6. *Actinidia fulvicoma* Hance var. *cinerascens* (C. F. Liang) J. Q. Li & Soejarto - [Reference]
7. *Actinidia fulvicoma* Hance var. *fulvicoma* - [Reference]
8. *Actinidia hemsleyana* Dunn - [Reference]
9. *Actinidia henryi* Dunn - [Reference]
10. *Actinidia hubeiensis* H. M. Sun & R. H. Huang - [Reference]
11. *Actinidia lanceolata* Dunn - [Reference]
12. *Actinidia latifolia* (Gardner & Champ.) Merr. - [Reference]
13. *Actinidia latifolia* (Gardner & Champ.) Merr. var. *latifolia* - [Reference]
14. *Actinidia liangquangensis* C. F. Liang - [Reference]
15. *Actinidia lijiangensis* C. F. Liang & Y. X. Lu - [Reference]
16. *Actinidia melliana* Hand.-Mazz. - [Reference]
17. *Actinidia persicina* R. G. Li & L. Mo - [Reference]
18. *Actinidia polygama* (Siebold & Zucc.) Planch. ex Maxim. - [Reference]
19. *Actinidia rubricaulis* Dunn var. *conacea* (Finet & Gagnep.) C. F. Liang - [Reference]
20. *Actinidia rufa* (Siebold & Zucc.) Planch. ex Miq. - [Reference]
21. *Actinidia rufotricha* C. Y. Wu - [Reference]
22. *Actinidia rufotricha* C. Y. Wu var. *glomerata* C. F. Liang - [Reference]
23. *Actinidia sabiifolia* Dunn - [Reference]
24. *Actinidia setosa* (H. L. Li) C. F. Liang & A. R. Ferguson - [Reference]
25. *Actinidia styracifolia* C. F. Liang - [Reference]
26. *Actinidia tetramera* Maxim. - [Reference]
27. *Actinidia zhejiangensis* C. F. Liang - [Reference]



Crop Trust – an update

Hannes Dempewolf

January 2018





Genebank
Platform

CGIAR Genebanks



Long-term conservation

- 756,000 accessions
 - 724,000 seed
 - 24,000 tissue culture
 - 29,000 whole plants

Responding to users EVERY YEAR:

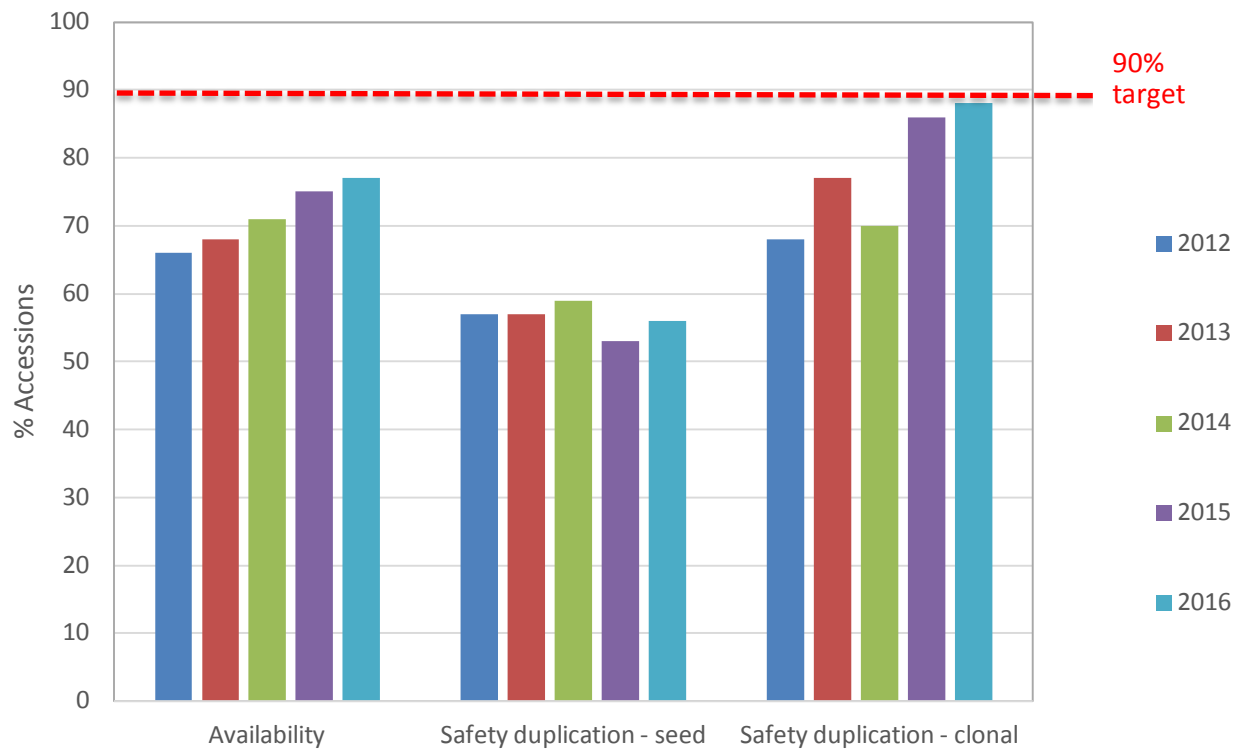
~ 2000 requests

~ 80-130,000 samples distributed

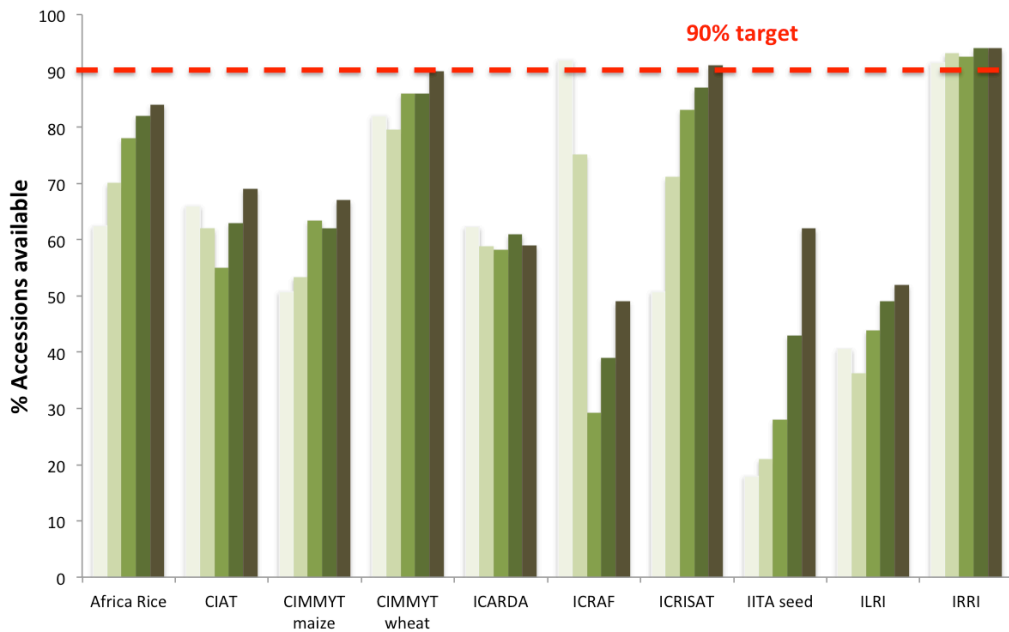
> 100 countries worldwide



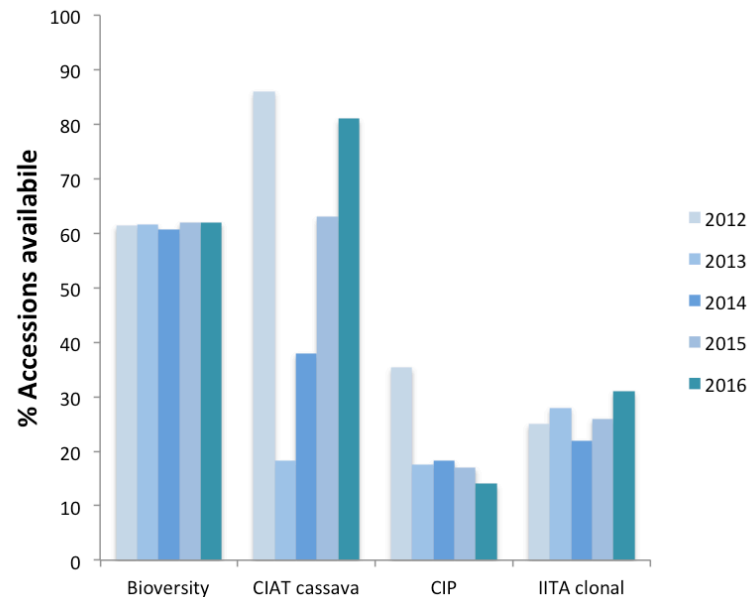
Genebank status



Genebank performance – Availability 2016



Seed collections



RTB collections

Eligibility for endowment funding

Fund Disbursement Strategy eligibility criteria require conformity to scientific and technical standards:

- ✓ 90% Accessions legally and physically available
- ✓ 90% Accessions safety duplicated
- ✓ Validated Quality Management System in place
- ✓ 90% Accessions documented to promote use

Pursuing cost efficiency and effective use

- Costing review 2018-2020
- Efficiencies (e.g. automated seed sorting, germination testing)
- Strategic curation
- Rationalization (e.g. forages collections ILRI-CIAT)
- Quality Management Systems
- Digital Object Identifiers (DOIs)

- Change in genebanks' leadership
- Major push on impact and communications (in response to IEA report)
- Adoption of DOIs by germplasm users and partners
- Genotyping of genebank accessions
- Data data data

The Svalbard Global Seed Vault

- Opened in 2008
- Managed by the Crop Trust, NordGen, and Norway
- Capacity to store 4.5 million varieties of crops (2.5 billion seeds!)
- Over 930,000 samples as of June 2017
- Seeds stored at -18°C



Two Retrievals: *Sept 2015 and Oct 2017*

Civil strife in Syria prompted the withdrawal of 128 boxes from Svalbard by the International Center for Agricultural Research in the Dry Areas (ICARDA)

ICARDA just recently returned the withdrawn seed collections to the Svalbard Vault





CROP TRUST
SECURING OUR FOOD, FOREVER

THANK YOU

WWW.CROPTRUST.ORG