

Annual Report for Calendar Year 2014

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Plant Germplasm Introduction and Testing Research
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A few samples of the approximately 90 accessions of nuña beans in the WRPIS Phaseolus collection. Peruvian “popping” beans have been selected and raised among the Andean natives in the high mountains and have desirable nutrition profile for product development for the snack market (See cover story on Page 4; Photo by Dr. Theodore Kisha).

June 2015

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EXECUTIVE SUMMARY AND HIGHLIGHTS

The Western Regional Plant Introduction Station (WRPIS) is one of the four regional plant introduction stations in the United States. Activities at WRPIS focus on acquisition, preservation, evaluation, documentation and distribution of plant species assigned to the station and conducting research related to its primary mission. This station includes five curatorial programs, one DNA marker lab and three research programs (agronomy, plant pathology and genetics). The operation is primarily funded by two CRIS projects managed through the USDA-ARS Plant Germplasm Introduction and Testing Research Unit at Pullman, WA, and the National Temperate Forage Legume Genetic Resources Unit at Prosser, WA. The Regional Research Project (W-6) also contributes considerable (approximately 15% of the total) funding which covers the salary and fringe benefits of six full time state employees working in WRPIS, as well as partial cost of land, equipment and farm operations for germplasm regeneration, seed increase, evaluation and enhancement research. We achieve our goals through close collaboration among scientists in various disciplines such as agronomy, horticulture, plant pathology, genetics, plant physiology and botany. As part of a Regional Multi-State Project (W-6), we work in close association and collaboration with scientists of the State Agricultural Experiment Stations, other state and federal agencies, and the private sector. Our scientists are also actively collaborating with scientists in international centers, foreign universities and research institutes. The global crop plant research community continued to show a high interest in the WRPIS germplasm collection. In 2014, seed samples from 20,924 accessions, approximately a quarter of the WRPIS' total collection, were distributed in 33,536 packets to 1,269 requesters residing in each of the 50 domestic states and 45 foreign countries. Satisfactory progress was made in the WRPIS's mission areas. Our scientists published 16 research papers in peer-reviewed journals; contributed to two book chapters; and presented 22 oral or poster presentations at various international, national and regional conferences.

The followings are the 2014 highlights:

- On December 31, 2014, there were 95,636 accessions belonging to 1,101 genera, 4,804 species and 5,450 taxa in the WRPIS collection.
- We acquired 1,698 new accessions including 1,403 native plant accessions from the SOS (Seeds of Success) project, 43 accessions from the country Georgia and 85 accessions of *Miscanthus sacchariflorus* received as live plants.
- We distributed a total of 33,536 packets of seed samples to 1,269 requestors with addresses in each of the 50 domestic states and 45 foreign countries. Fifty-seven percent (19,089 packets) were distributed to the U.S. and forty-three percent (14,447 packets) were distributed to foreign countries. Requesters in each of the 50 domestic states received germplasm samples from WRPIS in the Year of 2014. Approximately 36.2% (6,914 out of 19,089 packets) of the domestic distribution went to the 13 Western states.
- We uploaded 65,164 observation data points on 24,816 accessions into the Germplasm Resources Information Network (GRIN) database, which is accessible by researchers worldwide via the internet. These data points are on 157 established descriptors of 18 different crop species. Our collaborators contributed 18% and WRPIS staff collected 82% of the evaluation data.

- We entered 2,529 seed viability records into GRIN in 2014. The Pullman location tested 145 and the National Center for Genetic Resources Preservation (NCGRP), Fort Collins, CO tested 2,394 accessions.
- We packed and stored 2,775 newly regenerated/harvested inventories of a broad range of plant species. We determined seed quantities of 15,043 inventories.
- We shipped 3,020 seed inventories to the National Center for Genetic Resources Preservation (NCGRP), Fort Collins, Colorado and 451 inventories to the Svalbard Global Seed Vault, Svalbard, Norway for secured backup.
- In collaboration with researchers at DuPont Pioneer and Alforex Seeds companies, we identified SNP (single nucleotide polymorphism) markers associated with resistance to Verticillium wilt in two alfalfa populations using the high resolution melting technique. Eleven markers located on three chromosomes were significantly associated with Verticillium wilt resistance. Five markers on chromosomes 2 and 7 were presumably the Verticillium wilt resistance homologues reported in the diploid species *M. truncatula*. Six significant markers on chromosome 8 represent novel Verticillium wilt resistance loci in alfalfa and they contributed a total of 40% of the phenotypic variation explained. These identified markers are useful in marker-assisted breeding for improving the resistance of alfalfa to Verticillium wilt.
- Collaborative activities supported by grants from the BLM's Seeds of Success (SOS) project, the Great Basin Restoration Initiative, and the Forest Service to an ARS Research Agronomist have substantially advanced native plant collections needed for research and development of plant materials. Accession and distribution numbers continue to grow. In 2014, 1,403 new native plant accessions were added to the SOS-NPGS collection, which now totals 10,515 accessions. Since 2006, more than 1,250 seed orders and nearly 4,500 seed distributions have been made for research projects including federal, state, U.S. commerce and private cooperators. Nearly half of the accessions have been transferred to existing NPGS curators for permanent management. Research with key native species has provided extensive evaluation data, linked genetic variation with source location climate, and resulted in adaption driven seed zones to guide germplasm selection for restoration after fire and other disturbances.
- Our Research Plant Pathologist continued to generate useful information on blue mold of garlic and other bulb crops. We completed identification of additional agents of blue mold of Allium species: one Penicillium species belonging to series Corymbifera (*Penicillium albocoremium*) and four Penicillium species outside that series (*P. crustosum*, *P. expansum*, *P. glabrum* and *P. paraherqueii*) plus *P. polonicum*. We assessed experimentally their pathogenicity on garlic and two varieties of table onion. An abstract has been submitted. This is the third in a series of researches addressing identification and host range of agents of blue mold on bulb crops; the second in the series (concentrating on species in series Corymbifera) we have completed and published the results.
- The faba bean germplasm enhancement research progressed satisfactorily. An ARCS (Achievement Rewards for College Scientists) scholar Erik Landry successfully defended his PhD dissertation entitled "Faba bean (*Vicia faba* L.), a potential new pulse crop for southeastern Washington" and completed his degree requirement at WSU.

Several enhanced faba bean germplasms and advanced breeding lines are currently being processed for public release. Two MTAs (Material Transfer Agreement) were signed. One was with the Lundberg Family Farm, a leader in organic rice farming in California, which is looking for suitable legume crops that fit into their sustainable organic farming systems. The other was with the Weaver Seed of Oregon, which produces and sells both organic and conventional seeds for forage, cover crop and no-till farming systems.

Cover: The approximately 17,300 Phaseolus accessions held at the Western Regional Plant Introduction Station at Pullman WA comprise one of the largest single genus collections in the National Plant Germplasm System. Among these, about 90 are classified as nuña beans, or the Peruvian “popping” bean, which has a great potential in the snack market. These beans have been selected and raised among the Andean natives in the high mountains for millennia and have the unique characteristic of bursting when subjected to heat, making them a high protein food in conditions where boiling would consume scarce fuel. This property, and nutrient analysis which shows many of the accessions to be high in nutrition and sucrose, while lower in undesirable carbohydrates, makes these beans a potential tasty, nutritious snack food, both in and of itself, as well as in the form of an extruded product.

REPORT

ADMINISTRATION

Jim Moyer (Administrative Advisor)
Ann Marie Thro (NIFA Representative)
Michael Fitzner (NIFA Representative)
Peter Bretting (ARS National Program Staff)
Andrew Hammond (ARS, PWA Area Director)
Jinguo Hu (Research Leader and Station Coordinator)
Carla Miles (Program Support Assistant)

PERSONNEL

When ARS closed its operation at Prosser as a location, three full time employees were reassigned to the Plant Germplasm Introduction and Testing Research Unit. This included Research Geneticist Dr. Long-Xi Yu working on alfalfa genetics and breeding, and two technicians, Mr. Bill Boge and Ms. Martha Rivera.

There were some additional personnel changes on the federal side. Dr. Stephanie Greene, Lead Scientist and Forage Legume Germplasm Curator of the National Temperate Forage Legume Genetic Resources Unit (NTFLGRU) at Prosser, WA moved to Fort Collins, CO in May to take a position at the National Center for Genetic Resources Preservation. As a result, the critical position at Prosser has been vacant ever since. The daily operation of the forage germplasm management activities have continued with an experienced technician, Ms. Estela Cervantes. Dr. Hu worked with the ARS Pacific West Area Office and the Office of National Programs to upgrade the Forage Legume Germplasm Curator position with a full promotion potential to GS-14 to attract and retain an experienced scientist for this critical position in the future.

On the State side, there were many major changes. Two Plant Technicians came on board in the spring (Ms. Saber Jewell working in the seed cleaning lab and Mr. Kyall Hagemeyer working on our Central Ferry farm). Ms. Paula Moore, an experienced technician working in the seed storage in charge of seed viability (germination) testing and helping with seed sample distribution, resigned in August to work for the Washington State Department of Agriculture. Mr. Wayne Olson, the Pullman Farm and Facility Manager, retired in October. WSU was able to promote Mr. Sean Vail to fill this critical position before the end of the year. The two vacant technician positions (one on the Pullman Farm and one in the seed storage) were filled by Scott McGee and Kay Morris, respectively, in spring 2015 before the busy season.

RESEARCH PROJECT

In 2014, there was no program change for the two appropriated, five-year projects (2013-2018), Both project plans, entitled "Management of Plant Genetic Resources and Associated Information" and "Temperate Forage Legume Genetic Resource Management, Characterization, and Evaluation" for Pullman and Prosser, respectively, are relevant to the

Agricultural Research Service's National Program 301 Plant Genetic Resources, Genomics, and Genetic Improvement. The newly added, appropriated, five-year alfalfa research project entitled "Enhancing Resistance to Biotic and Abiotic Stresses in Alfalfa" is relevant to the Agricultural Research Service's National Program 215 Pasture, Forage, and Rangeland System.

The Previous NIFA Multi-State Research Project W-6 entitled "Plant Genetic Resource Management, Preservation, Characterization and Utilization", which was on a five-year cycle, expired on September 30, 2014. The current project entitled "Management and Utilization of Plant Genetic Resources" was submitted in January, 2014 and was approved for funding for two years, from October 01, 2014 to September 30, 2016. Work on project renewal will initiate in 2015 in hopes that the project will return to the regular five-year cycle.

FUNDING

The station received a \$270,000 increase in FY 14 which restored the fund level prior to the sequestration in the previous year. The total ARS budget for our programs was \$2,999,971 with \$2,309,780 for plant germplasm service and research at Pullman, WA, and \$266,643 for the temperate forage germplasm at Prosser, WA, and \$423,548 for the alfalfa research at Prosser, WA. The discretionary dollar per SY is \$35,271. The 'in kind' support from a NIFA Multi-State Research Project W-6, through Washington State University was \$415,000.

Other research funds received in 2014 by our scientists totaled \$400,061 and included: 1) a research grant of \$156,401 from NIFA-BRAG for the proposal entitled "Industry-driven Field and Landscape Research on Pollen-mediated Gene Flow in Genetically Engineered Alfalfa" to Stephanie Greene. A postdoc research associate was hired to work on this project in Prosser, WA through WSU on a SCA (Dr. Greene continued managing the project after she moved to Fort Collins, CO and the postdoc stayed in Prosser); 2) \$125,000 of Reimbursable Agreement with Bureau of Land Management with Dr. Richard Johnson entitled "Management, Evaluation, Acquisition, and Distribution of Native Plant Germplasm for Research and Restoration"; 3) \$35,000 grant to Dr. Richard Johnson from US Forest Service to conduct a research project entitled "Conservation, Adaptation and Seed Zones for Key Great Basin Species". The above two grants support two temporary employees (one full-time supporting scientist, and one part-time technician), other seasonal help, supplies and travel; 4) \$30,000 (\$25,000 from National Alfalfa Forage Alliance Research Fund and \$5,000 from Kazakhstan Medicago Fund) research grant to Dr. Long-Xi Yu for alfalfa genomics. The fund from Kazakhstan was the bench fee for a visiting scholar who conducted genomics research in Prosser for six months. 5) \$49,910 research grant to Dr. Clarice Coyne from USA Dry Pea and Lentil Council to support sequencing the pea genome and 6) \$3,750 from the Beet Sugar Development Foundation to Ms. Barbara Hellier in supporting Beta germplasm conservation and regeneration

FACILITIES

With the restored funding, we replaced several pieces of aging farm equipment in Central Ferry. These include a Polaris Ranger XP 900 (replacing a 2004 Ranger with a dead engine), a Kubota M6060 tractor with a Trimble field guidance, mapping, and GPS spray control (replacing a 1983 John Deere 2240), a Kubota BX 25D Compact tractor (replacing the 1984 Bolens G174 for which no parts are available), a John Deere Z915B lawn mower (replacing a 1994 John Deere F525 lawn mower with mechanical issues), and a Ford F350,

and a dump trailer (replacing three vehicles: a 1976 Loadstar 1600 farm truck, a 1996 Dodge ¾ ton Pickup with a bad front end and excessive oil usage, and a 2000 Chevy ¾ ton pickup with body damage and front alignment repairs needed). Modernizing these pieces of equipment will provide added efficiency and help us progress toward higher emission standards and reduced fuel costs.

There was little change in the WRPIS facilities at Pullman and Central Ferry during the year. There are 34,800 square feet of greenhouse facilities (22,375 sq ft Federal, 12,425 sq ft Washington State University) and 157.3 acres of farm land (86.2 acres Federal, 71.1 acres WSU). WRPIS staff uses 12 laboratories (5 Federal, 7 WSU), and 22 offices (4 in Federal buildings, 6 in Federal mobile office building, 12 in WSU buildings). The substantially retrofitted Seed Storage Building runs smoothly and keeps the seed samples at optimal conditions. At Prosser, the ARS Alfalfa Research Geneticist and the Forage Germplasm Curator have assigned office, greenhouse and laboratory spaces.

The Pullman-Moscow Regional Airport is preparing for a major construction project that will rotate its entire runway about ten degrees and lengthen it for about 400 feet. The New runway will allow larger planes to land on the Palouse. This project has been in the discussion phase for almost six years and is expected to take another four years to complete. The airport runway realignment project will impact 28.5 acres, 45.7% of the total WRPIS land used. It is critical for this land to be replaced so we can maintain our supply of quality seed for the user community.

Expanding the Central Ferry Research Farm facility to host the operation of alfalfa and other forage legume germplasm curation is still a non-funded plan. It would be better if we could relocate the operations of the National Temperate Forage Legume Germplasm Resources Unit to avoid the possible adventitious presence of transgenes of our germplasm collections. The current Prosser site is surrounded by alfalfa production fields in which the genetically-engineered Roundup Ready alfalfa (RRA) may be planted, whereas the Central Ferry site is more isolated from RRA production fields. At its 2014 meeting, the W6 TAC endorsed the station coordinator's proposal of moving the field operations to Central Ferry, WA. However, with our current funding level it is not possible to make the move. We have made this a major issue in WRPIS' 2016 Annual Resource Management Plan (ARMP) which will require the combined effort of ARS Pacific West Area Office and Headquarters to help materialize this relocation.

GERMPLASM MANAGEMENT

The five curatorial programs at WRPIS manage the diverse crop species assigned to the station by the National Plant Germplasm System (NPGS) which are divided roughly into ten groups: 1) forage and turf grasses; 2) cool season food legumes (pea, lentil, chickpea, faba bean, lupin, etc.); 3) temperate forage legume crops (alfalfa, lotus and clover); 4) beans; 5) lettuce; 6) safflower; 7) garlic; wild onion and onion relatives; 8) sugar beet; 9) selected ornamentals; and 10) medicinal plant species.. Figure 1 shows the number of accessions for major crop groups maintained at WRPIS. We are first among the four regional PI stations and second among the 28 NPGS sites/collections for accessions managed (<http://www.ars-grin.gov/npgs/stats/sitesummary.html>). Currently, WRPIS holds approximately 16.8% of the total NPGS holdings of 571,542 accessions. Most WRPIS accessions are maintained as seed, with a small proportion vegetatively-propagated (garlic and its relatives, rhubarb, and some other vegetables, grasses and ornamentals).

As of December 31, 2014, there were 95,681 accessions belonging to 1,101 genera, 4,804 species and 5,450 taxa in the WRPIS collection. The value of these collections continues to grow as international access to germplasm is increasingly limited by the changing political environments. The Agronomy and Safflower Program (Vicki Bradley) manages 24,653 accessions of cool season turf and forage grasses, and safflower; the Cool Season Food Legume Program (Clarice Coyne) curates a total of 22,433 accessions of pea, chickpea, lentil, faba bean, and lupine; the *Phaseolus* Beans Program (Ted Kisha) manages a collection of 17,306 accessions, all belonging to the *Phaseolus* genus; the Temperate Forage Program (Stephanie Greene, located in Prosser, WA) manages the germplasm of alfalfa, clover, lotus, and wild clovers with a total of 13,285 accessions; and the Horticultural Crops Program (Barbara Hellier) manages 11,826 accessions of sugar beet, lettuce, garlic, and many miscellaneous species that have potential use for ornamental or medicinal purposes.

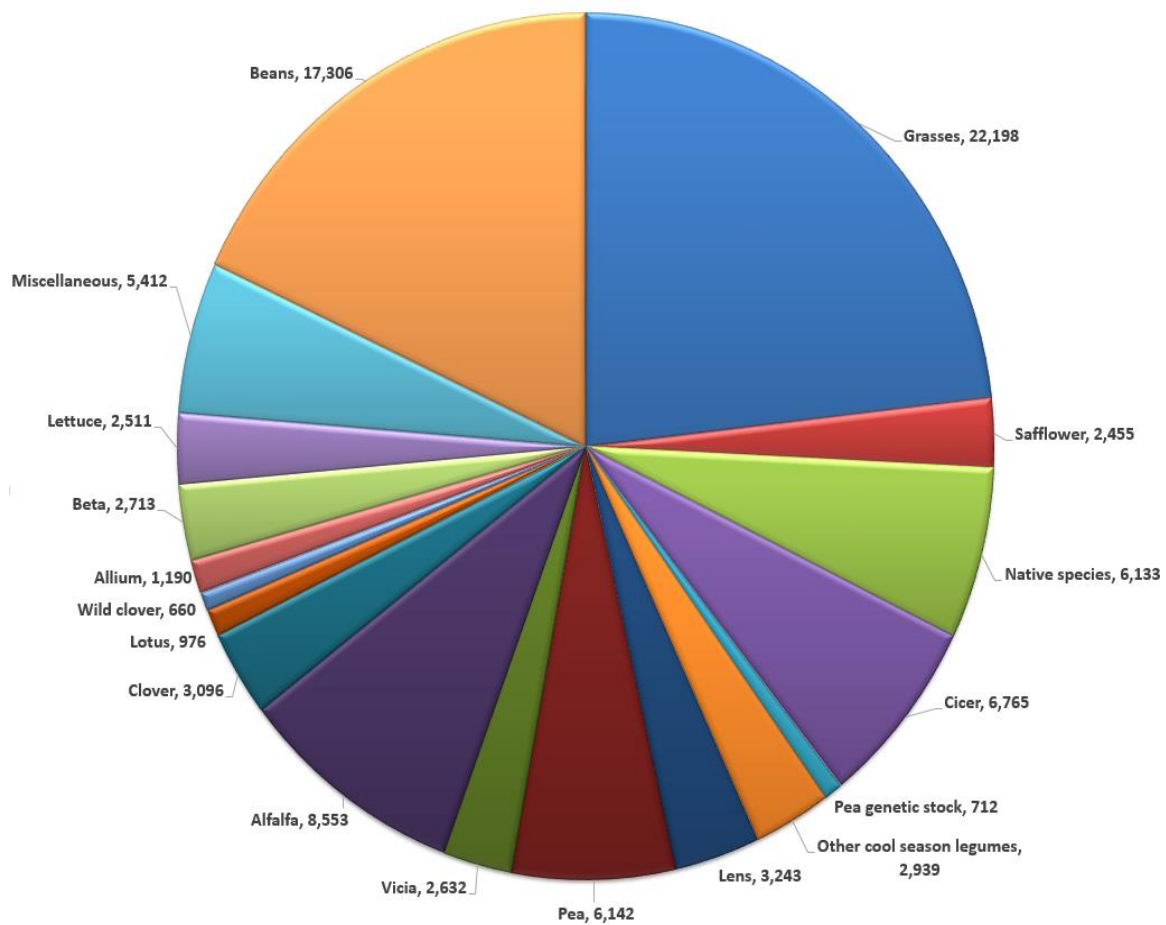


Figure 1. Number of accessions for major crop groups maintained by the five curatorial programs at WRPIS (as of April 17, 2015).

Supported by grants from the BLM’s Seeds of Success (SOS) project, the Great Basin Restoration Initiative, and the Forest Service, WRPIS Research Agronomist RC Johnson continued to lead the collaborative effort and substantially advanced native plant

collections needed for research and development of plant materials. Accession and distribution numbers continue to grow. The SOS-NPGS collection now totals 10,515 accessions. Since 2006, more than 1,250 seed orders and nearly 4,500 seed sample distributions have been made for research projects including federal, state, U.S. commerce and private cooperators. Nearly half of the accessions have been transferred to existing NPGS curators for permanent management.

Germplasm Acquisition

During 2014 there were 1,698 new accessions added to our collection and 1,403 of the new accessions were native plant materials from the SOS project. At the end of the year the total number of accessions managed by WRPIS was 95,636 (Figure 2).



Figure 2. Changes of total number of accessions managed by WRPIS since 2007. The numbers were recorded at the end of each calendar year.

Germplasm conservation

In 2014, WRPIS curators regenerated 2,775 inventories by following established, labor-intensive procedures and protocols for maintaining the genetic integrity and health of all germplasm collections. These included physical isolation, hand planting and transplanting, controlled hand and insect pollination, hand harvesting, cleaning and packaging for storage and distribution.

A total of 2,529 seed viability records were entered into the GRIN database. WRPIS tested 145 inventories, and NCGRP in Fort Collins, CO tested 2,394 inventories. The WRPIS number of tested inventories is unusually low this year since the technician responsible for seed germination and distribution resigned in August, and the position was vacant until

April 2015. Seed quantities of 15,043 inventories in our storage were updated by weighing and converting to number of seeds per inventory.

For security back-ups, we sent 3,020 inventories to NCGRP at Fort Collins, CO and 451 inventories to the Svalbard Global Seed Vault, Longyearbyen, Svalbard through the NCGRP during 2014.



Figure 3. Manually transplanting Lupin seedlings on the Pullman farm for seed increase or regeneration.

Germplasm evaluation and characterization

In 2014, a total of 65,164 observation data records were entered into GRIN representing 24,816 accessions, 157 descriptors, and 18 crop species. Eighty-two percent of the data were collected by WRPIS staff and the remaining 18% came from cooperators. Data records by crop were: 33,409 for *Phaseolus*, 9,641 for pea, 6,504 for faba bean, 4,622 for lentil, 1,307 for sugar beet, 4,537 for cool-season grasses, 3,005 for chickpea, 1,012 for sugar beet, 935 for safflower, 477 for lettuce, 471 for medics, 123 for vetch, 107 for lupin, 88 for alfalfa, 22 for *Lathyrus*, 14 for wild *Allium*, 25 for trefoil, and 150 for various W-6 miscellaneous species.

We applied available DNA marker techniques to assess phylogenetic and genetic diversity of priority crop germplasm in our collection. Projects carried out in 2014 included target region amplification polymorphism (TRAP) and AFLP genotyping of Tepary bean (*Phaseolus acutifolius* A. Gray), a native, short life-cycle annual desert legume indigenous to northwestern Mexico and the southwestern USA and considered drought and heat tolerant. Genotyping was also completed on wild kidney bean or thicket bean (*Phaseolus polystachios* (L.) Britton, Sterns, & Poggenb.), a perennial vine found in the eastern United States from Texas to Connecticut, and 35 nuña bean accessions. We also collaborated with an ICARDA lentil breeder in Morocco and completed a genotyping-by-sequencing project generating approximately 12,000 SNPs for an international lentil core collection.

Germplasm distribution

The annual number of seed packets distributed for each of the past five years is shown in Figure 4. This year's distribution, 33,536 packets of 20,924 accessions (21.9% of our total collection), was the second highest number of sample packets ever distributed by WRPIS in single year. We have appeared to have reached higher annual averages compared to previous decades. Among the distributed packets, 19,089 (57%) were sent to addresses in the USA and 14,447 (43%) were sent to 45 foreign countries. There were 1,578 orders filled by 1,269 different requestors. The most requested plant groups were grasses (8,076 packets), *Phaseolus* bean (4,446 packets), alfalfa (3,669 packets), pea and lettuce (both around 2,500 packets).

Plant germplasm users in the 13 Western states requested 36,822 items from NPGS. This accounts for 25.3% of the total NPGS domestic distribution. The WRPIS distributed 6,914 items to the western 13 states (approximately 36.2% of its domestic distribution). These genetic materials, used for research and education in diverse scientific disciplines contribute significantly to scholastic and economic activity in the Western region now and into the future.

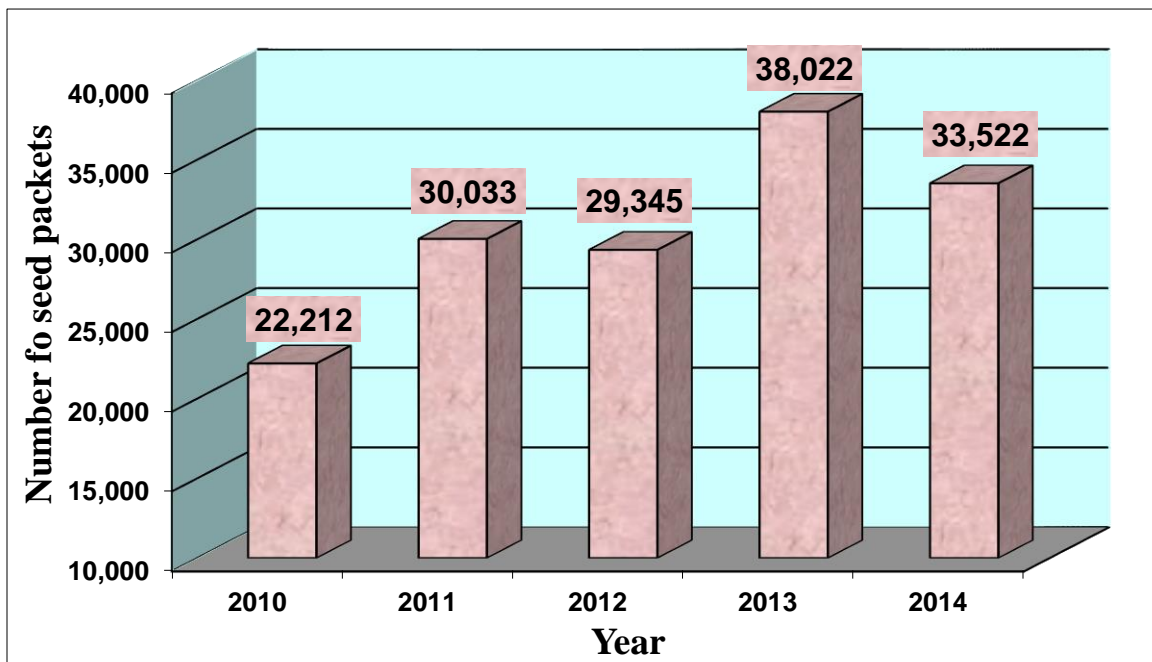


Figure 4. Number of seed packets distributed annually by WRPIS from Year 2010 to Year 2014.

Brief Summary of individual programs

1. Grasses and Safflower collections

- A. There were 606 grass regeneration field plots maintained in 2014. This included overwintering of 291 from the 2013 nurseries and 315 newly planted accessions at Central Ferry and Pullman in 2014. We harvested 256 grass accessions in the first and second year grass nurseries in 2014. One hundred-six new grass accessions were

- acquired this year and 333 accessions were backed-up at NCGRP. Four hundred and forty images of *Eragrostis tef* and data for 10 descriptors of 131 accessions of *Lolium multiflorum* were uploaded into GRIN. We continued to maintain 118 clonal accessions, mostly *Spartina* and *Miscanthus*, in the greenhouse.
- B. We planted, caged, and harvested 142 safflower accessions. Samples of 23 safflower accessions were sent to the NCGRP for back-up. Data from an evaluation nursery for 11 crop descriptors on 50 accession, and rust ratings from the safflower regeneration nursery, were uploaded into GRIN.
 - C. Management and editing of the Safflower Genetic Resources Homepage was continued. There were more than 250,000 hits on the homepage in 2014. Most were from the Russian Federation and the United States (40,382). Montana, California, and Washington were the most active states. Other countries with more than 10,000 hits were India, Canada, and Turkey.

2. Cool season food legumes

- A. Field regenerations of food legumes totaled 3979 transplants and 1,288 direct-seeded accessions. We collected 23,027 characterization data on agronomic traits, 25,317 genetic (molecular characterization) were processed, and all this data was entered into the GRIN database. This included 6418 faba bean observations from Chinese cooperators and 1285 Fusarium wilt disease data from the literature.
- B. The Cool Season Food Legume Curator is cooperating on several international research initiatives to increase the utilization of plant genetic resources. Chickpea vernalization genes and winter-hardiness from chickpea wild crop relatives were studied with colleagues at Texas A&M University and Israel. In collaboration with a lentil breeder of ICARDA in Morocco, we completed the genotyping-by-sequencing generated SNP genotyping (approximately 12,000 SNPs) of an international lentil core collection.
- C. The cool season food legume single-plant-derived core collections have been distributed for allele mining in pea, chickpea and lentil using SNP data sets completed by cooperators at Cornell University, U.C. Davis, and the University of Saskatchewan.

3. Medicago, Trifolium and Lotus collections

- A. With Stephanie Greene's departure to the NCGRP the forage legume curator position has been vacant since May 2014. The planned 2014 regeneration and evaluation was carried out by a capable technician with the help of two seasonal part-time employees. Although with minimal oversight, all operations went as well as could be expected. In 2014, seeds of 16 Lotus, 65 Medicago and 18 Trifolium accessions were planted, harvested and cleaned. Images of flowers, stems and pods of 100 accessions were scanned and uploaded into GRIN.
- B. Evaluation data and images of medic, alfalfa and trefoil germplasm accessions were uploaded into GRIN.
- C. Dr. Stephanie Greene carried on with her responsibility of managing and reporting of the NIFA-BRAG research project investigating gene flow from Roundup-Ready Alfalfa to conventional alfalfa. However, most of the research activities remained at Prosser. Dr. Sandya Kesoju, a post-doctoral research associate hired through a cooperative agreement with Washington State University, will continue working at Prosser until March 2016. WRPIS will continue to provide needed technical and

administrative supports to the project. Through a series of presentations at various conferences and growers meeting, this research project has increased public awareness of the occurrence of transgenic gene flow. It also found that seed-mediated gene flow may be as significant as pollen-mediated gene flow. Further study will develop appropriate strategies to minimize gene flow (isolation by distance) and to establish GMO-free zone.

- D. Recently, Stephanie Greene's team identified the adventitious presence (AP) of transgenic traits from alfalfa seed samples collected from hay fields in 2011 and 2012 that are on the Irrigated Agriculture Research and Extension Center farm at Prosser, WA. This finding caught the attention of ARS HQ and the PWA Area Office and emphasized the need to move the NPGS alfalfa field operations from Prosser to Central Ferry to prevent the possible unintended presence of the RRA transgene near our regeneration plots.

4. Horticulture Crops Program and Greenhouse management

- A. In 2014 the horticulture program regenerated/increased/maintained 526 accessions, producing seed, cloves, bulbs and/or crown pieces. These accessions were of *Allium*, *Beta*, *Lactuca*, *Rheum*, *Salvia*, *Astragalus*, *Onobrychis*, *Artemesia*, *Taraxacum*, *Oxytropis*, *Hedysarum*, *Sanguisorba*, *Achillea*, *Scrophularia*, *Glycyrrhiza*, *Veronica*, *Echium*, *Anthyllis*, *Thymus*, *Aconitum*, *Amethystea*, *Eschscholzia*, *Amorpha*, *Eriogonum*, *Callistephus*, *Plantago* and *Grindelia* germplasm.
- B. We added 109 new accessions to the Horticulture Crops collections. There were 65 accessions of *Lactuca* species collected by cooperators in Central Asia, 16 accessions of *Lactuca sativa* donated from US breeders, 12 wild *Allium* species, and 6 table beet accessions collected in Georgia.
- C. Descriptor data for 124 *Beta* accessions and images for 274 miscellaneous and *Beta* accessions was downloaded to GRIN. Passport data and images for the new collections and cooperator evaluation data were also downloaded. We also performed germination tests on 132 *Beta* accessions.

5. Common beans

- A. During 2014, 418 accessions of *Phaseolus* beans were grown for regeneration in the greenhouses plus 27 in the field at Parlier, CA. Thirty eight accessions were added to the collection. Eighteen thousand and forty one (18,041) data points and one thousand nine hundred and thirty seven (1937) images were uploaded into GRIN for the *Phaseolus* collection. The *Phaseolus* bean collection in WRPIS now has 17,313 accessions belonging to 58 taxa, collected from 110 countries. Approximately one-fourth of this large collection (4,612 accessions from 21 species/varieties) was distributed in 2014 to 18 different countries. The distribution number decreased by 813 packets or 15 % from the previous calendar year.
- B. A total of 2,050 plants from 41 accessions being regenerated in the greenhouse were tested for presence of the seed-borne Bean Common Mosaic Virus in 2014. Total number of accessions tested is reduced from previous calendar year due to a temporary procedural change of only testing accessions that appeared infected to the naked eye. Most of the accessions (31) were virus-free and the seeds harvested from them were recorded as virus-free. For the remaining 10 virus-infected accessions,

additional virus tests will be carried out in future regeneration cycles until sufficient numbers of virus-free plants are identified to produce virus-free seeds for each accession to preserve genetic diversity.

- C. The *Phaseolus* curator in collaboration with the Department of Food Science and Human Nutrition analyzed several nutritional components of nuña beans (Peruvian “Popping” bean) in comparison with a sample of common beans from eight market classes. These beans have been selected and raised among the Andean natives in the high mountains for millennia and have the unique characteristic of bursting when subjected to heat, making them a high protein food in conditions where boiling would consume scarce fuel. This property also makes these beans a potential nutritious snack food, both in and of itself, as well as in the form of an extruded product. We analyzed the molecular diversity of 35 nuña and 8 common dry bean accessions and compared a range of nutritional factors, including protein, starch, sugars, phytate, and antioxidant activity. Genetic analysis using AFLP markers showed nuñas were distinct from the common dry beans analyzed, and there were two distinct groups within the nuñas. There was a similar wide range of nutritional characteristics within both the common dry beans and the nuñas. Values for nuñas and common bean respectively were: protein (18-25 and 17-27%), extractable polyphenols (50-350 and 50-450 mg GAE/100g), non-extractable polyphenols (50-220 and 70-175 mg GAE/100g), phytate (0.45-1.2 and 0.6-1.0%), and total antioxidant activity (8-52 and 7-48 mgTE). There is enough genetic variation in both nuña and common dry beans to breed popping beans adapted to a temperate, long-day environment.

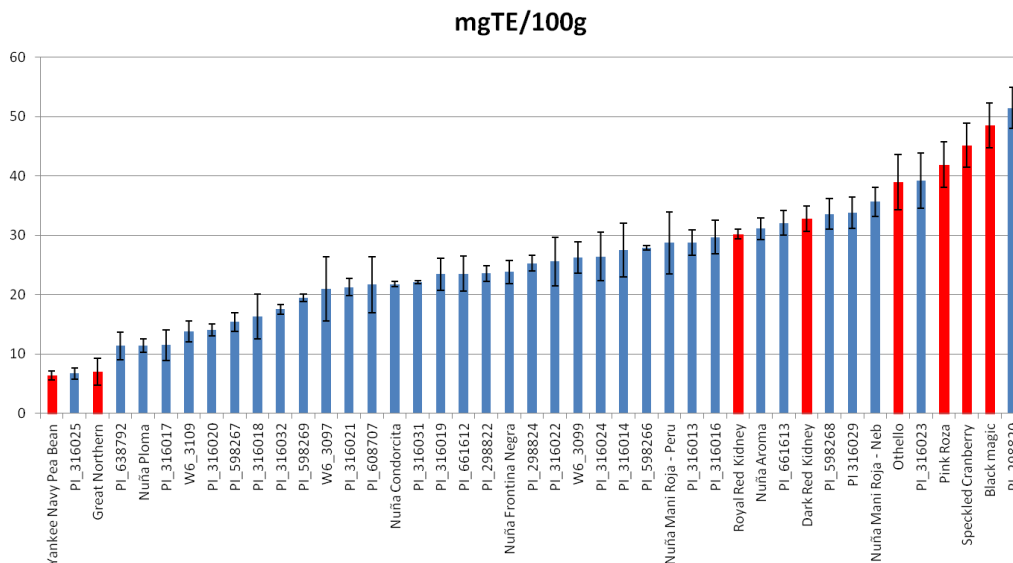


Figure 5. An example of the wide range of total antioxidant activity in common beans and the nuña bean. Common dry beans from eight market classes are given in red. Antioxidant activity is given as Trolox Equivalents.

6. The DNA marker lab

- A. We characterized 222 accessions of Tepary bean (*Phaseolus acutifolius* A. Gray), a native, short life-cycle annual desert legume indigenous to northwestern Mexico and the southwestern USA and considered drought and heat tolerant. Using

Targeted Region Amplified Polymorphic (TRAP) markers designed from sequences of genes associated with heat and drought tolerance, genetic relationships were compared to reactions to drought stress using measurements of variable fluorescence to maximum fluorescence (Fv/Fm). Cluster analysis using NTSys-pc and STRUCTURE found 3 major groups and 8 sub-groups with an average Fst of 0.71, but there was no association of drought tolerance with any group. In fact, some plants separated by seed color within an accession tested as both drought tolerant and susceptible, though genetically similar at all marker loci tested. In other cases, plants separated by seed type clustered apart in different groups. Given the level of diversity among groups, marker production will continue along with the addition of AFLP loci for future association mapping.

- B. Using 231 AFLP molecular markers from six primer combinations, we analyzed nine accessions and sixteen herbarium samples (provided by the Smithsonian Institution) of the North American wild kidney bean or thicket bean (*Phaseolus polystachios* (L.) Britton, Sterns, & Poggenb.), a perennial vine found in the eastern United States from Texas to Connecticut. While the DNA from the herbarium samples was somewhat degraded, markers at and below 200 bp were readily discernible and showed four distinct clusters. One herbarium sample from Florida was distinct from the others and, because of the lobed leaves, is likely *P. smilacifolius*. The USDA accession from Texas was very unique and has been reclassified as *P. texensis*. The level of distinction among the samples studied here reinforces the need for continued collection of this diverse species.
- C. We analyzed the molecular diversity of 35 nuña and 8 common dry bean accessions using 128 AFLP molecular markers. The nuña beans were genetically distinct from the common dry beans and formed 3 clusters. One cluster was admixed with common dry beans while the other two were separate.

MISSION-RELATED RESEARCH

1. Agronomy

- A. Collaborative activities supported by grants from the BLM's Seeds of Success (SOS) project, the Great Basin Restoration Initiative, and the Forest Service to Richard Johnson (Research Agronomist) have substantially advanced native plant collections needed for research and development of plant materials. Accession and distribution numbers continue to grow. In 2014, 1,403 new native plant accessions were added to the SOS-NPGS collection, which now totals 10,515 accessions. Since 2006, more than 1,250 seed orders and nearly 4,500 seed distributions have been made for research projects including federal, state, U.S. commerce and private cooperators. Nearly half of the accessions have been transferred to existing NPGS curators for permanent management.
- B. In associated research, extensive evaluation data on key rangeland species has been collected for entry into GRIN. Genetic variation of numerous adaptive plant traits has been linked to source location climates. Patterns of adaptation to varying inter-mountain West landscapes are emerging. With development of seed zones,

sustainable restoration with native species after fire and other disturbances will be enhanced.



Figure 6. Research Agronomist RC Johnson examining one of the replicated field trials of native grasses on the Central Ferry Research Farm.

2. Genetics (Alfalfa and other forage legumes)

- A. Molecular markers associated with resistance to *Verticillium* wilt in alfalfa were identified. *Verticillium* wilt, caused by the soilborne fungus, *Verticillium alfalfae*, is one of the most serious diseases of alfalfa worldwide. A study was conducted in two alfalfa populations segregating for *Verticillium* wilt in collaboration with researchers at DuPont Pioneer and Alforex Seeds companies. SNP genotyping was performed using high resolution melting. Polymorphic SNPs were identified based on the melting profiles with up to five clusters representing the various allelic combinations in tetraploid alfalfa. Manual inoculation of the pathogen to replicated cloned plants of each individual was performed and disease severity was scored using a standard scale. Marker-trait association was identified by TASSEL using the general and mixed linear models. Eleven markers were significantly associated with *Verticillium* wilt resistance and they were located on three chromosomal regions in the alfalfa genome. Six significant markers on chromosome 8 could explain 40% of the total phenotypic variation and represent novel loci associated with *Verticillium* wilt resistance. Additional markers associated with *Verticillium* wilt resistance were identified on chromosomes 2 and 7, and they co-located with regions of *Verticillium* wilt resistance loci reported in *M. truncatula*. This study highlights the value of SNP genotyping to identify disease resistance loci in tetraploid alfalfa. A research paper titled “Identification of molecular markers associated with *Verticillium* wilt resistance in alfalfa (*Medicago sativa* L.) using high-resolution melting” has been published in PLoS ONE. This is the first report on the identification of molecular markers associated with *Verticillium* wilt resistance in alfalfa. The markers identified in this study are useful for improving resistance to *Verticillium* wilt in alfalfa breeding programs.
- B. We identified alfalfa molecular markers and germplasm associated with drought tolerance and increased water use efficiency, as evaluated by biomass yield under

a deficit irrigation gradient. Enhancing drought resistance and water use efficiency of alfalfa varieties are important to meet the challenges of finite available water resource. However, no rapid and precise methods have been developed to identify the resistance resources for use in alfalfa breeding programs. Development of molecular markers associated with drought resistance and improved water use efficiency would be helpful for improving the accuracy in detection, accumulating the major and minor genes, and accelerating the breeding process. Toward this goal, we collaborated with Dr. Stephanie Greene and formed a panel of accessions of 202 alfalfa cultivars and landraces with potential drought tolerance selected from the USDA-ARS National Temperate Forage Legume Germplasm collection. We evaluated these accessions for drought resistance in field and greenhouse during the dry season of 2013 and 2014. Agronomic and physiological traits including relative leaf water content, osmotic adjustment, canopy temperature, and biomass and forage quality under water deficit were measured. A greenhouse procedure for phenotyping drought resistance index (DRI) was established. One thousand and eight hundreds Individuals were evaluated using this procedure. We have identified eight accessions with high resistance scores. With further characterization, they can be used as materials for breeding cultivars with resistance to drought/salt stresses and for developing populations for mapping QTLs for drought tolerance and enhanced water use efficiency. Private seed companies such as Alforex Seeds, S & W Seeds and Pioneer Hi-Bred have expressed interests in using the selected germplasm for developing alfalfa cultivars with improved drought/salt resistance and water use efficiency.

3. Genetics (faba bean and lettuce)

- A. In collaborating with University of Florida we conducted a genome-wide association analysis for resistance to bacterial leaf spot of lettuce with SNP (single nucleotide polymorphism) markers. PI 358001-1 was identified as almost immune to the Florida isolate of BLS. This germplasm line is from the recently formed special pure-line collection based on 322 SNP marker genotypes. Our result indicated that the resistance gene is most likely on lettuce linkage group 2 since the phenotype has significant association with a mapped SNP QGB19C20.yg-1-OP5. This information will lead to a rapid development of user-friendly markers for marker-assisted selection for this valuable trait in lettuce.
- B. Four enhanced winter hardy faba bean germplasm lines were developed through field selection in five consecutive winter seasons and are in the process of public release for pulse and cover crop development. Dr. Erik Landry, supported by an ARCS (Achievement Rewards for College Scientists) scholarship, successfully defended his PhD dissertation entitled “Faba bean (*Vicia faba* L.), a potential new pulse crop for southeastern Washington” and complete his degree requirement at WSU in December 2014. Several MTAs (Material Transfer Agreement) were signed, including one with the Lundberg Family Farm, a leader in organic rice farming in California, which is looking for suitable legume crops to fit into their sustainable organic farming systems; and another with the Weaver Seed of Oregon, which produces and sells both organic and conventional seeds for forage, cover crop and no-till farming systems.

4. Plant Pathology

- A. We completed identification of additional agents of blue mold of *Allium* species: one *Penicillium* species belonging to series Corymbifera (*Penicillium albocoremium*) and four *Penicillium* species outside that series (*P. crustosum*, *P. expansum*, *P. glabrum* and *P. paraherqueii*) plus *P. polonicum*. We assessed experimentally their pathogenicity on garlic and two varieties of table onion. An abstract has been submitted. This is the third in a series of researches addressing identification and host range of agents of blue mold on bulb crops; the second in the series (concentrating on species in series Corymbifera) we also completed and published in 2014.
- B. We published three seasons of data regarding relative susceptibility of numerous germplines of Great Basin wild rye to stripe rust (*Puccinia striiformis*). Resistant and susceptible germplines are identified.
- C. With the USDA-ARS Grain Legumes unit, we published a new record of dodder on chickpea in the United States.
- D. We detected *Ascochyta fabae* (agent of ascochyta blight) and *Botrytis* sp. (agent of chocolates spot) on faba bean grown in Washington State.

COMMITTEES, PRESENTATIONS AND RECOGNITIONS

During 2014 WRPIS scientists and curators served as committee members or chairs of the respective national Crop Germplasm Committees (CGC) and other academic or social organizations. Research Plant Pathologist **Frank Dugan** is adjunct faculty with WSU Department of Plant Pathology, and with College of Natural Resources, University of Idaho, is a member of the American Phytopathological Society (APS), a Senior Editor for APS Press, a member of the APS Mycology Committee, the APS Collections and Germplasm Committee, and Mycological Society of America. He also serves as Associate Editor for the journal *North American Fungi*. Research Agronomist **Richard Johnson** cooperated with a wide range of projects related to germplasm collection and enhancement. In 2014, he chaired the Interagency Seed Strategy Research Committee to develop plans for native seed utilization involving 12 Federal agencies, including ARS. As part of this he has provided advice to Peggy Olwell, BLM plant conservation lead for briefing with agencies heads. He is also working with graduate students at the University of Nevada Reno and the University of Wyoming to advance research on plant adaptation and seed zones development of native plants. Johnson is cooperating with Art Weisker of Seed-Tec, CalOils, on selection and breeding of winter type safflower using W6 field locations for winter screening. Cooperative projects are ongoing with Beth Leger, University of Nevada-Reno; Troy Wood, USGS, Flagstaff AZ; Erin Espeland, ARS, Sydney MT; Brad St. Clair, USFS, Corvallis, OR; Matt Horning, USFS, Bend, OR; and Francis Kilkenny, USFS, Boise, ID. International cooperators include Luciano Pecetti, CRA (Center for Research and Production of Forage and Dairy), Lodi, Italy, concerning forge grass collection, research, and utilization, and with Clara Franchini, Luis Hernández and Ivone Lindström, University of the South, Argentina, on adaptation of safflower to Argentina, and sunflower seed development research, and Riccardo Baldini, University of Florence, Italy, on collection of Mediterranean *Phalaris* species. **Long-Xi Yu** is adjunct faculty with WSU Department of Plant Pathology. He serves as member of The AOSCA National Alfalfa and Miscellaneous Legumes Variety Review Board and member of the editorial board of *Journal of Plant Biology and Soil Health*. Supervisory Research Geneticist and Research Leader **Jinguo Hu** continued to serve as an Associate Editor for *Crop Science*. He is an Adjunct Professor of the Department of Crop and Soil Sciences, Washington State University and was the technical advisor of a PhD student working on a cool season legume research project. He serves as a member in the Plant Germplasm Operations Committee and in various Crop Germplasm Committees including the Root and Bulb CGC, the Leafy Vegetable CGC, the Sugarbeet CGC, the Food Legume CGC and the Pea CGC. Agronomy Curator **Vicki Bradley** is the Chair of the International Safflower Germplasm Committee, an Ex-officio member of the Forage and Turf Grass CGC and the New Crops CGC. She is also an Adjunct scientist with the Department of Crop and Soil Science at WSU, and serves as a member on one MS graduate student committee for the department. Vicki is a member of the Plant Germplasm Operations Committee, serving on the *in situ* and the Crop Wild Relatives subcommittees. She is a member of the ARS Pullman Location EEO and Outreach Committee, and is the editor for the Safflower Genetic Resources Homepage. She is a member of the Association for the Advancement of Industrial Crops and the American Society for Horticultural Science. Cool Season Food Legumes Curator **Clarice Coyne** is an Ex-officio member of the Food Legume CGC, Pea CGC, Clover and Special Purpose CGC, and a member of the Plant Germplasm Operations Committee. She served on the Board of Directors for the North American Pulse Improvement Association as Secretary. She also served as Chair-Elect of the Crop Science Society of America C8 Division Plant

Genetic Resources. Clare is adjunct faculty with WSU Department of Crop and Soil Sciences and Department of Horticulture and was very active in supervising students and post-doctoral associates in both departments. Clare served as major advisor for Ph.D. student Erik Landry who successfully defended his research on new crop potential of faba bean on the Palouse. Temperate Forage Legume Curator **Stephanie Greene** is the Chair and Ex-officio of the Alfalfa CGC, and Ex-officio of the Clover and Special Purpose Legume CGC and a member of the Desert Legume Program (DELEP) Advisory Committee, Tucson, AZ, and the WSU Legume Variety Release Committee. Horticulture Curator **Barbara Hellier** is an Ex Officio member of the Root and Bulb, Leafy Vegetable, New Crops, Sugarbeet, Clover and Special Purpose Legume, Medicinal and Aromatic Oil and Herbaceous Ornamental Crop Germplasm Committees. Member of the PGOC Medicinals and *In Situ* Subcommittees. Member of the American Society for Horticultural Science. Member of the development team for USDA/ARS for procedures and practices handling transgenes in ARS genebanks and breeding programs. Member of the WSU Land Use Committee. *Phaseolus* Curator **Theodore Kisha** is a member of the American Society for Horticultural Science and a member of the "Center for Research on Invasive Species and Small Populations (CRISSP)" at the University of Idaho. He also serves as a volunteer in the Moscow Parks and Recreation Commission. By participating in the regular meetings and other activities of these organizations we effectively outreach and interact with our stakeholders, customers and general public. In 2014, Dr. Kisha mentored a Research experience for Undergraduates (REU) student through his affiliation with CRISSP at the University of Idaho. He also mentored a graduating high school intern through the UPWARD BOUND program of Washington. He also participated in the INTERNATIONAL RESEARCH FORUM of Washington State University and the resulting LATIN AMERICA BREAK OUT SESSION. He also presented a lecture to a class at Washington State University, Biol 401 Plants and People (Ethnobotany), a course that explores relationships between people and plants and followed up with of the seed storage facility. He also addressed the Moscow Idaho League of Women voters, presenting "The U.S. National Plant Germplasm System and the Pullman Gene Bank: Preserving Plant Biodiversity for Today and Tomorrow". He also addressed the US Dry Bean Convention, discussing the collection and ongoing research with stakeholders nationwide.

WRPIS scientists and curators were actively engaged in conducting mission-related research and in serving the scientific community. They made a total of 24 oral or poster presentations at either scientific or general public meetings, contributed two book chapters, and published 22 peer reviewed scientific journal papers in 2013. They were invited to review research manuscripts by editors of the following scientific journals: Theoretical & Applied Genetics, BMC Genomics, Crop Science, Crop and Pasture Science, Ecological Restoration, European Journal of Plant Pathology, Genome, Industrial Oil Crops, Journal of Sugar Beet Research, Molecular Breeding, Phytopathology, Plant Breeding, Plant Disease, Journal of Plant Registrations, Euphytica, Canadian Journal of Plant Science, Botanical Journal of the Linnean Society, Plant Genetic Resources, and African Journal of Agricultural Research.

SCIENTIFIC PAPERS PUBLISHED IN 2014

Peer reviewed journal articles (16):

- Chen, W., F.M. Dugan, and R. McGee. 2014. First report of dodder (*Cuscuta pentagona*) on chickpea (*Cicer arietinum*) in the United States. *Plant Disease* 98: 165.
- Dugan, F.M., M.J. Cashman, R.C. Johnson, M. Wang, and X. Chen. 2014. Differential resistance to stripe rust (*Puccinia striiformis*) in collections of Basin wild rye (*Leymus cinereus*). *Plant Health Progress* 15(2):97-102. doi:10.1094/PHP-RS-14-0002
- Dugan, F.M., S.L. Lupien, C.M. Vahling-Armstrong, G.A. Chastagner, and B.K. Schroeder. 2014. Host ranges of North American isolates of *Penicillium* causing blue mold of bulb crops. *Crop Protection* 64: 129-136.
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- Johnson, R.C., and Marc Evans. 2014. Comparative Growth and Development of Hexaploid and Tetraploid Reed Canarygrass. *Crop Sci.* 54: 1062-1069.
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- Konečná, E., Šafařová, D., Navrátil, M., Hanáček, P., Coyne, C., Flavell, A., Vishyakova, M., Ambrose, M., Redden, R., Smýkal, P. 2014. Geographical distribution of the eIF4E alleles conferring resistance to potyviruses in pea (*Pisum* sp.) germplasm. *PLOS One* 9(3), e90394.
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- Lu, H., J. Hu, S.J. Kwon. 2014. Association analysis of bacterial leaf spot resistance and SNP markers derived from expressed sequence tags (ESTs) in lettuce (*Lactuca sativa* L.). *Molecular Breeding*. 34:997–1006.
- Syamaladevi, R.M., S.L. Lupien, K. Bhunia, S.S. Sablani, F. Dugan, B. Rasco, K. Killinger, A. Dhingra, and C. Ross. 2014. UV-C light inactivation kinetics of *Penicillium expansum* on pear surfaces: Influence on physiochemical and sensory quality during storage. *Postharvest Biology and Technology* 87: 27-32.
- Yang, T., J. Jiang, M. Burlyeva, J. Hu, C. J. Coyne, S. Kumar, R. Redden, X. Sun, F. Wang, J. Chang, X. Hao, J. Guan and X. Zong. 2014. Large-scale microsatellite

- development in grasspea (*Lathyrus sativus* L.), an orphan legume of the arid areas. *BMC Plant Biology*, 14: 65.
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- Yu, L-X, H. Barbier, M. Rouse, S. Singh, R.P. Singh, S. Bhvanani, J. Huerta-Espino, M.E. Sorrells. 2014. A Consensus Map for Ug99 Stem Rust Resistance Loci in Wheat. *Theor Appl Genet* 127:1561–1581, DOI 10.1007/s00122-014-2326-7.
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Appendix 1
Western Regional Plant Introduction Station
Current Staffing List as of December 31, 2014

Position	Name	Federal or State	Position type
Pullman			
Research Leader/Station Coordinator	Jinguo Hu	Fed	PFT
Program Support Assistant	Carla Miles	Fed	PFT
IT Specialist	Gwen Pentecost	Fed	PFT
Biological Science Technician	Lisa Taylor	Fed	PFT
Seed Manager/Computer Specialist	Dave Stout	Fed	PFT
Plant Technician	Vacant	Sta	PFT
Farm Manager, Pullman	Sean Vail	Sta	PFT
Plant Technician	Saber Jewell	Sta	PFT
Plant Technician	Vacant	Sta	PFT
Farm Manager, Central Ferry	Kurt Tetrick	Fed	PFT
Plant Technician	Kyall Hagemeyer	Sta	PFT
Research Plant Pathologist	Frank Dugan	Fed	PFT
Biological Science Technician	Shari Lupien	Fed	PFT
Research Agronomist	Richard Johnson	Fed	PFT
Biological Science Technician	Vacant	Fed	TFT
Plant Biologist	Michael Cashman	Fed	TFT
Agronomy Curator	Vicki Bradley	Fed	PFT
Biological Science Technician	Bob Guenther	Fed	PFT
Cool Season Food Legume Curator	Clarice Coyne	Fed	PFT
Biological Science Technician	Landon Charlo	Fed	PFT
Horticultural Crops Curator	Barbara Hellier	Fed	PFT
Biological Science Technician	William Luna	Fed	PFT
Biological Science Technician	Alex Cornwall	Fed	TFT
Biological Science Technician	Marie Pavelka	Fed	PFT
Phaseolus Curator	Theodore Kisha	Fed	PFT
Plant Technician	Julie Thayer	Sta	PFT
Prosser			
Forage Legume Curator	Vacant	Fed	PFT
Biological Science Technician	Martha Cervantes	Fed	PFT
Plant Technician	Jesus Prieto	Sta	TPT
Research Geneticist	Long-Xi Yu	Fed	PFT
Biological Science Technician	Bill Boge	Fed	TFT
Biological Science Technician	Martha Rivera	Fed	TFT

Appendix 2

Research, Service and Outreach Activities

- January 9, Vicki Bradley provided information on the distribution of *Brachypodium distachyon* in 2011-2013 to Dr. John Vogel.
- January 9-13, Jinguo Hu attended in the XXIII International Plant and Animal Genome Conference, co-organized the Plant Molecular Breeding Workshop, and presented a poster entitled “Molecular Mapping of the Banded Cucumber Beetle Resistance in Romaine Lettuce Valmaine”, San Diego, CA.
- January 11-14, Clare Coyne participated in the 2014 Plant and Animal Genome conference, co-organized Genomics of Genebanks workshop, co-author on two presentations, “Genomics of chickpea domestication” and “The Cool Season Food Legume Database: An Integrated Resource for Basic, Translational and Applied Research.”
- January 14-16, Long-Xi Yu attended the 2014 National Alfalfa & MISC Legumes Variety Review Board meeting in Denver, CO.
- January 15, Vicki Bradley completed an interview about being an agronomist for a high school student in Northwest Florida.
- January 15, William Luna attended a WSU Safety and Health meeting representing WRPIS.
- January 17, Barbara Hellier attended a teleconference of the development team for USDA/ARS for procedures and practices handling transgenes in ARS genebanks and breeding programs.
- January 21, Vicki Bradley coordinated acquisition of a file with the number of accessions available for every grass taxon in the NPGS to Dr. Joseph Craine, KSU, for a study of drought tolerance.
- January 24, William Luna attended a Wilbur-Ellis Professional Seminar, Spokane, WA.
- January 26-28, Long-Xi Yu attended the 2014 Winter Seed School Conference in Las Vegas, NV, and gave oral presentation on Enhancing resistance to biotic and abiotic stresses in alfalfa: A progress report.
- January 28, Barbara Hellier attended a phone meeting of the development team for USDA/ARS for procedures and practices handling transgenes in ARS genebanks and breeding programs.
- January 28, Barbara Hellier provided a stakeholder with information on garlic cryopreservation, true seed production and the NPGS collection.
- January 28, Ted Kisha participated in the Washington State University INTERNATIONAL RESEARCH FORUM and LATIN AMERICA: BREAK OUT SESSION to discuss research opportunities with Latin American universities.
- January 28, Vicki Bradley completed two Crop Wild Relative crop expert surveys for Colin Khoury.
- February 3, Barbara Hellier attended a WSU Land Use committee meeting as representative for WRPIS.

- February 3-8, Jinguo Hu attended the 2015 Organicology conference in Portland OR
- February 6, Clare Coyne presented research progress to the USA Dry Pea and Lentil Council Research Review committee, “Genomics Assisted Breeding for Cool Season Food Legumes.”
- February 8-9, Frank Dugan attended a meeting of the APS Press Editorial Board in Minneapolis, Minnesota
- February 11, Ted Kisha gave the presentation “The U.S. National Plant Germplasm System and the Pullman Gene Bank: Preserving Plant Biodiversity for Today and Tomorrow” to WSU Class Biol 401 (Plants and people) and conducted a tour of the Seed Storage facility.
- February 12, Ted Kisha attended the webinar, “Special Presentation on Safety Culture during Administrator’s Council” sponsored by the USDA ARS Biosafety, Safety and Health Leadership Steering Committee (BSHLSC)
- February 13, Frank Dugan presented the WRPIS Plant Pathology Activities to WRPIS Food & Fact Fest, Pullman WA.
- February 13, Ted Kisha presented a summary of the genetics lab year’s work and future plans at the Unit’s annual Food and Fact Fest.
- February 13, The Unit’s annual Food and Fact Fest was held and a representative from each program presented a summary of the year’s work and future plans.
- February 19, Ted Kisha addressed the Moscow Idaho Chapter of the League of Women Voters with the presentation: “The U.S. National Plant Germplasm System and the Pullman Gene Bank: Preserving Plant Biodiversity for Today and Tomorrow” followed by discussion.
- February 19 to April 16, Jinguo Hu detailed in the Office of National Programs assessing the status of the vegetable genetic resource in the National Plant Germplasm System in ARS Headquarter, Beltsville, MD.
- February 20, Long-Xi Yu attended the Washington Alfalfa Seed Grower Association meeting in Kennewick WA.
- February 23-25, Clare Coyne hosted visiting scientist Eric Storlie, Colorado State University post-doctoral scholar who presented a seminar “Use of Historical Wheat Data to Gain Insight into the Predictability of Genomic Selection”.
- February 24 & 25, Bob Guenther attended classes for recertification of his pesticide applicator’s license.
- February 24-25, William Luna attended WSDA Pesticide Applicator's License recertification training.
- February 28, Ted Kisha participated in a WebExon Sequencher Software by the Gene Codes Corporation.
- March 3, review of “Description of safflower (*Cathamus tinctorius*) phenological growth stages according to the extended BBCH-scale” for Annals of Applied Biology.

- March 3, Ted Kisha attended a webinar by the Washington State University extension Service on an overview of the 2014 Farm Bill.
- March 3, Vicki Bradley provided 150g of seed of each of six safflower accessions for trials at the WSU Dryland Research Station in Lind, WA.
- March 6, Ted Kisha gave a presentation at Big Bend Community College on research at Washington State University and the ARS to potential applicants for the Washington UPWARD BOUND summer internship program.
- March 7, Long-Xi Yu served as Science Fair Judge at the Mid-Columbia Science Fair in Kennewick, WA
- March 11, Ted Kisha attended an open house and discussion session with the Washington State University's Office of Commercialization.
- March 13, Ted Kisha attended a seminar by Dr. Dave Sands, Professor of Plant Pathology at Montana State University: Taking on the Five Horsemen: Drought, Malnutrition, Obesity, Poverty and Pesticide Pollution.
- March 17, presentation, "Conservation, adaptation, and seed zones for key Great Basin species" for the Great Basin Native Plant Project Meetings Boise, ID
- March 19, asked by Peggy Olwell, BLM Plant conservation lead, to planning meeting for an interagency agreement to promote native seed for sustainable and diverse restoration. The Memorandum of Understanding resulting was signed by ARS and 11 other agencies on June 30, 2014.
- March 25, Ted Kisha attended the annual Women's Recognition and Symposium at Washington State University.
- March 26, Clare Coyne was a volunteer judge, Science Fair, Jefferson Elementary School, Pullman, WA.
- March 27, Ted Kisha judged the Jefferson Elementary Science and Technology Fair in Pullman, Washington.
- March 27, Vicki Bradley hosted a site inspection by George Bruno, APHIS, to renew the noxious weed permit for *Carthamus oxyacanthus*.
- March 27, Vicki Bradley, Clare Coyne, Ted Kisha, Melissa Scholten, and Lisa Taylor were judges at the Jefferson Elementary School Science and Technology Fair in Pullman, Washington.
- March 28, Barbara Hellier hosted Ron Amarel, VoloAgri, Boise, ID and gave him a tour of the garlic storage and garlic nursery.
- March 28, Ted Kisha attended the Washington State University Academic Showcase.
- March 31, Clare Coyne co-author presentation at the Washington State University's Plant Sciences Retreat "Identification of TRAP markers linked to stringless *sin-2* gene in *Pisum sativum* and conversion to SCAR marker."

March 31, Ted Kisha screened applicants for the 2014 Research Experience for Undergraduates (REU) program in conjunction with the University of Idaho Center for Research on Invasive Species and Small Populations (CRISSP).

April 6-11, Long-Xi Yu attended the 2014 the SolCAP workshop in Lansing MI.

April 7, Barbara Hellier attended a WSU Land Use committee meeting as representative for WRPIS.

April 9, Barbara Hellier attended a WSU Land Use committee meeting as representative for WRPIS.

Aug 15, review “Assessment of genetic diversity and population structure in a global reference collection of 531 accessions of the oilseed crop, *Carthamus tinctorius* L. (safflower) using AFLP markers” for Plant Molecular Biology Reporter.

April 14-17, William Luna attended the USDA-ARS OSHA 6000 training, Albany, CA.

April 19, Ted Kisha was interviewed by the University of Idaho Newspaper ARGONAUT about the development of the City of Moscow Hamilton Community garden; registered with the USDA People’s garden program.

April 21-25, Clare Coyne was invited to present a seminar “Improving the utilization of food legume genetic resources,” visited five research stations of collaborative lentil research projects with International Center for Agricultural Research in the Dry Areas (ICARDA), and participated in collaboration meeting, Rabat, Morocco.

April 24, Ted Kisha met with the University of Idaho Center for Research on Invasive Species and Small Populations (CRISSP) to select the 2014 Research Experience for Undergraduates (REU) program interns.

May 5, Barbara Hellier attended a WSU Land Use committee meeting as representative for WRPIS.

May 5, Long-Xi Yu gave a seminar on genome-wide association analysis of disease resistance in alfalfa in the Department of Plant Pathology, Washington State University, Pullman, WA.

May 15, Ted Kisha met with representatives of the Upward Bound program and the summer interns for orientation and a tour of the genetics lab and *Phaseolus* greenhouse.

May 16, Vicki Bradley attended a Graduate committee meeting for Paula Moore.

May 19, Vicki Bradley provided Dr. Rob Soreng with a *Poa flabellata* accession for a voucher sample.

May 20, Ted Kisha attended a meeting discussing requirements for greenhouse expansion at Washington State University.

May 21, Ted Kisha attended the webinar on Biosafety Training

May 22, Ted Kisha attended the Inland Northwest Genomics Symposium at the University of Idaho.

- May 24-28, William Luna participated in the USDA-ARS EMS audit.
- May 26-June 3, Barbara Hellier and Jinguo Hu traveled to Beijing, China and was hosted by Chinese Academy of Agricultural Sciences, Institute of Vegetables and Flowers Germplasm Department, in Beijing and toured a garlic growing region in Henan Province. Barbara Hellier presented a seminar titled "The Horticulture Crops Program of the Western Regional Plant Introduction Station: Garlic, Lettuce, Beets and More!" and Jinguo Hu presented a talk on vegetable crop genetic resources in the US National Plant Germplasm System.
- June 5, Vicki Bradley hosted Michael Neff and Anna Hulbert from WSU, and representatives from Landmark Turf and Native Seed - Orlin Reinbolt, Wayling Reinbolt, and Jason Miller – for plant selection in the second year grass nursery at Central Ferry.
- June 9, Ted Kisha participated in this year's orientation of the Research Experience for Undergraduates Program of the Center for Research on Invasive species and Small Populations (CRISSP) at the University of Idaho. Ted began mentoring a student for the fifth year in a row under this program funded by the NSF.
- June 10, Richard Johnson provided Indian ricegrass data to Troy Wood Research Ecologist, U.S. Geological Survey, for species distribution modeling research.
- June 11, William Luna attended WSU Safety and Health meeting representing WRPIS.
- June 12, William Luna provided 9 people training in WSDA Worker Protection Standards.
- June 18-30, Richard Johnson collected *Phalaris* species in Italy to strengthen Mediterranean collections, cooperative with Riccardo Baldini, University of Florence,
- June 19, Long-Xi Yu attended the 2014 Alfalfa Seed Production Field day in Touchet, WA.
- June 19, Vicki Bradley hosted a group from WSU – Dr. Michael Neff, Dr. Karen Sanguinet, Anna Hulbert, and two graduate students - for plant selection in the second year grass nursery at Pullman.
- June 25, Barbara Hellier provided a stakeholder with information on garlic pollen viability.
- June 25-26, Dave Stout and Jinguo Hu attended the 2014 W6 TAC meeting in Davis, CA.
- July 1, Ted Kisha met with the summer interns from the Upward Bound program and met with his summer intern. This is the fifth year that Ted has mentored a student under this program.
- July 1, Vicki Bradley sent three *Miscanthus* clonal accessions to the collector of the materials, Dr. Erik Sacks.
- July 3, Vicki Bradley sent information regarding our rubber drum thresher, and germination procedures for *Carthamus oxyacanthus* and *C. lanatus* to Dr. Mukta Nidmarty in India.

- July 7 – July 11, Ted Kisha, Clare Coyne and Jinguo Hu attended the combined meetings of the 7th International Conference on Legume Genetics and Genomics and the 6th International Food Legume Conference in Saskatoon, Canada.
- July 7, Asked by Area Director Hammond, Richard Johnson served on the selection committee for the RL position at the Forage Seed and Cereal Research Unit, Corvallis, Oregon.
- July 7, Richard Johnson provided requested input to Peggy Olwell, BLM, for briefing of agency directors concerning BLM, ARS and Forest service cooperation.
- July 7-11, Clare Coyne presented research on “Screening chickpea for cold tolerance under controlled conditions”, co-authored four presentations and organized a workshop on “Root Rots of Legumes” at the International Food Legume Research Conference, Saskatoon, Canada.
- July 8-10, Long-Xi Yu attended The 2014 joint meeting of the NAAIC and Trifolium Conference in Lethbridge, Alberta, Canada and made oral presentation on Genome-Wide Association Studies of Verticillium Wilt Resistance in Alfalfa using Genotyping by Sequencing.
- July 8, Barbara Hellier provided a peer review for Industrial Crops and Products.
- July 9, Barbara Hellier hosted Ron Amarel, Boise, ID and toured the garlic nursery.
- July 9, Long-Xi Yu attended The side meeting of Alfalfa Grower and Stackholder at The 2014 joint meeting of the NAAIC and Trifolium Conference in Lethbridge, Alberta, Canada.
- July 12-15, Clare Coyne hosted visiting scientist Gail Timmerman-Vaughan, New Zealand Institute of Plant and Food Research, Lincoln, New Zealand.
- July 14, Ted Kisha presented a seminar entitled “The U.S. National Plant Germplasm System and the Pullman Gene Bank: Preserving Plant Biodiversity for Today and Tomorrow” to REU (Research Experience for Undergraduates) students of the CRISSP (Center for Research on Invasive Species and Small Populations) program of the University of Idaho. The seminars were followed by tours of the greenhouses with Julie Thayer, the seed storage facility with Dave Stout, and the Pullman farm with Sean Vail.
- July 21, Ted Kisha presented a seminar entitled “The U.S. National Plant Germplasm System and the Pullman Gene Bank: Preserving Plant Biodiversity for Today and Tomorrow” to REU (Research Experience for Undergraduates) students of the REACCH (Regional Approach to Climate Change in the Pacific Northwest) students from Washington State University. The seminars were followed by tours of the greenhouses with Julie Thayer, the seed storage facility with Dave Stout, and the Pullman farm with Sean Vail.
- July 21, Vicki Bradley sent a crop curator statement to Patrick McGuire, University of California, Davis, for collecting wild wheat relatives in Italy.
- July 24-25, Clare Coyne hosted visiting scientist Eric Bishop von Wettberg, Florida International University, Miami, FL.

July 28-August 1, Barbara Hellier and Jinguo Hu participated in the American Society for Horticultural Science annual conference, attended the Root and Bulb and Leafy Vegetable CGC meeting and presented an oral presentation titled "Genetic diversity of Suksdorf's Desert Parsley (*Lomatium suskдорfii* (S. Watson) J.M. Coult. & Rose) in the Columbia Gorge".

August 1, Ted Kisha met with the USDBC and presented "The U.S. National Plant Germplasm System and the Pullman Gene Bank: Preserving Plant Biodiversity for Today and Tomorrow" with an emphasis on bean germplasm and a prelude to the International Year of the Pulse in 2016.

August 11, Barbara Hellier provided a stakeholder information on pollinators used for *Taraxacum kok-saghyz* seed production.

August 11, Frank Dugan met with the Pulse Working Group at the Annual Meeting of the American Phytopathological Society in Minneapolis, Minnesota.

August 12, Frank Dugan presented 'Identification of *Lasiodiplodia theobromae* from novel sources in Nigeria and Mexico' (poster) at the Annual Meeting of the American Phytopathological Society in Minneapolis, Minnesota.

August 18, Ted Kisha toured the *Phaseolus* research program at Colorado State University.

August 18-29, Long-Xi Yu visited Qinghai Academy of Agricultural Science in Xining and Lanzhou Institute of Husbandry and Pharmaceutical Sciences of CAAS, Lanzhou, China.

August 18, Vicki Bradley supplied instructions for finding plant height data in GRIN to V. Lehman, Blue Moon Farms LLC, Lebanon, Oregon.

August 19, Ted Kisha attended Dry Bean Field Tour at Scottsbluff to hear about the latest research into dry edible beans.

August 20, Ted Kisha attended the meeting of the W-2150, a group that plans multi-state regional research efforts that use U.S. Department of Agriculture funding. About 20 institutions are represented in W-2150.

August 27, Barbara Hellier attended a facilities planning meeting for greenhouse- 3 electrical panel upgrades.

August 28, Ted Kisha lectured a Washington State University class Hort 480, "Plant Genomics and Biotechnology" on the National Plant Germplasm System and the importance of biodiversity conservation.

September 15, Ted Kisha met with a representative of the American Pulse Association to discuss research under the Pulse health Initiative.

September 16, Jinguo Hu traveled to Prosser, WA to meet with ONP staff, Area director, other RL and SYs to discuss the Prosser operation after the location closure.

September 2, Ted Kisha attended Greenhouse Workers Training at Washington State University

September 22, review of ARS role in the Interagency Seed Strategy Plan with NPL staff Peter Bretting and Rosalind James and other ARS scientist on conference call.

September 23, Vicki Bradley supplied information about acquiring original seed of *Poa* for flow cytometry and chromosome counts to Shaun Bushman, Forage and Range Research Lab, Logan Utah.

September 5, Ted Kisha attended a conference call for PWA guidance on the plan for the ARS biosafety stand down.

September 8, Barbara Hellier attended a WSU Land Use committee meeting as representative for WRPIS.

September 9, Ted Kisha attended an information session at Washington State University for Emerging Research Issues Request for Proposals

October 6, Barbara Hellier attended a WSU Land Use committee meeting as representative for WRPIS.

October 6, Vicki Bradley arranged for fungicide treatment and wrote an AD for 50 safflower accessions for Prof. V. Emongor, Botswana College of Agriculture, Gaborone, Botswana.

October 7, invited presentation “Genecology and seed zone research for native forbs and grasses of the interior West” to the Society for Ecological Restoration Northwest and Great Basin Chapters.

October 8, Ted Kisha reviewed: [Low Frequency Paternal Transmission of Plastid Genes in Brassicaceae](#) for the journal *Transgenics*. December 3-4, Clare Coyne attended collaboration meetings with the Genebank group and the Metabolic Biology group at John Innes Centre, Norwich, UK.

October 10, WRPIS All Hands Meeting and Potluck to welcome new additions to our staff in Prosser.

October 20, Clare Coyne gave a guest lecture on pea and lentil production and genetic resources to Washington State University’s Hort 320, Olericulture class.

October 20, Ted Kisha gave a powerpoint presentation to the Washington State University class HORT 320 (Olericulture) on the History, genetics, and production of *Phaseolus* species.

October 22, William Luna attended WSU Safety and Health meeting representing WRPIS.

October 28-30, Clare Coyne represented the Western Regional Plant Introduction Station at the USDA Plant Germplasm Operating Committee and presented an annual report, Davis, CA.

November 1, Barbara Hellier provided information to a stakeholder on *Beta nana* culture.

November 2-5, Clare Coyne served as Chair-elect of the C8 Plant Genetic Resources division of Crop Science Society of America, presented research “Grain legume genetic resources for allele mining”, and presented Crop Curator Report to the Clover and Special Purpose Legumes Crop Germplasm Committee at the ASA-CSSA-ASA annual meeting, Long Beach, CA.

November 4, Jinguo Hu traveled to Prosser, WA to finalize the Prosser operation after the location closure.

November 11, Clare Coyne served as thesis advisor for the Ph.D. defense for Washington State University's graduate student Erik Landry.

November 13-21, William Luna participated in the USDA-ARS SHEM inspections.

November 18, December 4, December 9, Vicki Bradley participated in Grin Global training.

November 18, Ted Kisha spoke with Kenneth Morris of Elegant Beans in Clarksburg, CA about nuña bean production.

November 24-28, Clare Coyne served on an external review panel of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) genebank funded by the Global Crop Diversity Trust, Hyderabad, India.

December 2, Jinguo Hu visited the National Center for Genetic Resources Preservation (NCGRP) and Colorado State University, Fort Collins, Colorado.

December 3, Jinguo Hu participated an ARS RPES panel in Denver, CO.

December 11, Barbara Hellier provided collecting proposal reviews for the NPGS Plant Exchange Office.

December 12, Vicki Bradley coordinated the acquisition of 1 kg of 'Latar' *Dactylis glomerata* from the Pullman PMC for the French group GEVES to use as a reference variety.

December 18, Ted Kisha discussed the *Phaseolus* Collection and ongoing Nuña bean research on a conference call with the Idaho bean Commission.

Appendix 3

Minutes of the 2014 W-6 Technical Advisory Committee Meeting

W-6 Regional Meeting

June 25, 2014

National Clonal Germplasm Repository, Davis, CA

Officers: Shawn Mehlenbacher (chair), Joe Kuhl (vice-chair), and Carol Miles (secretary).

USDA and Administrators Present:

Jinguo Hu (Pullman, WA)
Jim Moyer, Project Advisor (Pullman, WA)
John Preece (Davis, CA)
Maureen Whalen (PWA)
Peter Bretting (Office National Program, Beltsville, MD) (Called in by phone)
Anne-Marie Thro (NIFA) (Called in by phone)
Joseph Postman (Corvallis, OR)
Tracie Matsumoto Brower (Hilo, HI) (Called in by phone)
Harold Bockelman (Aberdeen, ID) (Called in by phone)
Gary Kinard (Beltsville, MD) (Called in by phone)
Roger Chetelat (Davis, CA)
Stephanie Green (Fort Collins, CO) (Called in by phone)

USDA Absent:

Richard Lee (Riverside, CA) report made available

State Representatives Present:

CA Dan Parfitt
CO Mark Brick
ID Joe Kuhl
MT Jack Martin
UT Kevin Jensen (Called in by phone)
OR Shawn Mehlenbacher
WA Carol Miles

State Representatives Absent or Vacant:

AK (vacant)
AZ (vacant)
HI (vacant)
NM Ian Ray
NV (not participating)
WY (vacant)

The meeting was called to order at 8:30 am by chair Shawn Mehlenbacher. A welcome was given by John Preece.

Administrative Advisor's Report

Jim Moyer, W-6 administrative advisor (WSU)

The W-6 project is a multi-state project that receives off-the-top funding from Hatch. Funding is approved by Directors of Agricultural Experiment Stations in the Western Region, and until this past year was considered secure. This year, station directors were close to not approving any funding for W-6, and only agreed to a 2-year proposal instead of the normal 5-year proposal. Many station directors are new and are not familiar with NPGS, and state representatives need to educate them as to its importance. The demand used to be for the repository by academics (place to safeguard genetic material), and now demand is for access from stakeholders for business outputs; reports need to emphasize stakeholder use and value. Funding cannot be taken for granted in the future.

Dan Parfitt commented that the W-6 project objectives need to be inclusive of work going on throughout the west; he struggled to find a place to fit his project within the regional proposal objectives. Jim Moyer explained that specificity was needed to gain approval from the station directors, and future proposal should be output focused.

Report from NIFA – Anne-Marie Thro

Anne-Marie announced she is currently on loan to REE until next year, and Mike Fitzner and Mary Peet will be NIFA contacts for W-6 in the interim.

Today, PIs are being used for genomic traits and to find specific traits, and traits/genes are being transferred to new varieties more quickly than ever before with more outputs than before. This fulfills the original objective of the NPGS, it is not a museum but a germplasm resource that was prepared in advance for this day. We need to make this use known to administrators and legislators, and reports need to include citations of genetic resources. An important current role is maintaining wild species, and a particular segment of society needs to be assured wild species are not being consumed when their genes are being utilized. NIFA's responsibility is to provide funds through Hatch, and authors must acknowledge this funding in publications. There is a need for a referred publication that tracks such publications over the years to document the use and outputs of genetic resources; does anyone in the group have the ability to write this?

Joseph Postman commented that germplasm personnel should receive funding as collaborators on large grants that utilize the NPGS, such as ROSEBREED. Dan Parfitt commented that use of crispers provides the ability to insert specific genes precisely into another plant with high level of precision. Wild species are more likely to be incorporated into varieties with this new technology; back crossing is now not necessary; within 5 years genes may be incorporated into advanced breeding lines. Phenotyping of wild types is necessary and little current work has been done; will then be combined with genotyping to locate useful traits.

Shawn Mehlenbacher commented that private seed industry is a major germplasm user in Oregon but they do not share their results, so it is not possible to document impacts. Ann-Marie responded that industry pays its dues as they directly fund and advocate for NPGS; USDA is looking at its role in plant breeding overall.

Report from ARS PWA Regional Office – Maureen Whalen

The 8 regional areas are being reduced to 5 to gain efficiencies in staffing and to streamline operations so that things are done similarly nationwide; there is little change in the PWA but it will now be the second smallest whereas it was the largest. Budget in 2014 is \$1.112 million with \$270,000 increase to Jinquo Hu, a slight increase compared to 2013. Extra funds (\$200,000) were allocated to retrofit the seed storage facility at Pullman, to upgrade compressors to stabilize temperature, humidity and lighting; 25% of germplasm supplied to users comes from the W-6 program in Pullman. 2015 budget not yet released, but \$18 million decrease from the president and an increase from the senate appears to result in \$17 million above 2014 budget. Some pessimism about 2016 budget, but will focus on translational breeding, climate resilience, and pollinator health.

Seven (representing 46% of the germplasm) of 20 PWA locations have research as a priority. Jinquo Hu's lettuce project is considered one of the most important accomplishments in the PWA: 300 pure line single seed lettuce accessions made available to researchers for translational breeding.

Send Maureen suggestions for improving service from W-6 Pullman.

Report from National Program – Peter Bretting

Highlights of submitted report.

The germplasm collection continues to grow 1-2% per year; identify genetic gaps in the collection to target filling. Demand has increased due to the web, with significant increase in 2006 as search engines were permitted to index the GRIN database; from 150,000 to 200,000 total requests; demand for clonal material increased greater than the demand for seed. GRIN Global will likely increase demand even more. The budget has been flat since 2003 and is not keeping pace with the increase demand; real dollars shows a decline in funds after 2004. In 2014, only 1/3 of crop projects and 1/2 of germplasm repository sites received an increased budget. During the furlough in October 2013, some personnel worked 16 hour days to maintain plants, kudos to these people; no germplasm was lost or distributed, harvest delayed.

The seed industry lobbied the senate to ratify the FAO Treaty Plant Genetic Resources for Food and Agriculture; since 2000, U.S. presidents have been strong supporters but today it is very difficult to get the congress and senate to act. There are increased international partnerships, for example in the development of GRIN Global. Peter has more information he will provide upon request.

Site Reports:

Harold E. Bockelman, Curator, National Small Grains Collection, Aberdeen, Idaho
Highlights of submitted report.

The National Small Grains Collection (NSGC) presently holds 141,898 accessions of the small grains (wheat, barley, oat, rye, triticale, rice, and related wild species). NSGC distributed more than 61,000 accession samples in 809 separate requests in the past 12 months. Approximately one-fourth of the distributions were to foreign scientists.

We have an ongoing effort to identify ploidy levels of tens-of-thousands of the wheat, barley, and oat accessions using the Partec Cyflow™ which counts chromosomes by flow cytometry. To date we have completed analyses on more than 20,000 landrace wheat accessions. We are continuing our efforts to capture voucher images of spikes, panicles, and seeds. The images and characterization data provides valuable information to both the germplasm user and for NSGC curation. During the past year kernel images of the entire rice collection (more than 18,000 accessions) were added to GRIN. Also, kernel images for the barley genetic stock collection (more than 3,500 accessions) were completed and added to GRIN.

Evaluations of NSGC wheat landrace accessions are continuing for reaction to the Ug99 stem rust race in Kenya. We continue to coordinate the assembly of the Stem Rust Nursery in Kenya in cooperation with the Kenya Agricultural Research Institute, CIMMYT, and wheat and barley breeders in public and private programs throughout the U.S. The latest shipment in April included 6000 entries from more than 50 public and private breeders and researchers.

Gary Kinard, National Germplasm Resources Laboratory, Beltsville, Maryland
Highlights of submitted report.

There were two sudden deaths of NGRL employees in 2013. Mark Bohning, a key liaison among ARS, NGRL and the NPGS sites on many data related issues, died on May 13, 2013 after 33 years of service. He assigned PI numbers for the NPGS and was the coordinator for the Crop Germplasm Committees. Gorm Emberland, a lead programmer on the GRIN system, died on July 3, 2013 after 22 years of service. Much of the current GRIN software was developed by Gorm. Furthermore, programmer John Chung in DBMU retired in January 2014, and Ned Garvey, conduit in Beltsville to foreign requesters, is retiring next week. There were 10 personnel 10 years ago, today there are 3. GRIN Global has been delayed due to staffing losses and furlough; while preparation is underway again, the Pullman group has been beta-testing and provided valuable input; no delivery date can be set yet, but will keep the group notified. The technical capacity in DBMU is significantly reduced until these key positions are recruited and staffed.

Dan Parfitt commented that challenges of foreign exploration and collection have increased. Gary responded that historically new collections were 80% foreign 20% domestic and today new collections are 50% foreign and domestic. Shawn Mehlenbacher commented that hazelnut collection from Spain is now prohibited and asked if other sites are now limited. Gary responded that Not Authorized Pending Pest Risk Assessment (NAPPPRA) is new regulatory category of APHIS and Juglins are restricted; pest

assessment needs to be done to move plants from the list to allow access; primary concern for woody material is that longhorn beetle parts can be harbored in woody material; we are moving towards more regulation. Shawn suggested that NPGS should take the lead on permit requests and start dialogue with APHIS. This would be worthy of a special topic webinar.

Joseph Postman, National Clonal Germplasm Repository, Corvallis, OR

Highlights of submitted report.

Stakeholder/Service Accomplishments

- 11,952 accessions, 64 genera and 738 taxa of 645 species of temperate fruit, nut, and specialty crops were conserved.
- Obtained a total of 122 new accessions and 185 new inventory items in CY 2013.
- Obtained new accessions of *Fragaria* (42), *Rubus* (18) and *Vaccinium* (73) from Oregon and from subtropical locations through plant exchange with Botanical Gardens.
- Received 815 new plant requests and shipped 5,147 items in CY 2013.
- Improved the management and maintenance of 3200 accessions in the pear, hazelnut, quince and related tree field collections.
- Collaborated with NCGRP, Ft. Collins, CO, on cryopreservation protocols of dormant blueberry, hazelnut, pear, and currant.
- Provided tours to Slow Food group, Rotarians, Life Long Learning, Master Gardeners and school groups. Trained visiting scientists from China, Korea, Kazakhstan, and California.
- Served as advisory panel member for SCRI Research and Ext. Planning Project Seattle.
- Advised Citrus and Malus community on development of Global Conservation Strategies working with the Global Crop Diversity Trust.
- Served as co-Chair of a program review panel for the USDA Citrus Genebank, Riverside, CA.
- Participated on Governing Board for USDA National Clean Plant Network.
- Member of the organizing committee and editor of the proceedings for the ISHS 2nd Symposium on Cryopreservation of Plant Species
- Provided assistance to hop breeders for a hop mutation breeding project.
- Trained visiting scientists Ms. Victoria Rivero (Argentina) and Dr. Meera Das (India) for 6 months in cryopreservation techniques.

Research Accomplishments

- Developed the first high throughput 90K genotyping platform in strawberry an octoploid crop.
- Finalized two new pear media, one for scion cultivars (Pear 1 Medium) and one for pear rootstocks (PRS).
- Developed improved microsatellite markers for quince and analyzed genetic fingerprints of more than 100 *Cydonia* and *Pseudocydonia* germplasm accessions.
- Developed “Hazelnut 2013 Medium” by analysis of major and minor nutrients.
- Used 15 polymorphic SSR markers to examine population structure and genetic diversity of black raspberry cultivars.
- Completed analysis of meso and nitrogen nutrients for in vitro raspberry mineral nutrition.

- Used microsatellite markers to determine the genetic diversity and phylogenetic relationships of all clonal medlar (*Mespilus* sp.) accessions in the NCGR germplasm collection
- Analyzed diverse species and cultivars of blueberry fruit for nutritional components such as folate and abscisic acid (an anti-diabetic compound).
- Determined ploidy levels for *Vaccinium* species and related genera using flow cytometry.
- Validated association of an SSR marker with the Rpf1 gene for red stele resistance in strawberry.

PGOC will be in Davis October 2014, Joseph is the chair and John Preece is the co-chair. Historically, conservation has been the primary focus and research the secondary focus, today that appears to be shifting. With attrition and rearrangements in facilities staffing, federally-supported scientific permanent federal staff members dropped to 10 permanent FTE, 2 less than the previous year. Five permanent staff members remain retirement-eligible. Our staffing strategy now includes hiring more seasonal helpers and work study students to stretch our salary budget through the year. They are filling homeowner requests. Perry pears is now the most requested of pear germplasm.

John Preece, National Clonal Germplasm Repository, Davis and National Arid Land Plant Genetic Resources Unit, Parlier, CA

Highlights of submitted report.

NCGR

Distributions of NCGR germplasm are primarily winter collected, dormant cuttings or scionwood; leaves, summer cuttings, pollen, fruit and other plant parts distributed as requested. Each item shipped is 3-5 cuttings/item (accession). Almost no seeds are distributed, however this year 5 lots each of 1000 walnut seeds were distributed as part of a NIFA-SCRI and 38 seed lots of *Prunus* species (*P. cerasifera*, *P. salicina*, *P. spinosa*) totaling 5,700 seed for research at USDA Kerneysville, WV.

Total number of orders fluctuated since 2002, with the most in FY13 (616 orders) and a low in FY05 (299 orders). So far during FY14, there are in excess of 750 orders.

For the first time this year, *Vitis vinifera* accessions that were propagated from virus indexed plants from the UC Davis 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 200 accessions as virus indexed. This amounted to 22.6% of our grape dormant cutting distributions this current fiscal year, compared to 0% in the past. This is a silent upgrade to our distributions. With ancient clonal crops, viruses are often present in the propagules being distributed.

Resuming distributing *Juglans* germplasm after halting in 2010 based on advice from the *Juglans* CGC due to lack of knowledge about Thousand Cankers Disease caused by fungus *Geosmithia morbida*. Size of distributed scionwood does not have sufficient caliper to be favored by the walnut twig beetle that vectors the disease. Phytosanitary inspectors are inspecting for twig beetle holes, therefore, will fill orders for *Juglans* in FY15.

NALPGRU

The NALPGRU distributed 92 orders in 2013 and 73 so far during 2014. The numbers and accessions distributed are listed in Table 1. During 2014, the decommissioning of the *Atriplex*, *Bassia*, and *Proboscidea* collections was completed, therefore 483 *Atriplex* accessions distributed and thereby removed from the collection. Additionally, we stopped shipping *Bassia*, and *Proboscidea* in 2014.

The NCGR hosted 4 tasting events and The International Symposium on Energy and Protein Metabolism and Nutrition who had lunch at Wolfskill and a tour. Tours of the NCGR were provided to domestic and international individuals and groups.

General

One visiting scientist currently, 6-7 arriving in 2014; primary focus is micropropagation research which advances the unit's mission. Wild relatives are a rich part of the collection, opportunities for *Prunus* rootstock evaluation. More soft funds in 2013, collaborate on research and maintain collections. Clonal repository curator position is open, person will characterize as well as curate germplasm.

Roger Chetelat, Tomato Genetics Resource Center, Davis, CA

Highlights of submitted report.

Acquisitions – acquired 182 new accessions of cultivated tomato, including 148 recombinant inbred lines (RILs), 15 mutant stocks with altered trichome biochemistry, and 18 nearly isogenic lines (NILs) of developmental mutants in cv. 'Micro-Tom'. We also regenerated 'inactive' wild species accessions; current total of number of active accessions is 3,839.

Maintenance and Evaluation – 1,212 cultures grown including 555 for seed increase and 353 for germination tests. Progeny tests performed on 82 stocks of segregating mutants or various lines with unexpected phenotypes. Tests for transgenes (GMOs) in 18 stocks were all negative. Seed samples submitted to the USDA Natl. Center for Genetic Resources Preservation in Colorado and to Svalbard Global Seed Vault in Norway.

Distribution and Utilization – 4,718 seed samples representing 1,675 unique accessions were distributed in response to 304 requests from 227 colleagues in 22 countries. Overall utilization rate exceeds 125% with many accessions requested at least once each year, to support wide variety of research, breeding, and educational projects, with 95 publications mentioning use of our stocks. Overseas distribution limited by phytosanitary restrictions.

Documentation – website was updated to address security issues and add geographic mapping tools to maintain compatibility with the GoogleMap interface, and to enable charging for express shipping and phytosanitary certificates. Revised horticultural recommendations for growing wild species, and added guidelines on emasculating and pollinating tomato flowers. Database updates include descriptive data added for accessions, improving internal record keeping for seed requests, plant pedigrees, and seed lots. A revised list of wild species stocks was published in the Tomato Genetics Coop. Report (TGC).

Research – continued research on the mechanisms of interspecific reproductive barriers that restrict crosses between cultivated tomato and wild relatives. Increased research in genomics and evolution. Published a paper on the role of a pollen factor, *ui6.1*, in self-incompatibility, and identified natural variation for two pollen factors in self-compatible biotypes and species. Received new grant from the USDA-NIFA to develop a set of introgression lines representing the genome of *S. sitiens*, a wild tomato relative known for its tolerance to drought and salinity, but which has not been utilized in the past due to strong crossing barriers.

General – 30% reduction in funding due to sequestration. Requests tend to be for large sets of 100+ accessions. Collection trips to Chili (2001-2005) provided best new influx, material collected in Peru (2009) still in Peru. Encourage research grants to include funds to support provision of germplasm.

Stephanie Green, National Center for Genetic Resources Preservation, Fort Collins, CO

Highlights of submitted report.

540,062 total NPGS accessions, 78% backed up at NCGRP with 18,159 unique accessions. Also provide safety backup for non-NPGS plant germplasm: 7379 PVP accessions, 1737 *Journal of Plant Registration*, 300,000 black-box accessions (no supplemental funding, service to international community; storage only), and USFS Center for Plant Conservation.

In 2014 received 8,371 accessions, conducted 5,410 germination tests on incoming accessions, and 2,433 monitor tests on stored seed. Sent out 114 orders, comprising 603 seed inventories. Also sent out 109 tissue culture inventories to Corvallis repository. 18,473 accessions ready to be shipped to Svalbard.

Seeds of Success (SOS) – BLM native plants collection program coordinated by Pullman with back-up at Fort Collins. Total of 8,389 accessions with 1,099 received in 2014 and 7,889 tested and in storage. Accessions are in GRIN for distribution.

Challenges – develop germination and storage protocols for wild native species. Develop routine monitor testing based on FAO standards of testing intervals that are 1/3 expected longevity of species. Increase level of clonal security back up. Loss of technical help with retirements.

Tracie Matsumoto Brower, Tropical Fruit & Nut Germplasm Repository, Hilo, HI
Highlights of submitted report.

Dr. Francis Zee who started the repository which now includes 13 designated clonal germplasm collections with over 1000 accessions grown on 33 field acres, greenhouses and a tissue culture laboratory, retired on January 11, 2014 after serving for 28 years as curator. Currently, daily operations are maintained by 5 full time staff and acting curator.

Germplasm requests over the last year: 508 requests were filled for *Carica/Vasconcellea* - papaya (205), *Ananas* - pineapple (105), *Psidium* – guava (48), *Artocarpus* – breadfruit (16), *Macadamia* (15), *Litchi* – lychee (13), *Mapighia* – acerola (13), *Averrhoa* – starfruit (7), *Canarium* – pili nut (6), *Dimocarpus* – longan (6), *Bactris* - peach palm (5), *Nephelium* – rambutan (3), *Theobroma* - cacao (10), *Camellia* – tea (49), *Myrica* – bayberry (3), *Vaccinium* – ohelo (2), and *Zingiber* – ginger (2).

Surveyed “local” collections at University of Hawaii College of Tropical Agriculture and Human Resources Waiakea and Kainaliu Experiment Stations to identify gaps; 15 macadamia accessions requested from Waiakea; 15 accessions *Eugenia*, *Feijoa*, *Averrhoa*, *Canarium*, *Dimocarpus*, *Theobroma cacao*, *Artocarpus* and *Litchi* collected; 8 accessions *Litchi*, *Dimocarpus*, *Feijoa*, and *Psidium* identified at Kainaliu; others identified at Fairchild Garden, Florida, cost of shipment and the importation requirements are currently being investigated.

Continuing transfer of avocado germplasm from Miami to Hilo through Fort Detrick; 33 avocado accessions with no visible laurel wilt and tested free of Avocado Sunblotch viroid (ASBVd) were transferred to Hilo, and scionwood made available in Hawaii. Avocado samples from Hawaii Island are being evaluated to determine if ASBVd is in Hawaii.

Backup collection of 29 selected cacao, *Theobroma cacao*, accessions from Miami and Puerto Rico is maintained in Hilo; currently assisting Miami with field trial evaluations of select cacao varieties on Hawaii Island, Oahu and Puerto Rico. Breadfruit ‘Ma`afala’ scion and tissue cultures were sent to Puerto Rico for evaluation as a potential commercial crop.

Jinguo Hu, Western Region Plant Introduction Station, Pullman, WA

Highlights of submitted report.

- On December 31, 2013, there were 94,642 plant accessions belonging to 1,308 genera, 4,802 species and 5,397 taxa in the WRPIS collection.
- Acquired 1,556 new accessions including 1,304 native plant accessions from the SOS (Seeds of Success) project.
- Distributed 38,022 packets of seed samples to 1,220 requestors in each of the 50 domestic states (third consecutive year) and 43 foreign countries; 60% (22,833 packets) distributed to the U.S with 8,806 (38.5%) to the 13 Western states, and 40% (15,189 packets) distributed to foreign countries.
- Uploaded into GRIN database 25,969 evaluation data points on 12,618 accessions, for 106 established descriptors of 20 different crop species; collaborators contributed 48% and WRPIS staff collected 52% of the data.
- Entered 3,575 seed viability records into GRIN in 2013; we tested 1,186 and NCGRP Fort Collins, CO tested 2,389 accessions.

- Packed and stored 1,280 newly regenerated/harvested inventories of a broad range of plant species; determined quantity of 20,124 inventories by weight.
- Shipped 2,174 seed inventories to NCGRP, Fort Collins, Colorado and 2,875 inventories to Svalbard Global Seed Vault, Svalbard, Norway for secured backup.
- Progress made in improving oil content and % oleic fatty acids and evaluated for cold tolerance under controlled conditions and in the field in winter hardy safflower to meet need for the edible oil market. Seed was increased and fall planted for overwinter field evaluation in 2013-14.
- Formed a special collection of 298 lettuce pure-lines (53 romaine, 63 crisphead, 53 leaf, 122 butterhead, and 7 stem types), each derived from a single plant that had been identified as homozygote at all 322 EST-derived SNP (single nucleotide polymorphism) loci. Published a preliminary marker-trait association study and made seeds available to the research community. Seed has been distributed to requesters for uses in various research projects such as screening for lines with ability to germinate at low temperature in Washington and resistance to lettuce bacterial leaf spot, a devastating foliar disease in Florida.
- Alfalfa collection moving from Prosser to Central Ferry to protect against adventitious cross pollination with GE crops.

Richard Lee, National Clonal Germplasm Repository for Citrus and Dates, Riverside, CA

Highlights of submitted report.

- Citrus Variety Collection in collaboration with Univ. California Riverside – over 1200 accessions in the field.
- Citrus Relatives Collection – 85 accessions of genera other than *Citrus*; 28 of 33 genera of Aurantoideae family; over 1000 inventory items held at Riverside, Coachella (CVARS), and Irvine (SCFS)
- Protected Collection (for distribution of budwood) – over 450 accessions under protected conditions, available for distribution of budwood
- Date Palm Collection, at Coachella (CVARS) – 133 total accessions with 117 *Phoenix dactylifera* accessions, 585 plants
- 9 new *Citrus* accessions added in 2013; 8 accessions released from quarantine status and placed in the protected collection in May 2014; 57 additional accessions should be ready for release from quarantine by Oct 2014; 58 accessions into cryopreservation in cooperation with USDA ARS Plant Germplasm Preservation Unit and California Citrus Research Board; support for 3 years to do the entire protected collection
- Cryotherapy protocol for elimination of graft transmissible pathogens from citrus has been developed by modification of cryopreservation protocol in collaboration with USDA ARS Plant Germplasm Preservation Unit, Ft. Collins, CO; expertise may be developed within days rather than the months required for traditional shoot tip grafting
- Biological indexing is required to release quarantine accessions; traditional method takes 10-14 months to grow the indicator plant and perform the test, requires lots of greenhouse space, and cool temperature pathogens can only be indexed for during the winter months; protocol developed for using indicator plants 75-90 days post sowing

Approval of 2013 minutes

Carol Miles moved that the 2013 minutes be approved, motion was seconded by Dan Parfitt, the motion passed unanimously.

General Discussion

Joseph Postman commented that there is a risk that Eastern Filbert Blight may move into the Corvallis collection; may need to renew planting and remove old trees. John Preece responded they have a backup of germplasm and can provide material if/when needed.

State Reports:

CA Dan Parfitt

Highlights of submitted report.

452 requests from California users in 2013, representing 437 different users, an increase over 2012 but average for recent years. Requests for feedback sent to recipient via e-mail; of 300 messages sent, 6% bounced back. 71 responses received, about same as last year, but a lower response rate 16.2 %.

Distributed germplasm was used in a wide variety of applications, from basic research to home gardening. No single crop or crop group was especially requested. Much of the germplasm continues to be used for commercial breeding or research (University or USDA), but a significant number of the 15 requests were for materials to be used in molecular/biochemical studies, but less than 10 last year. Fewer respondents reported on clonal (fruit/nut) germplasm than in the past. Several members of the California Rare Fruit Growers requested materials for distribution to their members as in past years.

CO Mark Brick

Highlights of submitted report.

Orders for germplasm from the NPGS constituted delivery of accessions from both clonal repositories and Plant Introduction Stations. 4308 accessions were delivered that constituted 140 orders in Colorado during calendar year 2013. Fifty one of these orders were from the National Center for Genetic Resource Preservation or the USDA. This represented an significant increase in orders from the previous year (2,719 in 2012). Orders were made from the following locations: COR, CUT, DAV, GEN, GSOR, HILO, MAY, MIA, NC7, NE9, NR6, NSGC, NTSL, PALM, PARL, RIV, S9, SOY, and W6.

ID Joe Kuhl

Highlights of submitted report.

In 2013, 2,960 accessions representing 48 genera and 75 species were, a decrease in accessions as compared to 2012 (4,221) and 2011 (6,404) but similar in number of genera (33) and species (81) as 2012; decrease may reflect absence of large federal or state screening experiments. The top three genera requested were *Triticum* (1,061) followed by *Avena* (1,044) and *Brassica* (476).

A total of 67 orders with 5 from 4 individuals, 29 from the public sector, and 33 from commercial identities; this was a 19% decrease in the number of total requests as compared to 83 in 2012. Major user groups in 2013 were ARS scientists (all based in Aberdeen, Idaho; 71% of total accessions) and University of Idaho scientists (17% of total accessions).

- Dr. Jack Brown's canola breeding program requested 458 *Brassica* accessions.
- Dr. Jianli Chen's wheat breeding program requested 2 *Triticum aestivum* accessions.
- Dr. Nilsa Bosque-Perez's entomology program requested an assortment of species (15 accessions) to test for expanded host range to barley yellow dwarf virus when transmitted by *Rhopalosiphum*.
- University of Idaho nematologist Dr. Saad Hafez requested 20 sugar beet accessions for use as differential lines in evaluation for BCN resistance.
- Mountain Meadows Seed stands out among private companies with 188 accessions requested, or 61% of the accessions requested by private companies.
- J.R. Simplot Co. requested only 31 accessions in 2013 compared to 250 accessions in 2012.

MT Jack Martin

Highlights of submitted report.

Montana received 1699 accessions from in 2013, distributed to 29 individuals, 12 of were affiliated with the Montana University System and the remaining 17 were private individuals. *Triticum* species comprised the largest proportion of germplasm requests (70%). Selected highlights of use:

- Hullless oat accessions to develop gluten free food products.
- Secale cereal are rye accessions used in the rapidly growing craft distilling industry.
- *Triticum* accessions are winter wheat landraces collected from areas of the world where the wheat stem sawfly is a historical problem; goal is to identify novel genes for resistance to incorporate into current spring wheat cultivars.
- *Triticum aestivum* accessions with reported resistance to root lesion nematode used in crosses to study inheritance of resistance.
- 92 *Solanum* accessions used in an on-going project to identify a high amylose (low glycemic index) potato.
- 54 *Vicia faba* accessions selected for small seed size (50% smaller than the Saskatchewan line SSNS-1) to be used as cover crop, will test N fixation compared with pea, and emergence, plant growth, and seed yield as affected by seed coat color and seed size.
- 2 *Pisum sativum* (pea) accessions used in studies with pathogen *Aphenomyces euteiches*.

OR Shawn Mehlenbacher

Highlights of submitted report.

Users include state and federal researchers as well as private seed companies and private individuals in Oregon. 104 users requested germplasm in 2013, making it the third primary user in the western region (behind California and Washington). Selected highlights of use:

- Crosses of Hazelnut with resistance to eastern filbert blight from the Spanish cultivar 'Culpla', Serbian cultivar 'Crvenje' and Russian selection OSU 495.072 segregated 1 resistant : 1 susceptible; resistances mapped to the same location on the map as 'Gasaway' resistance.
- 13 *Solanum pimpinellifolium* lines currently being evaluated for late blight resistance in a field trial to find lines that may be useful to breed tomatoes resistant to late blight.
- On-going project to identify novel resistance QTL in scarlet runner bean *Phaseolus coccineus* and transfer to common bean *P. vulgaris*.
- 2 stripe rust resistance genes not currently available in PNW germplasm (Yr48 and QYr.ucw-3BS) from 2 spring wheat lines incorporated into elite lines through three rounds of backcrossing; will introduce into OSU breeding program in the spring of 2015.
- 2 sets of barley accessions from the National Small Grains Collection in 2011: the World Core (~ 2,000) and the World Core winter subset (~400) were assessed for resistance to stripe rust and scald, plant height, and heading date as part of OSU's role in the USDA-NIFA Triticeae CAP project.
- 174 accessions representing > 20 potato species were received from NRSP6 in Sturgeon Bay, WI to study folate (Vitamin B9) concentration.
- *Helianthus* accessions (PI 494571, PI 494711, PI 468651, PI 494572, PI 435624, PI 435629, and PI 435633) showed considerable variation in morphology: whorled inflorescences with sometimes synchronized flowering times such that a single plant can grow to 10', make 20 or more inflorescences which open at the same time on huge plants, have smaller seeds attractive to birds, have large central eyes in the flowers with color patterns from purple to lemon yellow to orange to red of horticultural and optical beauty. The recipient thanks GRIN and all those who support the public distribution of plant germplasm for the common good: "Public domain plant breeding is the core of a healthy and sustainable agriculture. It supports the adaptation of important food, fuel, medicinal and ornamental species to changes in climate both at local and global levels".

WA Carol Miles

Highlights of submitted report.

In 2013, 245 Washington State residents requested and received 315 orders (2 fold increase in requesters as compared to previous years): 9,402 samples, 1,069 species and subspecies, 206 genera ; 678 taxa (86%) requested by one researcher; most samples requested: *Triticum*, *Pisum*, *Poa*, *Eragrostis*, *Lens*, and *Cicer*.

Of recipients, 52 at universities, 19 with USDA, 32 with commercial firms, seed companies and nurseries, 5 for non-profit organizations, 7 for private research groups, and 1 for schools and school gardens. Response rate: 38 (16%); 33% in 2013 and 2012, 29% in 2011, and 22% in 2010).

Usage:

- adaptability testing of apples, pears and other tree fruit at various Puget Sound

- locations (Terry Alspaugh, Carole Blakey, Charles Polance, Erick Simpson)
- screening of pea genotypes for resistance to *Sclerotinia* diseases (Lyndon Porter)
- screening of *Pisum* lines for resistance to root rot (Dipak Sharma-Poudyal) and powdery mildew (Clarice Coyne)
- germplasm evaluation for *Verticillium* wilt resistance in potential rootstocks for grafted watermelon (Carol Miles, Jesse Wimer)
- development of wheat breeding lines (Colin Curwin-McAdams)
- acquisition of plant material for commercial nursery propagation and distribution (Booth Canyon Orchard, Cameron Nursery, Cummins Nursery, Raintree Nursery)
- acquisition of native plants for beach restoration (Madrona Murphy)
- *Eragrostis tef* grown out for DNA extraction (Ted Kisha)

One researcher who requested material of *Cicer arietenum* transferred the research material to Pakistan, the scientist's current research site.

A researcher working with *Triticum* species included a note that seed collection storage is a topic ripe for a new publication, stating that the previous publications are out of date. He suggested including methods pertaining to small, medium, and large collections that are intended for short, medium, and long term storage, especially low input or "passive" methods rather than high-tech systems.

AK, AZ, HI, NV and WY Presented by Dave Stout

Highlights of submitted report.

No active State representative for these five States; report from database. Recipients in these 5 states placed 176 orders requesting samples from the National Plant Germplasm System (NPGS): Alaska, 15; Arizona, 71; Hawaii, 64; Nevada, 17; and Wyoming, 9. User categories were: individuals, 65; state employed, 52; company employed, 48; and government employed, 11.

Recipient response rate is low (19 or 11%) to email query. Germplasm is used for a wide range of purposes:

- the *Ficus carica* is used to breed for fruit for the Jewish holiday festival in Tucson, Arizona
- *Zinnia bicolor* was grown to flower for digital images for use in a book on the history of garden zinnias in Sonita, Arizona
- Some Teosinte varieties were partly for education/display purposes for a middle school science fair, and *Zea Mays* B73 was used to generate material for gene expression study, both in Tucson, Arizona
- Part of a peony collection are being tested for hardiness and evaluated for use as cut flowers in Fairbanks, Alaska
- *Taraxacum* (Russian dandelion or rubber weed) from Pullman station is grown with an intention to experiment with homestead scale rubber production in Fairbanks, Alaska
- *Zea mays* plants were used in a series of trial experiments to determine the optimal species for a larger scale/longer term experiment to determine the effects of atmospheric pCO₂ levels on carbon stable isotope fractionation in plant tissues in Hawaii.

Encouraging testimonies:

- “The germplasm system has been a big benefit to me; it is critical to be able to obtain obscure material to find plants suitable for our extreme climate. I hope it continues to function well.” from Vic Johanson, Fairbanks, Alaska
- “The material is greatly useful.” “I intend to plant these and maintain a new section of the orchard with the Assad varieties. These plants will be bred for their fruit for the Jewish holiday festival.” from Gabriel Acron, Tucson, Arizona
- “This material was very useful. We used the material to grow a “history of corn breeding” nursery. This small nursery allows us to better teach visitors, employees, and students” from Josh Hager, Waimea, Hawaii.

Open Discussion

Joe Kuhl commented that recipients commonly do not know how to propagate/grow the material they receive.

Shawn Mehlenbacher noted there is a growing demand for Quinoa production throughout the western region, and requested an update report from Kevin Murphy at Washington State University. Carol Miles responded that she will request the report and forward to the group.

Dave Stout commented that W-6 is following the lead of the soybean collection by creating single plant collections; have completed lettuce (genotyped), cicer and lens. Use the PI suffix to provide clear identification for publications. Seed images are being uploaded to website. When GLOBAL Grin is released, not sure how this will impact the annual report he sends to each state. Shawn Mehlenbacher responded that annual reports of recipients are essential for the annual reporting process.

FY 2014 Budget

The W-6 FY2015 budget proposal is \$405,204, which is flat as compared to 2012 and 2014, and does not provide for inflation (2.5%). There is strong concern that the project was only approved for 2 years instead of the standard 5 years. Jim Moyer stressed that funding for WRPIS cannot be turned on and off each year and that project renewal needs to be commensurate with other regions. He further stressed the need for each state representative to communicate NPGS mission and outputs to their station directors. Joe Kuhl moved to endorse the budget at \$405,204, Jack Martin seconded. The motion passed unanimously.

Relocation of alfalfa collection

Jinguo Hu proposed to relocate the alfalfa collection and staff from Prosser to Central Ferry research station in Washington in order to protect against cross pollination with transgenic varieties. Joe Kuhl moved to endorse the alfalfa collection relocation, Dan Parfitt seconded. The motion passed unanimously.

Resolution committee

Shawn Mehlenbacher appointed the resolution committee: Mark Brick, Joseph Postman, and Dan Parfitt.

Future Meeting Location

A motion was made by Mark Brick and seconded by Dan Parfitt to hold the 2015 meeting in June in Pullman, WA. The motion was passed unanimously.

Resolutions:

1. The W-6 Technical Advisory Committee thanks Dr. John Preece, Mary Parker, Ellen Preece and Howard Garrison for their efforts and kind hospitality organizing, hosting and providing the field tour for the W-6 meeting in Davis CA for 2014.
2. The W-6 Technical Advisory Committee thanks Dr. Francis Zee for his many years of service as curator of the germplasm collection in Hilo, HI and wish him well in retirement.
3. The W-6 Technical Advisory Committee recommends that:
 - The budget for the W-6 project be developed as a 5 year project recognizing that NPGS is a significant enterprise important to the growth and vitality of US agriculture.
 - The W-6 budget cycle should be harmonized with the other three regional plant introduction stations NE9, NC7 and S9.
4. The W-6 Technical Advisory Committee recognizes the importance of the alfalfa collection and endorses the relocation of the Alfalfa collection from Prosser to Central Ferry, WA to achieve greater isolation and thereby reduce the potential introduction of adventitious transgenes in the alfalfa collection.

A motion was made by Joe Kuhl and seconded by Dan Parfitt to accept the resolutions as written. The motion was passed unanimously.

Adjourn

At 5 pm, a motion was made by Mark Brick to adjourn, seconded by Shawn Mehlenbacher, and passed unanimously.