Minutes of the Third APS/USDA National Plant Disease Recovery System (NPDRS) Workshop
October 27-28, 2008, San Antonio, Texas

NPDRS is mandated by Homeland Security Presidential Directive #9 (HSPD-9) to develop procedures to mitigate potential damage from exotic, emerging, or reemerging plant diseases that could threaten the economic viability, long-term stability, or sustainability of U.S. agriculture through cooperative efforts of USDA, private industry, and states for:

- Early plant pest detection and surveillance,
- Threat identification and mitigation, and
- Specialty crop certification and risk management.

Thirty-six scientists representing USDA, the States, APS, and industry participated in the third National Plant Disease Recovery System (NPDRS) workshop to review the four recently developed recovery plans, prioritize and select diseases for future plans, and discuss the role of the various federal, state, and private groups in mitigating potential damage from exotic, emerging, or reemerging plant diseases that could threaten the economic viability, long-term stability, or sustainability of our agricultural infrastructure. The development of recovery plans through the NPDRS is mandated by Homeland Security Presidential Directive #9 (HSPD-9) and fourteen plans are now completed or in review.

- **Activities of Federal agencies:**
  - USDA-APHIS PPQ
    - Enhanced threat analysis and surveys
    - Domestic inspection activities
    - Pest identification and detection technology enhancement
    - Safeguarding nursery production
    - Outreach and education
    - Rapid response to prevent establishment and mitigate damage
  - USDA-FS EXFOR (Exotic Forest Pest Information System
    - Identify potential pests off shore
    - Early detection and rapid response (sentinel plantings)
    - Invasive species program
    - Control and management
  - USDA-CSREES
    - Partnership programs with USDA-APHIS to detect, diagnose, monitor, respond, and mitigate damage for recovery through:
      - Offshore Pest Information System (OPIS)
      - National Plant Diagnostic Network (NPDN)
      - National Identifier Labs (NIL)
      - Cooperative Agriculture Pest Survey (CAPS)
      - Pest Information Platform for Education and Extension (PIPE) to couple extension and research for direct action on the ground.
        - Integration, detection (NPDN, CAPS)
        - Diagnosis (NPDN, NILS)
        - Mitigation (PIPE)
        - Monitoring (OPIS, NPDN, CAPS, PIPE)
        - Response (PIPE) efforts
  - USDA-RMA
    - Managing risk through strategic solutions based on best management practices (BMP)

- **Activities of state extension services, state agencies and Land-Grant Universities**
  - National Plant Diagnostic Network (NPDN) interfaces with NPDRS and other entities in the education, detection, diagnosis, and development of SOPs for working with the various pathogens.
  - Extension Disaster Education Network (EDEN) works within the comprehensive emergency management plan (CEMP) to include local community planning to reduce the impact of disasters through education.
  - The Kansas Biosecurity Program is a new facility for research and education on exotic diseases.
  - FOODSHIELD is a free web-based community for food and agricultural sectors
  - The Florida Emerging Pathogens Institute (EPI) is expanding its research emphasis on emerging and exotic pathogens now with the introduction of nine new plant diseases in 2008.
  - The National Plant Board includes all 50 states to provide economic cooperation in a multistate approach to funding.

Four new recovery plans were presented and reviewed. Each recovery plan encapsulates a basic understanding of the disease, its distribution, entry pathways, potential impact if introduced, mitigation strategies, and knowledgeable individuals. Knowledge gaps and critical research necessary to mitigate damage from each disease are prioritized. Review of the four new recovery plans centered on focus of the recommendations in the executive summary, having the plan subject categories sufficiently developed, and making sure research and extension/education priorities are on target. The plans reviewed during the meetings included:

- Citrus variegated chlorosis – CVC- caused by *Xylella fastidiosa*,
- Late wilt of corn caused by *Harpophora maydis*,
- Forest and ornamental declines caused by *Phytophthora kernoviae*, and
- Scots pine blister rust caused by *Cronartium flaccidum*.

These plans will be revised as recommended by the review groups and added to the existing completed plans. Recovery plans have been developed for all of the pathogens on the Homeland Security "Select Agents" list. After reviewing data on various exotic diseases, it was recommended that recovery plans also be developed for wheat blast (*Magnaporthe grisea*) and walnut canker (*Geosmithia* sp.).

Recent regulatory activity highlighted the need for pathogen (disease) prioritization for exotic pests to utilize resources most effectively. Using an analytic hierarchy process with weighted criteria and expanded pathways analysis, criteria for prioritization should include potential for:

Entry,
Establishment,
Spread,
Economic impact, and
Management

Aphis-PPQ Select Agents List (SAL): The APHIS-PPQ Select Agent List (SAL) dropped all *Candidatus* Liberibacter spp. from the list since there are no practical field differences in their biology, the management responses for the three species are identical, and the presence of citrus greening in Florida makes them unlikely agents of bioterrorism. The three new plant pathogens added to the SAL (effective November 17, 2008) are:

Xanthomonas oryzae (to now encompass all pathovars)

Phoma glycinicola (formerly *Pyrenochaeta glycines*)
Rathayibacter toxicus

Peronosclerospora sacchari also was included as a synonym of *Peronsclerospora philippinensis*. Individuals and labs working on SAL pathogens must be registered with APHIS-PPQ (source information) and all personnel must have an FBI clearance. Current possessors of the three added pathogens to the SAL had until November 17, 2008 either to destroy, transfer, or initiate the registration process. APHIS will assist with the registration process since failure to comply is a violation of the Agricultural Bioterrorism Act of 2002 and subjects an individual to severe penalties of $250,000 fine, 5 years in prison, and denied future registration. There was considerable sentiment expressed that placing a pathogen on the SAL may be counter productive since research is greatly restricted and registration cumbersome. Although the Administrative Procedure Act provides that an agency may make a rule effective in less than 30 days, comments were that there is a critical need for a streamlined process to remove an agent from the list if it becomes established in order for the field research necessary for management to be implemented. The Florida Research Council cited the three-year delay in delisting HLB (*Liberibacter*) from the SAL after establishment was determined as a critical delaying factor limiting management efforts and other research necessary for recovery which put the industry at further risk.

Other groups involved with new high consequence emerging pathogens.

- APS Microbial Forensics interest group is tied into the National Institute for Microbial Forensics and Food and Ag Biosecurity (Jacqueline Fletcher, Chair)
- APS Emerging Diseases and Pathogen Committee (Doug Luster, Chair)
- The Federal Interagency Committee on Invasive Terrestrial Animals and Pathogens (ITAP) facilitates efficient networking to share technical information, data bases, and program planning among Federal and State agencies involved in invasive species research and management (Amy Rossman, chair)

Potential candidates and recommendations for new recovery plans were reviewed**.**

Wheat blast (*Magnaporthe grisea*)
Walnut canker (*Geosmithi*a sp.)
Mal Secco (*Phoma tracheiphila*)
Brown blight of pine (*Mycosphaerella gibsonii*)
Zebra chip (HLB) on potato
Phytophthora forest pathogens (*P. pinafolia* and *P. alni*)
Triticum mosaic virus

Wheat blast and walnut canker were recommended for new recovery plans along with two new "generic" plans, one for cyst and root knot nematodes and one for *Phytophthora* spp. on ornamentals. The *Phytophthora* plan will use *P. kernoviae* as a starting document with lessons learned from *P. ramorum* also.

Prioritization of pathogens and development of new recovery plans: Limited time and resources prevent development of recovery plans for the literally thousands of species and potential strains of exotic pathogens that could impact our agricultural infrastructure. This workshop discussed the concept of developing generic plans based upon commonalities in commodity, detection, epidemiology, spread, and mitigation. A matrix could be developed in two or more dimensions to represent the characteristics of pathogen groups whereby specific plans for unexpected pathogens could be rapidly developed as needed.

- A response component (usually APHIS role) is needed in recovery plans to ensure continuity to the recovery phase (ARS, CSREES, etc. role).
- Each new recovery plan should have a section defining where in the continuum from response to recovery, the emphasis moves to recovery. This can probably be best identified through a "decision tree" concept with 'tipping points' based on regulatory status, detection, possibility for eradication, and mitigation/control potential.
    - **Tier I elements identify regulatory elements (regulated or not)**. Mitigation on site (quarantine, containment, monitoring and eradication are possible) versus managing after establishment. Epidemiology (rate, distance, method of spread, establishment), trade restrictions, and economic value (host range, damage potential by related species, infrastructure impact) come into consideration. A pathogen must be limited in distribution for eradication to be possible. If eradication is not possible, movement to mitigation and recovery should proceed rapidly to minimize damage. A more sensitive and streamlined procedure to remove an established disease from the SAL will facilitate rapid movement into the recovery phase. Delayed mitigation or recovery efforts after establishment of an exotic disease puts production at further risk.
    - **Tier II elements deal with detection and favorability (conduciveness) of the environment for disease**. Is the disease contained or widespread, in a conducive environment or near a susceptible host, able to be monitored, or early or late in an epidemic? Does a detection method exist (bioassay, sentinel plots or plants, identifiers, etc.) or can an existing technique be modified? What should be sampled (soil, water, air, plant tissue, vector)?
    - **Tier III elements focus on biology of the pathogen**. Epidemiology (airborne, seedborne, soilborne, vectored, plant-borne), survival, host range, and disease cycle (monocyclic/polycyclic).
    - **Tier IV elements involve mitigation and disease management.** What controls are effective for eradication, mitigation, or management (genetic resistance, chemicals, biological, cultural) of the disease and/or its vector? Are chemicals registered (labeled) and available for this purpose? Can effective controls be developed? Linking the recovery plans to NPDN developed Standard Operating Procedures (SOPs) for working with the pathogen will provide functional depth to the plan and identify communication networks involved in detection, monitoring and mitigation.

From decision tree to matrix could be by specific recovery plan, generic plans, or template plans. The decision tree could be used to develop a multi-dimensional matrix where branch ends of the 'decision tree' could become components of these plans. This would also identify gaps where new plans are needed and should be incorporated into a decision support system that is programmed and connected to a knowledgebase. It is very important to review/update the plans annually as new research and survey data are available (especially international sources).

- **Examples of generic recovery plans** (a completed framework that is applied to multiple situations) could be for rusts (wheat, soybean, etc. rusts), soilborne pathogens (Fusarium wilts, cyst nematodes), Phytophthora diseases, host category (grain, pulse, forest/ornamental, fruit, vegetable, citrus, tree fruit, forage), etc. where

unique characteristics of specific diseases could be added as specific appendices. The matrices would be based on commonalities in detection and surveying, epidemiology, spread, mitigation, etc.; taxonomically by pathogen type for fungus, bacteria, virus, etc.; animal and human impact (toxins, etc.), management strategies (eradication, resistance, chemical, cultural control), or by 'pathosystem' (rusts, smuts, sporulating leafspots, seedborne and vectored pathogens, wilts and xylem or phloem-limited pathogens, cankers, soft rots, protozoans, soilborne and nematodes, etc.)

- **Recovery plan templates** (a framework in which specifics can be added later as needed) were thought to be very helpful since these would be based on common features and encompass multiple types. Examples could be based on regulatory status, detection, epidemiology, biology of the pathogen, or mitigation/control.
- **Recovery plans should emphasize the strategies and procedures needed for effective mitigation and recovery.** These will require knowledge of pathogen biology, epidemiology, and control.
- **Expertise lists** should be available on a generic level (taxonomy of pathogen, epidemiology, control, etc.) as well as for a specific disease. The latter list should provide a ready resource for updated information and research.
- **Plans for outreach** of critical plan components to stakeholders need to be identified.
    - A summary of pathogen threats and chemical control needs consolidated from all plans needs to be available to government, academia, and industry.
    - Research gaps consolidated from all plans should be reported to NRI, ARS, etc. to encourage RFPs and funding resources.
- **Specialty and organic crops** often don't have the same over-all economic impact as major commodities, but impact particular niches in the agricultural production infrastructure and should be considered.

"Lessons learned" evaluation of regulatory responses and plans: It was felt that a "lessons learned" exercise of previous regulatory actions taken after introduction of a pathogen and implementation of a response or recovery plan (such as citrus canker, HLB, potato cyst nematode, soybean rust, etc.) would assist in the development of new plans. Experiences with sudden oak death (SOD) were a significant help and incorporated into strategies in the new *P. kernoviae* plan. This information also will be used to develop the new 'generic' plan on *Phytophthora*. APHIS indicated the recovery plan for HLB provided essential information and a list of experts to facilitate their response with this disease.

Post-entry recovery plan selection: It is not always possible to anticipate disease introductions, and some newly introduced diseases may not be concerns in areas of origin. Orange rust of sugarcane that was introduced into Florida in July of 2007 was the first detection in the Western Hemisphere. This is a potentially damaging disease with yield loss of 29% in Australia. This is an example where generic or template plans could provide an initial basis for action based on the wheat rust recovery plan and soybean rust knowledge base. Development of plans prior to introduction is preferred since this would provide a readily available source of information for mitigation and recovery efforts after introduction that involves all stakeholders. The need for a plan also will depend on whether management tools are already in place, the state of recovery, if the disease is difficult or more easily controlled, and the extent of recovery and spread. Financial support for plan development and expertise are generally significant limiting factors for plan

development, and reasons the group considered generic and template approaches to address these situations. Appendices to template plans can then be added to provide specific information necessary for recovery.

The 4th APS/USDA NPDRS Workshop will be scheduled for 2010.