

Revised
June 7, 2005

Report of the ESCOP Plant Germplasm Task Force

Background: The National Plant Germplasm System (NPGS) has responsibility for the conservation, maintenance, preservation and utilization of the Nation's plant genetic resources. The NPGS is funded through a partnership of State and Federal resources, real and in-kind. This report for the most part will focus on the four Regional Plant Introduction Stations and NRSP-6 (Interregional Potato Introduction Project) to which the state agricultural experiment station (SAES) Directors annually commit resources.

Charge: The recently concluded CSREES/ESCOP 5-year review of NRSP-6 recommended that ESCOP review the SAES current fiscal commitment to the NPGS and determine the level of future engagement.

In September 2004, ESCOP established a Task Force to help map the SAES's future involvement in the NPGS. The charge from ESCOP also requested the task force evaluate and examine the SAES's future interaction with the NPGS related to programmatic involvement, administrative structures, and funding support.

Introduction:

To maintain a safe and secure food system for the US, the first line of defense on the integrity of our agricultural system will be the ability to tap into existing and new germplasm resources that will provide the necessary genes to combat any new or emerging diseases and/or pests that may threaten the agricultural sector. Currently, USDA in conjunction with the state agricultural experiment stations is charged with maintaining the Nation's germplasm resources; however there is evidence that it does not have the capacity to fully meet this challenge and to guarantee that our system remains safe, secure and relevant.

While it is evident that plant germplasm is vital to the health of the US agricultural system and to our national economy, it remains a near impossible task to find and allocate sufficient resources to achieve the conservation and evaluation of genetic resources. Several reports from the General Accounting Office (GAO) have noted the shortcomings of the NPGS, the most recent in 1997 (Noted in the report: "Many of the system's collections lack sufficient information on germplasm traits to facilitate the germplasm's use in crop breeding. Officials of the germplasm system acknowledged that some information on plant traits, such as resistance to disease or plant structure either has not been developed or has not always been entered into the system's database." In addition

the GAO Report noted, “Preservation activities – including viability testing, regeneration, and secure long term backup storage of germplasm – have not kept pace with the preservation needs of the NPGS’ collections. Two major NPGS sites accounting for over one-quarter of the active collections do not conduct sufficient viability testing to determine the quantity of viable seeds.”). In addition, and at this time there is no advisory body which incorporates the State Agricultural Experiment Station network, USDA (including ARS, CSREES and ERS) and the private sector that evaluates the priorities, funding, or current and emerging issues that need examination. The former National Genetics Resources Advisory Council (NGRAC) established in the Farm Bill of 1990 had responsibility for advising, assisting, consulting with and making recommendations to the US Secretary of Agriculture on matters concerning and related to the activities, policies and operations of the National Genetics Resources program, however it no longer exists, having last met in August of 1999.

Our U.S. agricultural system, known worldwide for its productivity owes a great deal of its success to the continuing flow of improved cultivars and varieties, developed by both the public and private sectors. The genes that are responsible for many of the new traits expressed in improved cultivar and variety development are maintained in this Nation’s germplasm collections which are funded through this unique state / federal partnership. To continue this productivity and to retain the global competitiveness of the American agriculture enterprise, the support and maintenance of our system for cultivating, preserving, and maintaining germplasm with unique and diverse characteristics is critical. The collections which are discussed in further detail in this report are listed below for reference.

- **NE-009: Conservation and Utilization of Plant Genetic Resources** (Geneva NY). *Collection emphasis:* Tomato, onion, selected crucifers, celery, winter squash, radish, other vegetables, and buckwheat. The clonal collections include apple, grape, and cherry. Station holdings – 11,821 accessions
- **NC-007: Conservation, Management, Enhancement and Utilization of Plant Genetic Resources** (Ames IA). *Collection emphasis:* Maize, sunflower, root and bulb vegetables, forage and turf grass, crucifer, herbaceous ornamentals, woody landscape plants, leafy vegetable, cucurbits, clover and special purpose forage legumes. Station holdings – 47,861 accessions
- **S-009: Plant Genetic Resources Conservation and Utilization** (Griffin GA). *Collection emphasis:* Capsicum, clover and special purpose forage legumes, cucurbit, warm season turf grass, peanut, sorghum, sweet potato, cowpea, vegetables (okra, pepper, watermelon, squash, eggplant, gourds), mung bean, legumes (clover, guar, winged bean), bamboo, castor bean, sesame, pearl millet. Station holdings – 84,145 accessions
- **W-006: Plant Genetic Research Conservation and Utilization** (Pullman WA). *Collection emphasis:* Forage and turf grasses, beans, cool season food legumes (pea, lentil, chickpea, fava bean, lupine, etc.), lettuce, safflower, onion relatives, and forage legume crops, along with selected ornamental and medicinal species. Station holdings – 72,422 accessions

- **NRSP-006: Inter-Regional Potato Introduction Project** (Sturgeon Bay WI). Station holdings – 5,665 accessions
- **Total holdings of the 5 PI Stations – 221,914** accessions

Currently the germplasm network, otherwise referred to as the NPGS maintains plant germplasm collections for over 85 crops at 28 sites nationwide, including the five sites listed above (see: <http://www.ars-grin.gov/npgs>). In addition to the NPGS there are 40 Crop Germplasm Committees (CGC's) with responsibility of providing technical advice to the curators of the specific collections held in the system. The CGC's are composed of crop experts, scientists for both the public and private sector, and the NPGS crop collection curators.

By way of history, it is important to review the background that established these germplasm centers. The Agricultural Marketing Act of 1946 established the major components of the NPGS as well as creating the legal basis for the federal / state partnership that emerged for managing and preserving germplasm resources. USDA-ARS has primary responsibility for management of the national system; however states contribute in ways beyond the annual off-the-top contribution from the Multistate Research Fund (MRF). In fact, scientists in the SAES system are major users of the germplasm in the collections.

Currently the system has approximately 462,000 accessions in the collections at the 28 active sites, with half of the collection maintained at the four Regional Plant Introduction Stations and the Potato Introduction Station at Sturgeon Bay.

While we estimate that USDA-ARS provides 80 – 90 % of support for the NPGS, the states through the regional trust accounts annually allocate off-the-top funds from their Multistate Research Fund (MRF) portfolio to support this activity. In addition, those states where the regional centers are located provide land and other in-kind resources, often difficult to fully equate in terms of dollars. To a much lesser degree, private industry funds selected NPGS projects and regularly transfers germplasm to the system in the form of new varieties and cultivars. While USDA-ARS reports expenditures in excess of \$23M for the NPGS, much of this is not directly involved with the maintenance, preservation conservation, and / or utilization of the genetic resources in these collections, yet is accountable with in National Program area 301. See:

<http://www.ars.usda.gov/research/programs.htm>

In addition, ARS maintains that it contributes approximately 84% of the total funds provided to the NPGS, however this most likely does not account for significant in-kind contributions from those state agricultural experiment stations where the regional centers are located. In addition, there is evidence that funding of the NPGS has been flat-lined and / or declining in terms of real dollars for some years, yet the collections continue to expand.

Role of ARS in the NPGS

ARS incorporates the NPGS within National Program 301 – ***Plant, Microbial, and Insect Genetic Resources, Genomics and Genetic Improvement***. The mission statement for this National Program area is “*to safeguard and utilize plant, microbial and insect germplasm (genetic raw material), associated genetic and genomic databases, and bioinformatics tools to ensure an abundant, safe and inexpensive supply of food, feed, fiber, ornamentals, and industrial products for the US and other nations*”. Research components of this activity include 1) genetic resource management, 2) genomic characterization and genetic improvement, and 3) genomic databases and bioinformatics. Accomplishments by component area can be found at the following website:

http://www.ars.usda.gov/research/programs/programs.htm?np_code=301&docid=1797

Within the action plan, ***Component 1 - Plant Genetic Resources Management***, relates most directly to the majority of the NPGS activities, including the research and service activities at the 4 Regional PI stations and NRSP 6. Component 1 focuses on the following problem areas: 1) safeguarding threatened genetic resources and associated information; 2) conserving genetic resources and associated information efficiently and effectively; 3) documenting and characterizing genetic resources; 4), expanding germplasm evaluations and characterizations; and, 5) technology transfer of genetic resources and associated information.

The GAO report of late 1997 noted several concerns in the NPGS, however no formal recommendations were put forward following the review of the NPGS. USDA however, noted that the success of the NGPS has been dwarfed by its increasing responsibility in the face of declining resources. USDA also noted that unless funding for the National Plant Germplasm System is augmented, the system will need to juggle its multiple, sometimes divergent priorities, by making incremental progress in addressing an exceptionally broad array of user demands.

Recommendations:

1. Develop an ARS-CSREES–ESCOP Coordinating Committee reporting jointly to ARS, CSREES, and ESCOP, for reviewing and setting national scientific and service priorities as related to the role of germplasm in promoting the economic health and security of the agricultural system. The Coordinating Committee should have clear annual reporting functions back to ARS, CSREES, and ESCOP. From our overview of the NPGS as it now exists and as we understand it, it appears that the current system is constrained by a lack of clearly defined priorities and responsibilities that define the roles of each of the parties (e.g., ESCOP, ARS, and CSREES) that are involved in providing both the programmatic and fiscal support for the system. In addition, the plant germplasm system as currently organized and coordinated has no clearly defined method of measuring impact and effectiveness and defining annual budgetary needs. The ESCOP Germplasm Task Force was unanimous in its support for a National Coordinating Committee, believing it is not only important but makes sense to plan together, in that we all, USDA-ARS, the

SAES's and their associated scientists, and CSREES have a stake in this matter. Without a Coordinating Committee the ESCOP Task Force is concerned that the needs of the national germplasm network will continue to go unaddressed.

- a. The Coordinating Committee should meet annually to review and make recommendations (with justification) to both ESCOP and the Regional Associations (to be presented at the spring meetings of the associations) for off-the-top contributions from the RMF in support the regional PI stations. Currently the requests for funding come from the regional PI Station Directors via the administrative advisors for the stations, with input and consultation of the scientific and technical committee of the respective regional PI station. A first task for any Coordinating Committee should be to look at the current funding model that is in place and determine if there are alternative models that should be discussed and debated that would simplify and insure adequate funding for the regional centers (As an example, would it be appropriate to consider a single NRSP model that would provide the funding for the four regional germplasm centers and NRSP 5 and 6?)
- b. With ARS and CSREES, the State Agricultural Experiment Stations and the regional plant introductions stations (including the potato introduction station) need to prioritize those activities that focus on the preservation, maintenance, documentation, and distribution of the germplasm. The primary function of the PI Stations should remain the acquisition, preservation, documentation and distribution of materials from their collections; however the full capability of ARS and State scientists can not be fully utilized until a greater effort is realized that will allow for more detailed evaluation and enhancement of the collections. Mechanisms, based on capabilities in the SAES's and ARS, need to be proposed and implemented to encourage much greater and more effective characterization, evaluation, and usage of holdings. This activity is fundamental and the Coordinating Committee should consider this as a priority matter. (Perhaps the development of a competitive grants program through the USDA-NRI or the NSF-PGRP to encourage scientists to understand and utilize the genetic basis of key agronomic traits harbored in collections should be considered). It should be noted that nearly 50% of the collection holdings are maintained by the five repositories highlighted in this report. In addition, 17 of the 28 germplasm repositories are located on Land Grant University campuses, associated with an SAES. Without a coordinated, responsive, and effective national system, scientists and educators would have to rely on the private sector or other national and/or international collections for access to new germplasm and useful information.
- c. The Coordinating Committee should take responsibility for developing material(s) to promote not only the value of these collections to the

Nation's ability to maintain an economically viable agriculture in the face of increasing international competition and other threats. A layman's public relations piece needs to be commissioned. The Coordinating Committee needs to engage a broader user / stakeholder community to speak on its behalf and on the needs to maintain this system. In addition to its classical constituencies (plant breeders, geneticists, agronomists, horticulturists, plant pathologists, and entomologists), the NPGS must serve both a broader basic research community (molecular biologists, biochemists, food scientists, etc.) and educators interested in utilizing and exploiting plant diversity for educational purposes.

- d. We recommend that the Coordinating Committee develop impact statements resulting from the National Plant Germplasm System that stress qualitative rather than quantitative impacts. Since financial resources to collections are limited, big collections are not necessarily better collections. Distribution numbers may or may not reflect effective use of collections. Other measures of success, *e.g.*, finding new and useful genes or genotypes, building useful combinations of genes and genotypes, targeted screening and evaluation of collections, user community networking, etc., must be established and monitored. The NPGS needs to be strong in the scientific disciplines and service activities related to plant breeding, genetics, and genomics. (**See:** *Report drafted by C. Qualset and H. Shands that focuses on the international issues associated with the need to maintain and support crop collections to preserve genetic diversity in ongoing global efforts to combat pests and diseases, and to adapt to environmental changes. This report supports the thesis that more attention nationally and internationally needs to be given to these valuable resources now and in the future.*)
2. Operational priorities for the NPGS should continue to include the acquisition, preservation, characterization, evaluation, documentation, and distribution of germplasm. Perhaps even more important is the need to build a more robust and effective continuum from conservation to use, additional and expanded priorities should be added to foster germplasm enhancement and use for commercial and educational purposes. These two activities can best be accomplished working in unison with scientists at the SAES's. To be sure that the NPGS Regional PI Stations are focused and making priority decisions, we would recommend that the Coordinating Committee undertake a national scientific review and assessment of the NPGS, to include an in-depth evaluation of the priorities, collaborations with the SAES's, current and future infrastructure needs, and the future direction of the program in light of progress in basic plant sciences as well as issues relating to international ownership and access to germplasm. Moreover, we recommend that ARS consider some mechanism or realignment of scientific program area 301 (*Plant, Microbial, and Insect Genetic Resources, Genomics and Genetic Improvement*), so that there is a way to clearly separate and distinguish those activities and associated budgets directly involved in the germplasm collections and

their use from other important research activities undertaken within research program area 301.

3. The most important strategic issue facing the NPGS and the relationship between USDA-ARS and the SAES's is the need to make sure that the SAES Directors are informed of the existence, extent, impact, and importance of the NPGS to U.S. agriculture. If there is agreement that this activity is important and critical to ensure the health and continuity of our current U.S. agricultural system, but not important enough for the SAES Directors to fully support through the existing funding structure, then viable alternatives need to be proposed and supported. There is a clear need to raise the visibility of the NPGS within ESCOP, ARS and CSREES, and the Coordinating Committee should assume this responsibility for the system.
4. The ESCOP Germplasm Task Force recommends that ESCOP review its committee structure and current efforts with regard to plant breeding, genetics, and genomics. Presently three subcommittees are listed under the ESCOP Science and Technology Committee, *e.g.*, Genomics Subcommittee, Genetic Resources Subcommittee, and the Genomic Steering Subcommittee. At the present time none are or have been functional.

Citations:

GAO Report – Information on the Condition of the National Plant Germplasm System (GAO /RCED-98-20) October 1997. www.gao.gov/archive/1998 report RC98020

Qualset, C. O. and H. L. Shands. 2005. Safeguarding the Future of U.S. Agriculture: The Need to Conserve Threatened Collections of Crop Diversity Worldwide. Univ. Calif. Genetic Resources Conservation Program. Davis, CA.

National Plant Germplasm Centers

1. Barley Genetic Stock Center, (GSHO), Aberdeen, ID
2. C.M. Rick Tomato Genetics Resources Center, Davis, CA
3. Desert Legume Program, Tucson, AZ
4. Genetic Stocks – Oryza (GSOR) Collection, Stuttgart, AR
5. G.A. Marx Pea Genetic Stock Center (GSPI), Pullman, WA
6. Maize Genetics Cooperative Stock Center (GSZE), Urbana, IL
7. National Arid Land Plant Genetic Resources Unit (PARL), Parlier, CA
8. National Clonal Germplasm Repository (COR), Corvallis, OR
9. National Clonal Germplasm Repository for Citrus and Dates, Riverside, CA
10. National Clonal Germplasm Repository for Tree Fruit/Nut Crops and Grapes (DAV), Davis, CA
11. National Germplasm Resources Laboratory (NGRL), Beltsville, MD
12. National Center for Genetic Resources Preservation (NCGRP), Fort Collins, CO
13. National Small Grains Collections (NSGC), Aberdeen, ID
14. National Temperate Forage Legume Genetic Resources Unit, Prosser, WA
15. North Central Regional Plant Introduction Station (NC-7), Ames, IA
16. Ornamental Plant Germplasm Center, (OPGC), Columbus, OH
17. Pecan Breeding and Genetics, Brownwood and Somerville, TX
18. Plant Genetic Resources Conservation Unit (S-9), Griffin, GA
19. Plant Genetic Resources Unit (NE-9), Geneva, NY
20. Plant Germplasm Quarantine Center (PGQC), Beltsville, MD
21. Soybean/Maize Germplasm, Pathology and Genetics Research Unit, Urbana IL
22. Subtropical Horticulture Research Station (MIA), Miami, FL
23. Tropical Agriculture Research Station, Mayaguez, Puerto Rico
24. Tropical Plant Genetic Resources Management Unit (HILO), Hilo, HI
25. United States Potato Genebank (NRSP-6), Sturgeon Bay, WI
26. Western Regional Plant Introduction Station, (W-6), Pullman, WA
27. Wheat Genetic Stock Center (GSTR), Aberdeen, ID
28. Woody Landscape Plant Germplasm Repository, Washington, DC