National Plant Diagnostic Network

A Record of Accomplishment

January 2007

National Plant Diagnostic Network

LETTER TO THE REVIEW PANEL

This five year review document is a compilation of the planning, activities, and accomplishments of the National Plant Diagnostic Network (NPDN) from its inception in 2002 to the present. Contained within this document are reports from the five regional networks, reports from the committees that implement the plans of work and coordinate the activities within and among regions, and the accompanying CD-ROMs contain an array of support documents representative of work products and accomplishments.

The NPDN Executive Committee and NPDN Operations Committee appreciate the time and effort you are giving to this review process. This review is important to the future of NPDN. It is an evaluation of accomplishments relative to the cooperative agreement that established the NPDN and an assessment of the funding allocation process. It will become the basis for the development of a new five year cooperative agreement.

The mission of NPDN is to develop a state of preparedness that secures our national plant resources; natural, horticultural, and agricultural plant systems. NPDN is comprised of five regional networks that were delineated based upon similarities among member states with respect to agricultural plant systems, climate, and environmental factors. For a variety of reasons including differential rates of declining support for plant diagnostics nationally, there was great variation among the land grant universities for diagnostics infrastructure and expertise. Consequently, the structure, function, and fund allocation strategy of the five regional networks are not identical; the regional networks reflect the variation in plant systems and the status of LGU diagnostic labs important to that region.

NPDN can be viewed as a model for effective partnerships among local, state, and federal agencies and organizations. NPDN's solid record of accomplishment in its short history is made more remarkable when considering the small investment made. In light of the enormous economic threats posed by foreign plant pathogens and pests, this investment was appropriate and timely. NPDN labs have played critical roles in the national response to several recently introduced threats to our national plant systems, including Asian soybean rust, *Ralstonia solanacearum* r3b2, sudden oak death (SOD)/*Ramorum* blight, Soybean aphid, potato cyst nematode, and the Pink hibiscus mealybug.

To most involved, the NPDN experience has been great. Improved interagency relationships, effective partnerships between LGU diagnostic labs and USDA APHIS expert labs, and reinvigorated state plant diagnostic labs with improved infrastructure are among the many benefits that can be highlighted. The working relationships established have resulted in publications in refereed journals and in the validation of newly developed diagnostic protocols. These positive outcomes are a reflection of the cooperative philosophy of NPDN.

Many people are responsible for the creation of NPDN and for the execution of the work plans. The accomplishments detailed in this document become more impressive when one considers the fact that most of these individuals took on NPDN objectives in addition to an already full work agenda. Representatives in all fifty states and U.S. territories in the Pacific and Atlantic have embraced the Network and are committed to its success.

Thank you for your time and contribution to this review process. Please let me know if you require additional information or need assistance at any point during the review.

Sincerely,

Jim Stack

Executive Director, NPDN

EXECUTIVE SUMMARY

Established in June 2002 by the United States Department of Agriculture (USDA), the National Plant Diagnostic Network (NPDN; http://www.npdn.org) has become a key component of our national plant biosecurity infrastructure. The brief history of NPDN is one of accomplishment and commitment.

This USDA CSREES program review documents the planning and implementation of annual plans of work in fulfillment of the Cooperative Agreement that established the consortium of five regional networks which make up the NPDN. A secure agricultural system requires the capability for rapid detection of outbreaks, accurate diagnoses of problems, secure communications of sensitive information, and early response to minimize impact of new pests or pathogens. NPDN has developed and implemented programs to address these needs. NPDN is not a research program and has been granted no regulatory authority for response during an outbreak. Local, state, and national response plans to contain outbreaks are in large part developed and implemented by state departments of agriculture and the USDA Animal and Plant Health Inspection Service (APHIS). NPDN has supported those efforts when called upon as demonstrated during the following introductions and outbreaks since 2003: citrus greening, *Ralstonia solanacearum* r3b2, Pink hibiscus mealybug, Plum pox virus, Soybean aphid, Asian longhorned beetle, Asian soybean rust, potato cyst nematode, sudden oak death (SOD)/*Ramorum* blight.

Throughout this document you will find descriptions of programs developed and implemented in the major program areas of diagnostics, communications, and training. It will be apparent that each region has evolved to meet the needs unique to that region while adhering to the national plans of work that bind the regions together. The five regions were delineated based upon several criteria including, climate, ecology, and similarity of agricultural production systems. Within each region is a regional diagnostic center to serve as a hub for diagnostics, communications, and training. The five regional centers are located at Cornell University (Northeast Region), Kansas State University (Great Plains Region), Michigan State University (North Central Region), University of California at Davis (Western Region), and the University of Florida (Southern Region). The National Database is located at Purdue University. In addition to the coordination of regional programs, each regional center has at least one national responsibility:

Diagnostics (Northeast), Governance (Great Plains), Public Relations (North Central), Epidemiology (Western), Exercise (Western) and Training (Southern).

The infrastructure of regional and state diagnostic laboratories has been measurably enhanced since 2002. NPDN member labs have been equipped with an array of technologies to ensure a state of preparedness. Among the technologies deployed is web-enabled microscopy to provide access to expertise with exotic pests and pathogens wherever it resides. Advanced diagnostics technology including standard and Real-Time PCR has been strategically deployed nationally.

During an outbreak, there are at least two primary objectives: to identify the positives and to clear the negatives. Both are necessary to an efficient response system that minimizes impact to industry. NPDN is a system of laboratories to assist in the triage and preliminary diagnoses during outbreaks. This was extremely important during the response to the shipment of sudden oak death *(SOD)/Ramorum blight* contaminated plant materials across the U.S. from 2004-2006. Triage by NPDN labs resulted in an approximate 100-fold reduction in samples shipped to the APHIS PPQ CPHST expert lab for confirmatory diagnoses.

An important component of a secure agricultural system is a secure and rapid communication system. NPDN developed and implemented a secure communications system to ensure the timely transfer of sensitive information during outbreaks. NPDN secure communications protocols integrate digital and analog technologies and incorporate flexibility that allows for adaptability to the unique features of each outbreak.

Preparedness requires practice. NPDN developed and implemented an effective exercise program that trains those involved in an outbreak response to understand the roles and responsibilities of all involved. This includes local, state, and federal personnel. Over 40 states have conducted exercises often involving more than 40 individuals per exercise. After action reports are prepared and reviewed by all participants to provide a mechanism for lessons learned.

NPDN training programs have been developed for first detectors and for diagnosticians. Rapid diagnostics is a function of technology; as technology evolves, the tools and protocols used in diagnosis evolves. A program for training diagnosticians to keep current with advanced diagnostics is essential. NPDN conducts hands-on workshops where new technology is learned and standardized protocols are explained. USDA APHIS PPQ CPHST expert labs have provided several outstanding training opportunities for NPDN diagnosticians. In addition, periodic video conferences are convened to discuss protocols and share experiences.

First detectors are those most likely to first encounter an outbreak whether unintentional or deliberate. Training programs have been developed and delivered for agricultural systems where first detectors include producers, ranchers, crop consultants and advisors, crop scouts, agricultural extension specialists and agents/educators, and agriculture professionals that service fields, orchards, groves, and packhouses. Training programs have also been developed and delivered for natural or domestic plant systems where first detectors include master gardeners, landscape technicians, horticulturalists, home owners, naturalists, environmentalists, agricultural extension specialists and agents/educators, and other agriculture professionals.

The history of NPDN is a record of accomplishment through effective and strategic partnerships. The most important resource to ensure success in any endeavor is people. NPDN has benefited from the talents of a long list of dedicated and knowledgeable individuals working together as a highly efficient team. Without those individuals, this Network would not be successful. Just as many individuals and institutions contributed to the creation of the Network, many individuals are responsible for the creation and production of this document.

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MISSION AND VISION

The mission of the National Plant Diagnostic Network is to safeguard U.S. plant agriculture against introduced pests and pathogens by enhancing our diagnostic and detection capabilities; by improving communication among federal, state, and local agencies involved in monitoring for plant pests and pathogens; and by delivering educational programs regarding the threats posed by their introductions.

Because protection of our food supply and natural resources must be a joint effort among many state, federal, private and university partners, the NPDN strives to be an integral part and partner in this process through enhanced diagnostics, education and communication. To attain this vision of the NPDN, a nationwide network of public agricultural institutions, coordinated by five regional centers, is in operation. The NPDN continues to develop capacity that facilitates rapid detection of high consequence plant pests and pathogens that may have been introduced into agricultural and natural ecosystems intentionally or otherwise. The NPDN aims to continue training its state and local partners on proper use of tools for rapid identifications and establishing protocols for immediate reporting to appropriate responders and decision makers. The NPDN will continue to educate land grant university diagnosticians and faculty, state regulatory personnel, and first detectors to efficiently communicate information, images, and methods of detection throughout the system in a timely manner. The NPDN will also continue to provide and improve communications that ensure all participating land grant university diagnostic facilities are alerted of possible outbreaks and/or introductions and are technologically equipped to rapidly detect and identify pests and pathogens. These goals continue to be accomplished by developing state-of-the-art regional centers, enhancing diagnostic infrastructure at land grant university diagnostic clinics, supporting an effective communication network between regional experts, developing and refining harmonized reporting protocols for the NPDN, and cataloging pest and disease occurrence to be included in the National Database. The NPDN will also continue to develop and deploy education programs for first detectors who stand as our first line of defense against the introduction of new pests and pathogens.

HIGHLIGHTS AND ACHIEVEMENTS

When the NPDN was conceived in 2002, it was unclear initially what the Network would look like and how it would function. What is remarkable is how quickly experts from many disciplines from throughout the U.S. mobilized to create what has become a unique resource for the country. The accomplishments highlighted below derive from the collective energy and dedication of many people. We discuss these accomplishments in terms of the major thrusts of the Network mission: **education and training, diagnostics, and communication.**

EDUCATION AND TRAINING

To begin to address our efforts to increase awareness of the threat posed by introduced pests and pathogens and to train a national team of first detectors, an Education Committee was formed which developed modules designed to engage audiences requiring different levels of training. These modules provide training at three levels: general awareness, first detector, and first detector educator. The first generation modules were designed so that they could be tailored to meet regional and local needs, and a series of specialty modules were developed with focus on specific diseases and pests. Through our training programs, the Network has created a registry of approximately 6,000 first detectors and scores of first detector educators nationwide. Our audiences represent the spectrum of plant health professionals, and include diagnosticians, county extension educators/agents, agricultural commissioners and staff, Farm Advisors, growers, crop consultants, and master gardeners. The information is delivered to these audiences by regional staff and materials are also available on-line. Under development in partnership with other groups and with support from the USDA NRI and the NSF are content-management based programs for web-based education and diagnostics to further enhance the delivery of information to our stakeholders.

The Network has invested heavily in training programs for both plant disease diagnosticians and insect pest identification specialists to bring together experts from throughout the country. This training has included:

- Workshops on diagnostic methods for sudden oak death (SOD)/Ramorum blight, plum pox virus, citrus greening, Asian soybean rust (SBR), and *Ralstonia solanacearum* r3b2, at Beltsville;
- SOD and SBR training at Michigan State University;

- Two SBR identification workshops in Florida;
- Training and entomology workshops focused on identification of *Coleoptera*, *Homoptera*, thrips, and pink hibiscus mealybug at the University of Florida, University of California, Davis, and the University of Hawaii/HDOA;
- A workshop on the use of virus inclusions in plant disease diagnosis at the University of Florida;
- Hands-on training in advanced diagnostic methods in Puerto Rico;
- Workshops on soil borne diseases, *Ralstonia*, emerald ash borer, and viruses at the University of Wisconsin;
- A PCR workshop for GPDN diagnosticians in Texas;
- Mycotoxin and insect vector workshops in Bozeman, MT;
- Training and workshops on the Pacific Islands Distance Diagnostics and Recommendation System (PIDDRS) for the island territories at the University of Hawaii.
- In 2004 during the SOD crisis in the nursery industry, a one-day on-line training national teleconference involving over 700 participants was coordinated by the NPDN, US Forest Service, and the national IPM centers program with great success.

DIAGNOSTICS

The NPDN has made significant investments to strengthen plant disease diagnostic labs throughout the country. NPDN funds are used to supplement state and regional commitments for salaries for technical staff, infrastructure (equipment, supplies, and, in some cases, lab renovation) and training in contemporary laboratory techniques. The support provided came at a crucial time for several labs, enabling them to continue to provide services after suffering severe funding cuts from traditional sources. A new diagnostics lab was created in Amarillo, TX with support for a new full-time diagnostician. The Diagnostic Committee in collaboration with APHIS and Dr. Laurene Levy at USDA Beltsville took the lead in assembling standard operating protocols (SOPs) for select agents and other key target diseases. These manuals were given to all the Network diagnostic laboratories. The USDA allocation for soybean rust to the NPDN enabled regional centers to purchase real-time PCR equipment and reagents, critical investments for addressing the diagnostic needs not only for SBR, but also for *Ralstonia*, plum pox, and sudden oak death *(SOD)/Ramorum blight*. This equipment also allowed NPDN labs to participate in a large-scale experiment with ARS that was published in PMN and focused on determining when the fungi that cause SBR can be detected using different protocols and equipment.

The NPDN provides critical funding for developing, expanding, and maintaining distance diagnostic capabilities for the nation. All NPDN labs utilize web-based systems, principally the Plant Diagnostic Information System (PDIS), developed by Kansas State University and the Distance Diagnostics through Digital Imaging system (DDDI), developed by the University of Georgia. These systems allow textual information and descriptive images to be exchanged in a secure format for rapid collaborative diagnoses. The PIDDRS system, which has been expanded throughout the Pacific Islands in part with support from the NPDN, utilizes the DDDI interface.

Several examples illustrate where the investment in training, diagnostics, and communication (see below) achieved the desired goals of enhanced capability and rapid detection and diagnosis. When the first sample in the continental U.S. of Asian soybean rust was found in Louisiana, it was found on a Saturday at a university research plot. Just prior to this, the first detector in this case had participated in a NPDN diagnostic exercise. He acknowledged that the exercise training was critical for knowing the communication and notification path to be followed. With this preparation, the distance diagnostic system was used appropriately, samples were immediately sent to Beltsville and a confirmatory diagnosis was returned within 36 hours of detection. Similarly, the diagnostics and communications structures put in place by the Network were key to rapid detection and response during a *Ralstonia solanacearum* r3b2 outbreak in a New York nursery greenhouse that occurred during the holiday season in 2003-04. The NPDN diagnostic labs were also central to the national effort to handle and process the several hundred thousand trace-forwards and trace-backs following the sudden oak death (SOD)/*Ramorum* blight outbreak in the nursery industry during 2004.

COMMUNICATION

An important contribution of the NPDN to the nation's efforts in agricultural biosecurity is the Network's role in facilitating crosstalk among the various agencies responsible for plant pest detection and diagnostics. The degree of interaction among land grant universities, state departments of agriculture, USDA CSREES, USDA APHIS, USDA ARS, and other agencies such as U.S. Customs is unprecedented and would not have occurred without the establishment of the NPDN and the National Animal Health Laboratory Network (NAHLN). Although the NPDN has no regulatory role or authority, the resources provided by the NPDN and the inclusive culture created by the regional centers has reduced barriers and created partnerships and synergies for addressing the nation's needs in plant protection.

Important to this effort is the exercise program created in 2004. The USDA requested that NPDN conduct diagnostic exercises for Asian soybean rust in all the major soybean producing states before its arrival to the US. This goal was accomplished and enabled the

rapid diagnosis of the first occurrence of SBR mentioned above. Since then, the exercise program has expanded considerably to include other high consequence pests and pathogens, which generally target threatening insects or diseases of regional or local significance. Forty-four states and territories have conducted exercises, in some cases with multi-state participation. In 2004, APHIS launched a full-scale response exercise program, and since then NPDN and APHIS have partnered their exercise programs. The NPDN/PDIS exercise and secure communication modules have been so successful that the NAHLN is now using these for its own operations. Other highlights of the exercise program are documented in the committee report.

Another example of enhanced communication is the efforts of NPDN to conduct epidemiological analyses of anomalies in outbreaks to help identify patterns of introduction and spread. The National Data Repository of diagnostic records that is being created will provide a national resource for such analyses. Examination of the Phase 1 data already has revealed some anomalies that may not have been recognized without a central database. For example, day lily rust is a disease of regulatory consequence and limited distribution in the US. In 2005 during a 10-day period, analysis of a multistate outbreak using the disease records submitted to the repository indicated that each state had received samples from the same central distribution center for a large national retail chain.

Finally, key NPDN leaders were recognized in 2006 for their contributions to the Asian Soybean Rust Team by the Secretary of Agriculture who presented the team with the Secretary's Honor Award. The award recognizes the team's efforts for enhancing protection and safety of the nation's agriculture and food supply. Specifically, the award acknowledges "…advance planning, rapid response and recovery of a disaster that was averted by using science-based and technological strategies or addressing and mitigating risks for a potentially devastating plant disease, the Asian soybean rust."

NPDN AND THE CSREES BIO-SECURITY PORTFOLIO

The Cooperative State Research, Education, and Extension Service provides funding and leadership for homeland security related research, development, and outreach activities conducted by land grant universities and other partners. Many of these research projects and outreach programs support Homeland Security Presidential Directive-9 (HSPD-9) which was enacted in the wake of the September 11, 2001 attacks. Below is a brief summary of the agency's overall bio-security portfolio, including NPDN and a sampling of programs that were created in response to HSPD-9.

CSREES Funded Bio-Security Research Activities

CSREES provides funding and leadership for bio-security research projects through Hatch, NRI, Sections 406 and 1433, and congressionally directed legislative authorities. Notable among these projects are those funded by the National Research Initiative Plant and Animal Bio-security Programs. These programs help agricultural producers and professionals implement strategies to better safeguard American agriculture from potential foreign bio-security threats and the American public from diseases that could be transmitted from animals to humans. Current projects include such topics as global tracing and recall systems for US grain, soybean rust epidemiological forecasting and modeling, new detection and diagnostic methodologies for high consequence pathogens such as causal agents of avian influenza and citrus greening. The projects mentioned directly support HSPD-9 sections 8 and 23; which call for the development of commodity tracking systems and the accelerated development of countermeasures against the intentional introduction or natural occurrence of catastrophic animal, plant, and zoonotic diseases.

CSREES Funded Development Activities

CSREES provides funding and leadership for bio-security development projects through the Small Business Innovation Research (SBIR) program. The SBIR program funds research and development by small businesses on a broad range of issues, ideas, or products; including many that address bio-security threats. Notable among these projects are several that focus on the goal of detection of food borne bio-security threats; including: *Salmonella*, *E. coli*, *Listeria*, hepatitis, and foreign contaminants. These projects directly support HSPD-9 section 4.c; which calls for enhancing screening procedures for domestic and imported food products.

CSREES Funded Land Grant University Outreach Activities

CSREES provides funding and leadership for homeland security related stakeholder engagement activities through the **National Plant Diagnostic Network (NPDN)**, the National Animal Health Laboratory Network (NAHLN), and the Extension Disaster Education Network (EDEN). The primary objectives of the two diagnostic laboratory networks is to rapidly and accurately detect and report plant and animal diseases of national interest, particularly those pathogens that have the potential to be intentionally introduced through bio-terrorism. These Plant and Animal Diagnostic Networks support HSPD-9 section 8.c, which specifically calls for the development of such networks. Notable among these networks, in addition to those listed in the attached summary listing, is the **NPDN**'s first responder training initiative that endeavors to provide stakeholder education to those on the front lines of agriculture homeland security. The EDEN is a collaborative multi-state effort by Extension Services across the country to improve the delivery of services to citizens affected by disasters through shared educational resources. This Network supports Homeland Security Presidential Directive - 9 section 22, which calls for the establishment of opportunities for professional development and specialized training in agriculture and food protection.

Lessons Learned

First responders in agriculture are also the first detectors. To determine that an introduction of a crop or animal pathogen is intentional, the first cases need to be found and diagnosed very quickly so that the pattern of infection can be subjected to forensic analysis. Early detection and diagnosis are necessary for timely and effective application of countermeasures. In agriculture, the first detectors and the first responders are the same extension specialists and veterinarians, often from land grant universities. Thus, research and education programs designed to detect rare events are as important as programs on how to mitigate outbreaks.

As the **National Plant Diagnostic Network (NPDN)**, National Animal Health Laboratory Network (NAHLN), and Emergency Disaster Extension Network (EDEN) were stood up using existing land grant university infrastructure, there was a transition from state-based to a national strategic mission for these institutions. An initial period of building stakeholder understanding and buy-in was required, both for the university and the regulatory communities. That a public sector, non-federal, non-regulatory institution could have a function in protecting the homeland was a new concept. The lesson learned is that land grant universities with their infrastructure of cooperative extension, experiment stations, IPM centers and diagnostic laboratories, can be quickly mobilized and coordinated to participate in regional or national scale response.

In accordance with HSPD-9 section 23, it is noted that CSREES and its partners in the land grant university system is also a primary research and development resource for countermeasures against catastrophic animal, plant, and zoonotic disease. Universities provide much, if not most, of the intellectual raw materials in molecular biology, microbial genetics, predictive modeling, and plant and animal genetics needed for detection, prevention, agent characterization, and disease control technologies.

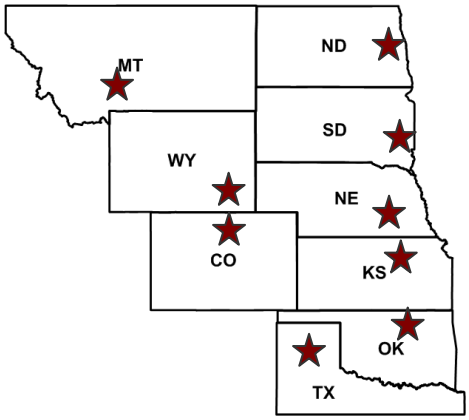
FUTURE EFFORTS

- The NAHLN has laboratories in 50 states, while the **NPDN** covers the 50 states and 3 US territories. The primary mission for both laboratory networks is enhanced connectivity and adequate diagnostic capability in the event of surge of disease samples.
- Both networks are awaiting the development and validation of diagnostic assays for remaining Select Agents and other pathogens of high consequence.
- The **NPDN** plans to establish an accreditation and standards system so that **NPDN** laboratories may reliably perform sensitive diagnostic tests with the oversight and recognition required by the regulatory authorities in the Animal Plant Health Inspection Service.
- EDEN resources target development of educational resources for animal and food bio-security. Cooperative Extension will need resources for more first detector/first responder training (animal, food and plant).
- CSREES, APHIS and the private sector have begun developing the next generation monitoring tool for crop-based agriculture. This tool, and national, real-time mapping system, has been deployed to monitor developments in soybean rust and provide a useful forecast tool for industry. The plan is to expand this capability to other crops and crop risks to be managed by Regional Integrated Pest Management experts.

REGIONAL REPORTS

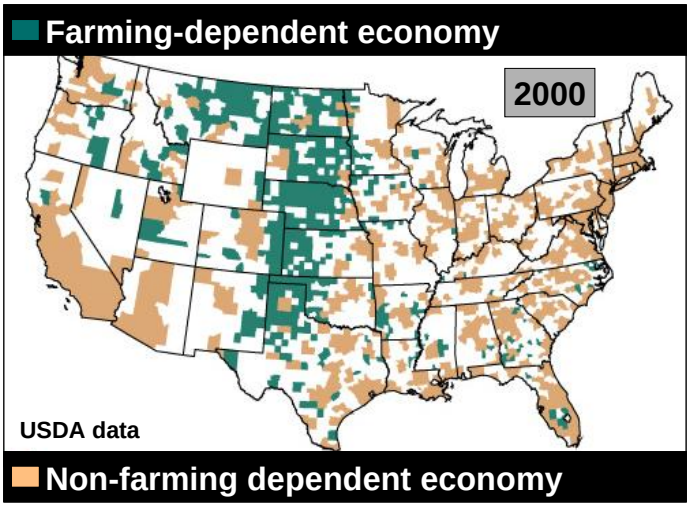
The five regional reports describe progress made to establish regional networks within the national structure while adjusting for the unique features of each region. Each regional report contains information on regional membership, regional programs, and a graphical representation of the funding allocation process for that region. The review panel is encouraged to seek input from members on progress to date and suggestions for the future.

GPDN
Great Plains Diagnostic Network



In 2005 there were 554,900 farms in the Great Plains region, occupying over 70 million hectares (175 million acres or 273 thousand square miles). Major crops in the region include: wheat, corn, soybean, sorghum, millet, sunflower, potato, dry beans, and a variety of specialty crops including grass seed, chickpea and onion. The land grant university system within each state is the operational organization for that state; members of GPDN include Colorado State University, Kansas State University, Montana State University, North Dakota State University, Oklahoma State University, South Dakota State University, Texas Tech University, University of Nebraska, and the University of Wyoming.

The Great Plains region is the last area of the nation where agriculture is the primary economic force. Almost half of production is destined for export markets. It is a region where plant-based agriculture is intricately linked to animal-based agriculture; much of the grain is produced for animal feed. Consequently, biosecurity risks to one sector impact other sectors. Natural introductions of pathogens and insect pests are facilitated by weather fronts from the west, south, east and north which often collide over the Great Plains. The risk of accidental introductions is high due to the large-scale transportation of agricultural products and the movement of farm workers and equipment across the Great Plains.



Great Plains agriculture is characterized by small to very large farms and ranches spread over very large geographic areas. With low profit margin commodities and sparse populations, support for plant diagnostic resources in the Great Plains has been minimal. GPDN has revitalized these programs in every GPDN state. Kansas State University serves as the regional center and houses the Regional Diagnostic Laboratory. The regional center provides administrative management for the regional programs, maintains a secure communications system, and coordinates the diagnostic and training programs for both diagnosticians and first detectors. The regional diagnostic lab provides diagnostic support to state labs and serves as a resource lab to APHIS expert labs for surge capacity during outbreaks.

GPDN has implemented a distributed management approach; the GPDN Associate Director for Diagnostics is located at Colorado State University while the GPDN regional Training and Education Committee is co-chaired by a plant pathologist and an entomologist from Montana State University.

Diagnostics Program

A program to improve the infrastructure of the regional and state diagnostic labs was implemented. All GPDN state labs have been equipped with web-enabled microscopy to provide access to diagnostic expertise for exotic pests and pathogens wherever it resides. Microscopes, bio-safety cabinets, and PCR technology have been deployed throughout the region.

A professional development program for GPDN pathology and entomology diagnosticians has been established. Workshops conducted within the region include, PCR Diagnostic Techniques Workshop, Amarillo, TX (2004); Insect Vectors & Pathogens Workshop, Bozeman, Montana (2005); and Mycotoxins & Toxigenic Pathogens Workshop, Bozeman, Montana (2006). GPDN diagnosticians participated in 10 NPDN Biosecurity Preparedness Exercises; all nine states have participated in at least one single or multi-state exercise.

The GPDN regional center lab partnered with USDA ARS in a ring test validation of an SBR PCR protocol. GPDN also partnered with USDA APHIS in an experiment to compare diagnostic assays for sudden oak death (SOD)/*Ramorum* blight. These

partnerships demonstrate the benefit of Network-facilitated development of expertise and capabilities of the regional center diagnostic labs.

Communications Program

An important component of a secure agricultural system is a secure and rapid communication system. The Plant Diagnostics Information System (PDIS) software with a secure communications module was developed at KSU and field tested by GPDN diagnosticians. This system was later adopted by 34 NPDN laboratories across all five regions and includes all Network laboratories in GPDN, NCPDN and NEPDN.

Training Program

Rapid diagnostics is a function of technology; as technology evolves, the tools and protocols used in diagnosis evolves. A program for training diagnosticians to keep current with advanced diagnostics is essential to the success of NPDN; the key to minimizing impact is rapid response which is dependent upon rapid detection and diagnosis. In conjunction with the national diagnostics committee, GPDN has developed a training program that involves hands-on workshops where new technology is learned and standardized protocols are explained and periodic video conferences are conducted to discuss protocols and share experiences.

NPDN and GPDN training programs introduce first detectors to the mission of NPDN and raise awareness to the threats to plant systems from high risk pests and pathogens. First detectors include producers, ranchers, consultants, scouts, extension specialists and agents, master gardeners, landscape technicians, horticulturalists, home owners, naturalists, and environmentalists.

Governance

The Great Plains Region has a national leadership responsibility for facilitating the development and evolution of NPDN governance. See the Governance Committee Report for additional information.

Accomplishments

- GPDN was the first region to conduct state preparedness exercises. All nine GPDN states have been involved in at least one exercise.

- GPDN hosted the U.S. Deputy Secretary of Agriculture for a presentation and tour of an NPDN regional center and laboratory.

- The GPDN regional center laboratory is participating in the USDA APHIS sudden oak death *(SOD)/Ramorum blight* lab accreditation pilot program.

- In FY2007, GPDN received $886,000 in base and supplemental funding; approximately 45% of the GPDN budget supports GPDN regional center; the remainder is distributed to the GPDN member states.

- The GPDN Director served as Executive Director for the National Network and chair of the National Operations Committee.

- A GPDN regional training committee was established and the Montana delegation provides regional leadership for this committee.

- State outbreak response exercises were conducted in all GPDN states. After action reports were generated for each exercise.

- A two day hands-on virus-vector workshop was developed and delivered for all diagnosticians (entomology and pathology) that included methods for identification of specific insect vectors and virus pathogens problematic in the Great Plains.

- The GPDN regional lab participated in a ring test with USDA ARS and other NPDN labs to validate a new diagnostic protocol for Asian soybean rust. A publication resulted from this collaboration.

- The GPDN regional lab participated with USDA APHIS to compare and validate diagnostic protocols for sudden oak death (SOD)/*Ramorum* blight. A publication resulted from this collaboration

GPDN Fund Allocation FY2006

Funding for the GPDN has remained relatively stable from 2002 to 2006.

Allocations to GPDN member states are based upon meeting regional objectives that are consistent with the national plan of work. GPDN member states prepare an annual plan of work that includes objectives to address the three basic NPDN program areas; communications, diagnostics, and training.

The proportion of the allocation applied to each objective varied among states and from year-to-year within each state due to the significant discrepancies among state laboratories with respect to technology and experience at the start of the project.

Each state allocation also includes a travel budget to cover participation in an annual regional meeting; the meeting site rotates around the region. At the national and regional levels, the focus has been to enhance the detection and diagnostic capabilities within each state. This has required flexibility in the allocation process in order to meet our national and regional objectives.

The regional center leadership team includes a director, associate director for diagnostics, associate director for information technology, regional training and education coordinator, two plant pathology diagnosticians, an entomology diagnostician, a weed systematist, and a horticulture diagnostician.

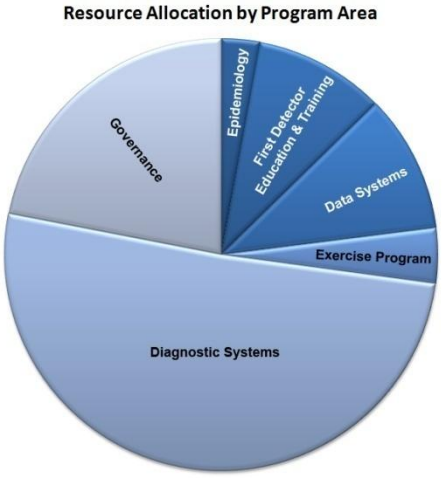


Figure 1

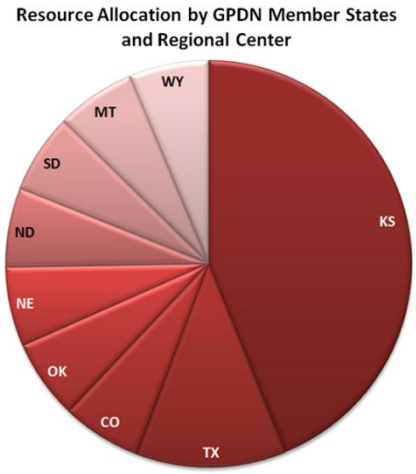


Figure 2

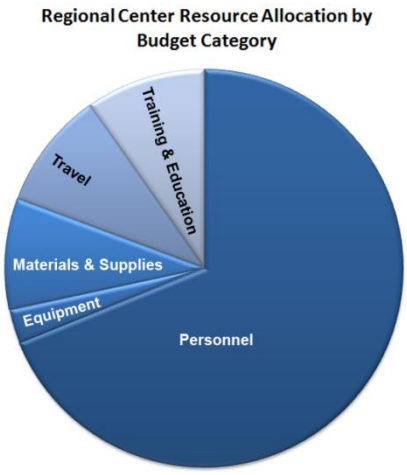


Figure 3

Regional Overview: North Central

The North Central region produces a wide variety of crops ranging from soybeans and corn to asparagus and blueberries to bedding plants and nursery crops. The region produces a significant amount of the U.S. soybean (66%) and corn (67%) crops. Additionally, states in the region produce a significant number of bedding plants, some of which originate from off shore, thus increasing the possibility of the unintentional introduction of new pests and pathogens.

Regional meetings have focused on diagnostics techniques. A hands-on PCR workshop that covered all aspects of PCR from primer development to data interpretation was held at Michigan State. Diagnostic approaches to soil borne diseases and emerald ash borer were the focus of the regional meeting held at the University of Wisconsin. A diagnostic kit for emerald ash borer was provided for each of the NCPDN states.

Data collected from diagnostic samples is uploaded to the National Data Repository (NDR) via the Plant Diagnostic Information System software (PDIS). Since the data upload process began in the spring of 2004 information from 23,007 diagnoses including plant pathology, entomology, nematology and abiotic problems has been transferred to the NDR by diagnosticians in the North Central region.

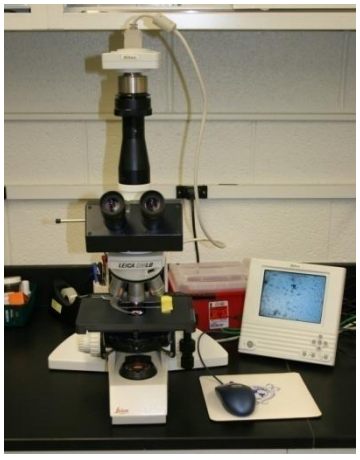
Soybean rust diagnostics and detection have been major areas of focus for the NCPDN states. For example, at Iowa State University, NCPDN funding was also used for Asian soybean rust educational efforts. Informational pamphlets were purchased and distributed to approximately 20,000 growers and agriculture professionals. Video conferencing delivery methods were also used in Asian soybean

rust diagnostic training. In addition, supplemental funds for soybean rust diagnostics and data upload were provided to each NCPDN state.

Sudden oak death (SOD)/*Ramorum* blight testing can be performed at both Purdue and Michigan State Universities using PCR. These diagnostic labs are provisionally authorized by APHIS PPQ to perform this testing. To achieve this status diagnosticians from both laboratories attended training sessions and passed proficiency test panels.

IT: The NCPDN web page was upgraded and has links for diagnosticians and first detectors. At Michigan State and Ohio State Universities, The PDIS system was used to create "virtual laboratories" for Soybean Rust Survey and Detection and sudden oak death Survey and Detection. These allowed for better coordination and tracking of samples in these programs. The NCPDN completed an information security assessment in 2005. As a result, best security practices were adopted to ensure that systems are secure and free of vulnerabilities. An Information Security Policy and a disaster recovery plan are being developed. As PDIS users, NCPDN members participate in the Change Management Committee and have contributed to the evolution of PDIS.

First detector Training: At Purdue, a four hour First Detector Educator Course was coordinated and presented using the IP video delivery system to Indiana county extension educators in 16 counties. Across the NCPDN, nearly 3000 individuals have received some level of training; First Detector, First Detector Educator, and/or First Detector expanded awareness.



Distance diagnosis technology was purchased for diagnostic labs in all eight states within the region. Each lab has at least one web enabled camera mounted on a microscope. This equipment has allowed for easy sharing of electronic images taken from diagnostic samples facilitating rapid, accurate diagnoses.

Leveraged funds: NPDN funds in the North Central region were successfully used to leverage funds from other granting agencies. Leveraged funds included those used to produce IPM publications, purchase PCR equipment, develop and test new diagnostic tools, and maintain operating funds for daily diagnostic lab functions and personnel.

NPDN PR: The NCPDN coordinated public relations activities for the Network. We also assisted in coordinating discussion sessions at the national APS and ESA meetings. The NPDN booth was at the NAACA, APS, and ESA National meetings. In addition, informational materials on progress and accomplishments of the NPDN were prepared.

North Central Region – National Plant Diagnostic Network

Structure and Budget Overview

2007 - 2007

The North Central Plant Diagnostic Network regional committee is composed of representatives of the 8 North Central States. The NC region is the smallest NPDN region with respect to number of states, but each of the states is intensively engaged in production agriculture. Although the North Central region states account for over two-thirds of all corn and soybean production in the US, the region does have significant diversity in crop production. For example, other field crops of significance include dry beans, potatoes, sugar beets and wheat. Several states have significant tree and small fruit production as well as a large variety of vegetables. Greenhouse ornamentals and nursery production is also of importance across the region along with forestry.

Because of the intensive nature of production agriculture across the NCPDN, it is important that the diagnostic labs have the needed capacity and infrastructure to accomplish their individual mission and that of the Network. Many of the labs have PCR capabilities and some have additional special diagnostic technologies. Several of the labs are capable of handling most any plant pest or pathogen. Most of the NCPDN labs also have permits required to receive samples from out of state. This is important for providing surge capacity and in assisting other labs in diagnostics. All labs also have capacity for real time image sharing to assist in identification of pests and pathogens. Members of the NCPDN are engaged in first detector training and in related educational programs.

Because of the nature of plant agriculture across the region, we have distributed equal amounts of funding to each state (An average of $62,000 per year). Each year, the states are asked to develop a plan of work that addresses the following areas: training and education, diagnostic infrastructure and operating enhancement, travel to regional and national meetings related to NCPDN and, over the last few years, a targeted amount to entomology diagnostics. Figure 1 illustrates how funds were distributed by function (using FY 2005). Figures 2 and 3 illustrate allocation by cooperator for FY 2005 and for all years. Each state has received an equal amount. NCPDN operations refer to costs related to regional activities (e.g., salaries for regional support staff, travel, educations & training and the national public relations efforts). The allocation to KSU represents costs associated with PDIS. These funds have been very important to the strength of diagnostic efforts across the region, and it is clear that some of our states would not be able to provide such a high level of service without NCPDN funding.

The NCPDN has also received several supplements (Table 1). These include funds for sudden oak death diagnostics, funds to support the national teleconference hosted by the NC IPM group, diagnostic and data upload support for soybean rust, and support for the national quality control/quality assurance specialist hired this past fall.

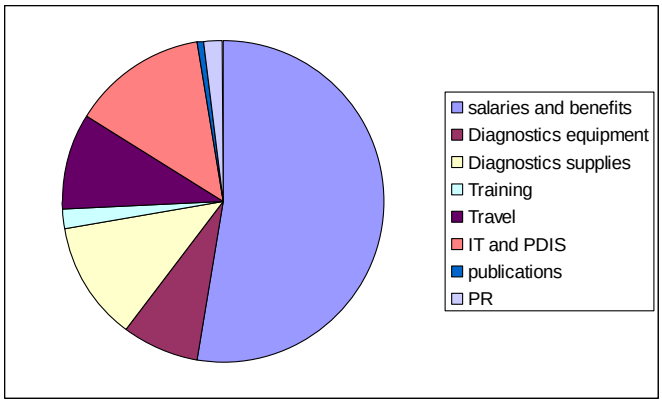


Figure 1. FY 2005 – NCPDN allocations by category

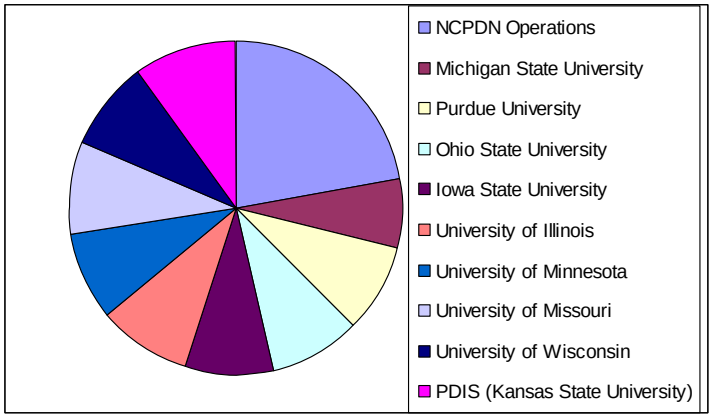


Figure 2. FY 2005 – NCPDN base allocations by cooperator

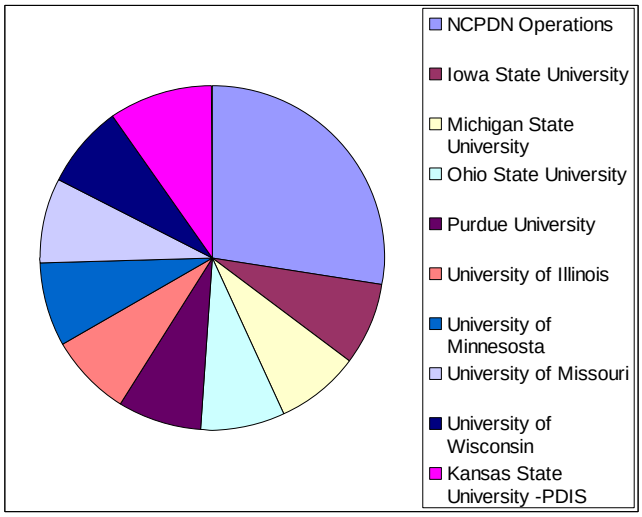


Figure 3. NCPDN base allocations to cooperator: all years

Table 1: Supplemental funding for the NCPDN

Funding type	Date	Amount
SOD Surge Diagnostics*	2004	$20,134
SOD Teleconference**	2004	$82,000
SOD Surge Diagnostics*	2004	$24,139
SOD Surge Diagnostics*	2005	$9,866
Soybean Rust Diagnostics and data upload***	2005	$188,000
QA/QC project	2006	$120,000

*Funds used to handle samples sent from other states to MSU NCPDN lab

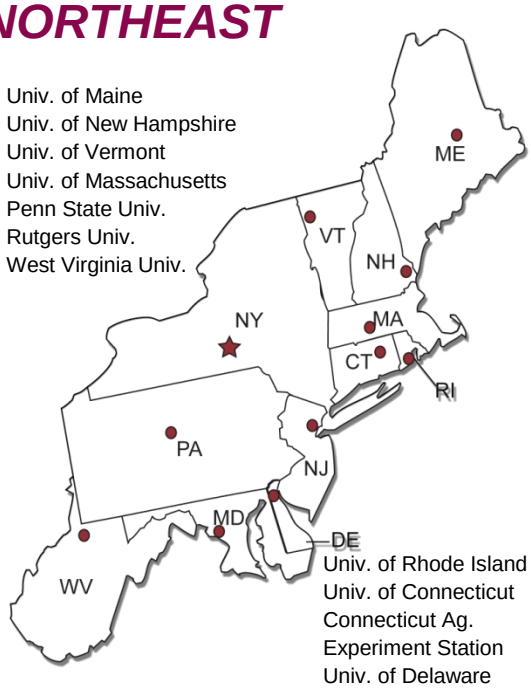
** Subcontract to NC IPM at University Illinois

***Soybean rust funds distributed to the 7 NCPDN states based on soybean acreage with the University of Illinois and Iowa State University, receiving the most and University of Wisconsin and Michigan State the least.

Regional Overview:

NORTHEAST

The temperate climate in the Northeast allows for a wide variety of crops to be grown here. Our apples, wine grapes, and fresh market vegetables provide food and drink for much of our region, and our field crops feed cows for a thriving dairy industry. We also produce most of the U.S. maple syrup crop and host a robust Christmas tree industry. The Northeast also has the dubious distinction of being the entry point to the U.S. for several devastating plant pathogens including the golden nematode, white pine blister rust and chestnut blight and insect pests like Asian longhorned beetle, hemlock woolly adelgid, and gypsy moth. International traffic through three major ports requires constant vigilance by skilled specialists on site and throughout the region.



Organizational Structure

The Northeast Plant Diagnostic Network (NEPDN) is comprised of specialists in the 12 state northeastern region of the U.S. Most states are represented by plant pathologists at their respective land grant universities, but the NEPDN also works closely with specialists in allied disciplines (e.g. entomology, weed science) and with other state and federal agencies. Since 2002, NEPDN members have upgraded equipment and attended training sessions to learn how to use state-of-the-art diagnostic procedures and communications packages. They have become a cohesive team capable of rapid response to a wide array of potential threats to Northeast agriculture. The Regional Center is at Cornell University. Staff at the Regional Center coordinate training in diagnostic techniques and communications, they conduct annual exercises to assure that members follow a prescribed protocol in case a suspect select agent is found, and they collaborate with partners in other regions to develop modules for training "first-detectors". They also maintain web sites for both regional and national audiences and they provide technical support to assure that communications within the Network are secure and seamless. Publication of a monthly newsletter used by all members of the National Network also originates in the Northeast. Our first five years have allowed us to build a foundation from which we expect to continue to play a vital role in protecting the Nation's agriculture in the 21st century.

Table 1. Factors for Determining Funding Allocation

State /Institution	Counties**	Value of Crops Including Nursery and Greenhouse ***	Number of Housing Units****	Funding Allocation
CT/UCONN*	8	327,527	1,423,343	121,300
DE/UD	3	150,404	374,872	116,300
ME/UMaine	16	222,356	683,799	115,200
MD/UMD	24	450,202	2,273,793	117,800
UMASS	14	277,069	2,688,014	121,700
NH/UNH	10	83149	583,324	111,300
NJ/Rutgers	21	657,494	3,443,981	134,700
NY/Cornell	62	1,135,129	7,853,020	399,008
PA/PSU	67	1,320,914	5,422,362	135,700
RI/URI	5	47,138	447,810	111,300
VT/UVM	14	71,583	307,345	113,300
WV/WVU	55	69,693	872,203	118,200

* CT received an additional $20,000 for the CT Agricultural Experiment Station.
**Rhode Island, Connecticut and Massachusetts have abolished some or all of their county governments.
*** ($1000) From 2002 Census of Agriculture State Profile
****State Housing Unit Estimate 2005 from U.S. Census Bureau. State housing unit is defined as a house, an apartment, a mobile home or trailer, a group of rooms, or a single room that is occupied, or, if vacant, is intended for occupancy as separate living quarters.

There is tremendous diversity in local governmental organization, land use and population within the Northeast Region. Annual funding to individual states is based on programmatic needs as determined by an integration of the three parameters listed in Table 1 with the following assumptions:

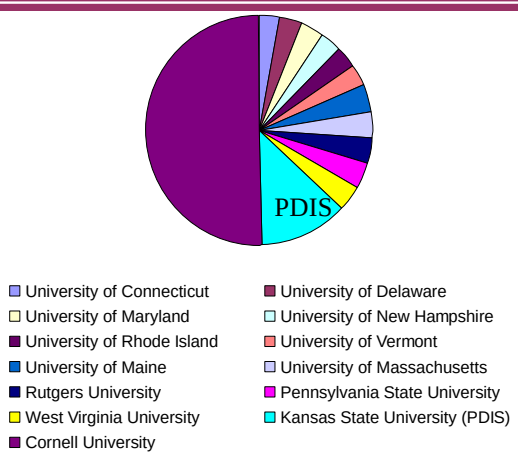


Figure 1. Resource Allocation for the NEPDN by State

1. The number of counties in a particular state is a reasonable approximation of the number of Cooperative Extension associations; thus the number of extension educators and the size of the potential audience for First Detector training.
2. The value of agricultural crops is a measure of the size of the economic resource at risk.
3. The number of housing units is an indicator of the amount of trade in agricultural commodities to the extent that housing units is a measure of population and the likelihood of pest/pathogen introduction via intercontinental travel.

In years when supplemental funds for work on a particular pest/pathogen are available, we use a similar ranking system. For instance, only states that grew soybeans were eligible for supplemental money for soybean rust detection and data entry when Congress approved a special appropriation for that disease, and the amount per state was calculated to reflect actual soybean acreage.

Almost 45% of the regional budget has gone toward salaries and benefits for technical support staff. This includes full or partial support for 18 specialists throughout the region. In some states, the funding has enabled their diagnostic labs, otherwise threatened by diminished institutional support, to continue to provide services. Network-funded, full time positions at the Regional Center include the Associate Director, an Education and Training Coordinator, and an Information Technologist. Part-time data entry technicians

and laboratory assistants are employed on Network funds in the summer when sample load is highest. About 19% of the budget is spent on diagnostic supplies and equipment, computing hardware, and other expenses. Travel costs for the NEPDN are a major part of our budget at 6%. A primary factor that contributes to the high level of travel costs relates to the limited proximity of major airports to most of the Northeast land grant universities. Air travel on short notice is especially costly.

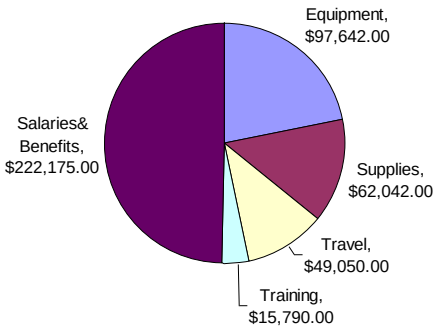


Figure 2. Funding Allocation 2005-2006

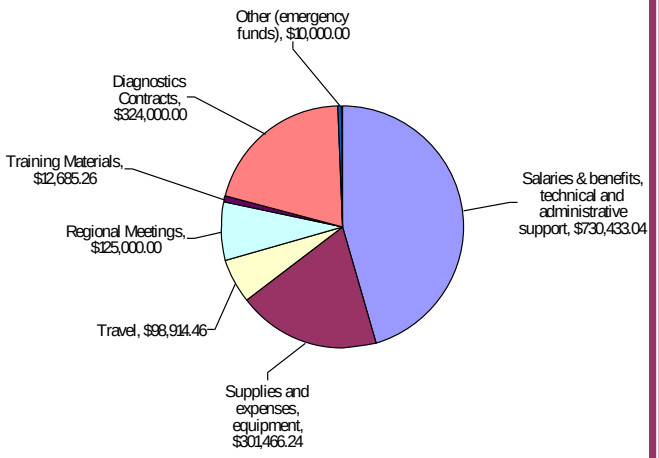
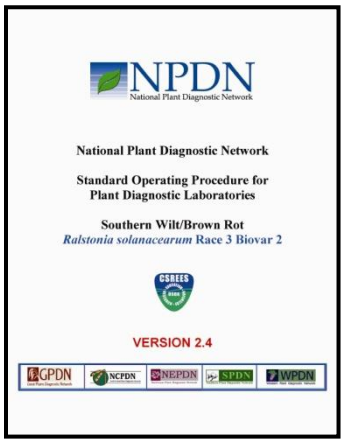


Figure 3. Funding Allocation 2002-2007

Network Leadership: Diagnostics

The unique contribution of the Northeast Region staff to the broader mission of the NPDN is to collaborate with industry and governmental agencies to test and publicize protocols for detecting selected, high risk pathogens and to identify training opportunities for diagnosticians in the Network. Regional center staff has created websites and list-serves to clarify diagnostic objectives, facilitate acquisition of permits, update lists of national and regional significant agents, post standard operating procedures, and announce select agent identification workshops. We also keep NPDN partners abreast of changes in protocols for transmitting data to the NPDN National Repository.



Each year NPDN diagnosticians have continued to revise and expand the standard operating procedures that were created to guide Network labs on processing samples suspected to be infected with "select agent" pathogens. A true test of the Network's response occurred with the introduction of *Ralstonia solanacearum* r3b2 in January, 2004. The Network's preparedness enabled a high volume of samples to be processed rapidly in NPDN labs across the country. Similar episodes requiring a

quick, high-throughput response followed the discoveries of pathogens that cause sudden oak death in March 2004 and soybean rust in November 2004.

The NEPDN Regional Center: Partners for Plant Protection

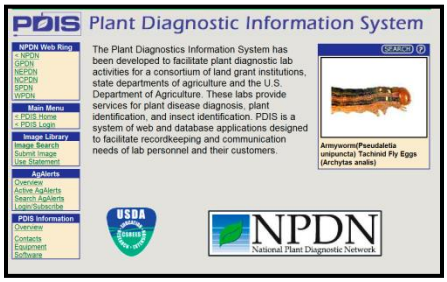
Number of Regulated Pathogen Samples Processed by NEPDN Regional Center				
Pathogen	2006	2005	2004	Surge
Plum Pox Virus	67,418	13,964	14,030	400 (MI)
Sudden Oak Death	427	804	1,517	196
Soybean Rust	168	2	0	0

Cornell University serves as the hub of the NEPDN, providing training, guidance, and sample diagnosis for the region, as well as back-up for the four other NPDN regional centers. Regional staff has participated in numerous USDA sponsored workshops to learn new diagnostic techniques and protocols that identify highly significant pathogens. Three regional center staff members passed requirements to become provisionally certified to conduct sudden oak death (SOD)/*Ramorum* blight testing at the Regional Center laboratory. This certification benefits the entire Network inasmuch as there are now 10 laboratories that are approved to process these samples. It also relieves pressure on the APHIS confirmatory laboratory in Beltsville by lowering the number of suspect samples that that lab needs to process as only regional positive results are forwarded to Beltsville for confirmation. Since the 2004 season when the Beltsville laboratory received and processed 4,000+ samples, their numbers have been reduced to 1,900+ in 2005 and 1,200+ in 2006.

Success in the Northeast Region

Education and training. Efforts in the Northeast have resulted in heightened awareness of the introduction of exotics along the U.S. Northern border. To date over 800 first detectors have been trained in the Northeast including at least one first detector in 18 of the 21 counties along the Northern U.S. border. All 12 states in the region have participated in at least one and in some cases two NPDN scenario exercises. In July 2006, the NPDN, NEPDN, APHIS PPQ and the New Jersey Department of Agriculture partnered to conduct a full scale exercise on s*irex* woodwasp that tested the current communication and chain of custody practices. Combining exercise activities among the organizations listed above assisted in maximizing the efficient use of resources. **Diagnostics:** Diagnosticians from the NEPDN and other regions worked with USDA collaborators to conduct an experiment designed to detect the presence of soybean rust in the early stages of development. This helped determine the ideal stage of development to conduct testing. Regional members participated in molecular workshops given by USDA APHIS PPQ-CPHST personnel on the pathogens that cause citrus greening, soybean rust, sudden oak death and plum pox virus.

Additionally regional members have worked closely with PPQ personnel to develop a plan toward laboratory certification.



Information Technology: IT specialists and Diagnosticians have participated in meetings focused on the National Repository data collection, which now contains 46,277 NEPDN records. We designed and implemented both regional and national websites for the Network, which have received 258,325 hits since 2004. We have also conducted numerous PDIS training sessions for users.

NEPDN Regional Contacts

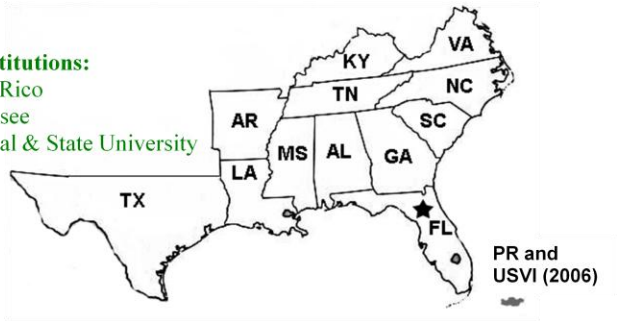
State	PI	Institution
Connecticut	Rob Durgy	University of Connecticut
Connecticut	Sharon Douglas	University of Connecticut
Delaware	Robert Mulrooney	University of Delaware
Delaware	Nancy Gregory	University of Delaware
Maine	Bruce Watt	University of Maine
Maine	Clay Kirby	University of Maine
Maryland	David Clement	University of Maryland
Maryland	Sandra Sardenelli	University of Maryland
Massachusetts	Robert Wick	University of Massachusetts
Massachusetts	Bess Dicklow	University of Massachusetts
New Hampshire	Cheryl Smith	University of New Hampshire
New Jersey	Richard Buckley	Rutgers University
New Jersey	Sabrina Tirpak	Rutgers University
New York	George Hudler	Cornell University
New York	Karen Snover-Clift	Cornell University
New York	Mary McKellar	Cornell University
New York	Karen Scott	Cornell University
Pennsylvania	John Peplinski	Pennsylvania State University
Rhode Island	Heather Faubert	University of Rhode Island
Vermont	Ann Hazelrigg	University of Vermont
West Virginia	John Baniecki	West Virginia University

Regional Center Overview: South

Southern Plant Diagnostic Network

The Southern region is comprised of **14 member institutions:**

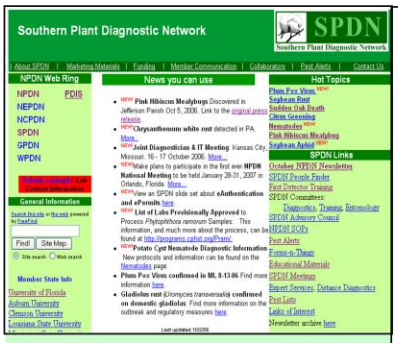
Auburn University
Clemson University
Louisiana State University
Mississippi State University
North Carolina State University
Texas A&M University
University of Arkansas
University of Florida
University of Georgia
University of Kentucky
University of Puerto Rico
University of Tennessee
Virginia Polytechnical & State University
US Virgin Islands



Numerous ports and extensive coastlines in the southern region of the US create gateways for introductions of new threats to agriculture and natural resources. The climate ranges from temperate to subtropical, allowing for a number of new pests and pathogens to adapt to US soil, both in agricultural areas and natural resources such as forests. Economically-important crops grown primarily in the South include 94% of the US peanuts, 94% of the sugarcane, 74% of the cotton, 61% of the citrus, 36% of the floriculture crop and leads the nation in fruit and vegetable production. Pathogens, insects, weeds, and nematodes increase the cost of production and can cause significant yield losses. Early detection of these pests increases management options and protection of our agricultural livelihood.

Mission: Training and Education of First Detectors

First Detectors are trained in the classroom and out in the field. Practical, hands-on knowledge will enable these new First Detectors to detect unusual or high-impact occurrences in their day-to-day work in agriculture. These participants received training in detection of soybean rust, other rusts, and bacterial and viral diseases .with a hand lens. They received 3 hours of training in the classroom prior to this field trip. The combination of **classroom and hands-on training reinforces knowledge gained.** The NPDN develops **training materials** specifically for First Detectors. Additional materials from other sources are also made available to First Detectors and trainers as appropriate. Detailed information on this program can be found in the **Training and Education section**. Communication and training do not stop at the end of a training session; two other means of update and communication include the monthly NPDN First Detector newsletter, "Network News", and the SPDN website at http://spdn.ifas.ufl.edu. Newly-identified pest outbreaks, state personnel contact information, diagnostic protocols, and other links and documents of interest are posted to the online regional "filing cabinet", open to not only the SPDN members, but the network and public at large. Dissemination of accurate and timely information encourages anyone in contact with plants to become eyes and ears for agricultural security.



The SPDN website keeps the region's diagnosticians, First Detectors, and others in touch with current news. Our network members are the real heroes of the NPDN system – finding new pests, reporting new finds, and keeping our agricultural systems healthy.

The SPDN hub: training for the future, serving national needs. The University of Florida Extension Plant Disease Clinic serves as the hub of the SPDN, providing training, guidance, and sample diagnosis for the region, as well as surge support for the other four NPDN hub labs. Personnel in the lab are trained by APHIS to perform expert diagnoses through PCR for *Phytophthora ramorum* (Sudden oak death). This approval sets the SPDN hub lab apart from most laboratories in the country, speeding up the response to the states the hub lab serves. The SPDN hub lab also includes a Nematode Assay Lab, an Insect Identification Lab, and connections with other labs around the state. These labs are also nationally-known for their Virus Inclusion-Body Course and insect identification trainings, as well as a working relationship with the FL State Department of Agriculture diagnostic service personnel. In addition to training in diagnostics, the hub lab personnel are developing and improving diagnostic techniques and methods, adding to the body of knowledge that diagnosticians anywhere can access. By building around a flexible network the SPDN center at the University of Florida assists the region in diagnostics and permitting, leveraging funding, and networking and training.

Pathogen	'06	'05	'04	Total	Out of State total
CG	123	125	NA	248	3 (all 2006)
SOD	40	97	893	1030	905 (14-'06; 3-'05; 888-'04)
SBR	23	66	21	110	10 (2006)
Total Samples	186	288	914	**1388**	918 total

Success in the Region:

Training: Texas Prepares for Soybean Rust and Exotic Scales. More than 297 Texas extension specialists and agents, farmers, and crop consultants, were trained on the biology, identification, and management of soybean rust. Dr. S. Ludwig participated in the 2004 SPDN Hemiptera workshop and subsequently made the first ID of an armored scale in 2005. Management recommendations from Dr. Ludwig and grower implementation saved $4000 in crop losses.

Diagnostics:Molecular Diagnostics in KY: "The KY lab can quickly detect pathogens that previously required an inordinate amount of time and effort, such as *X. fastidiosa* and the *Ophiosphaerella* species, even when they are not producing critical structures needed for morphological identification, such as powdery mildews without teleomorphs, and nonsporulating isolates of fungal pathogens. In addition to using this technology for KY, the lab is offering, for the fourth year, a popular workshop on real-time PCR for applied plant pathologists in 2007. There is no question that the funds from the SPDN have been substantially leveraged with state and other funds into this area of molecular diagnostics, a high degree of activity which would not have happened otherwise." P. Vincelli

IT: New Systems in TN: "A newly-developed diagnostic website was developed to replace an older system that was difficult to search for specific data. The newer system allows extension personnel, either county or specialists, to search specimens which may have been sent to the lab via mail or distance diagnostics. If GPS coordinates are included in submissions it allows the agent to review the specific location(s), providing highly-relevant real-time information to extension personnel." D. Hensley

SPDN and Fiscal Responsibility: Funding Allocations FY 2005-2006

2002 marked the inception of the NPDN/SPDN and the development of five regions, each with regionally-specific needs based on climate and crops. The Southern region viewed each of 12 member states and one (now two) U.S. Territories as equal partners in the region, albeit with different needs based on their state's crops and the status of the diagnostic laboratories. Working towards bringing all of the land-grant institution laboratories up to minimum standards set by a regional committee, it was decided that each state would receive an equal distribution from the regional grant. One exception to this is the recent addition of the U.S. Virgin Islands; since they are being added in 2007, the goals and budget agreed upon by the regional center and the Virgin Islands representatives are at a level commensurate with joining a team at the end of a five-year Cooperative Agreement.

The accompanying figures depict the apportioning of funds (does not include supplemental or leveraged funds) from FY 2005-2006, a typical year, with respect to principal activity areas as a region including the regional center in Florida (Fig. 1), on a state-by-state basis (Fig.2), and the funding percentages at the regional center, in its role of support for SPDN and NPDN members (Fig.3).

Support personnel, laboratory equipment and supplies, and travel to training/meetings accounts for 80% of the region's funds. 22 people are employed by the network, many of whom enable labs to continue and extend diagnostic services. The support team at the regional center includes two full-time positions dedicated to the SPDN/NPDN: an Assistant Director with major responsibilities in pathology and diagnostics and a second Assistant Director with major responsibilities in First Detector training and entomology, administered by the University of Florida Depts. of Plant Pathology and Entomology and Nematology respectively. In addition, the center supports part-time technical assistance in IT, training and diagnostics. The SPDN hub laboratory processes surge samples for member states of the region ,the NPDN, and

Fig. 1

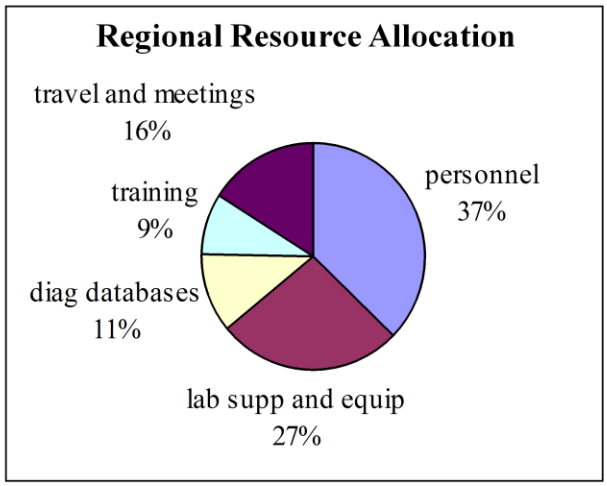


Fig. 2

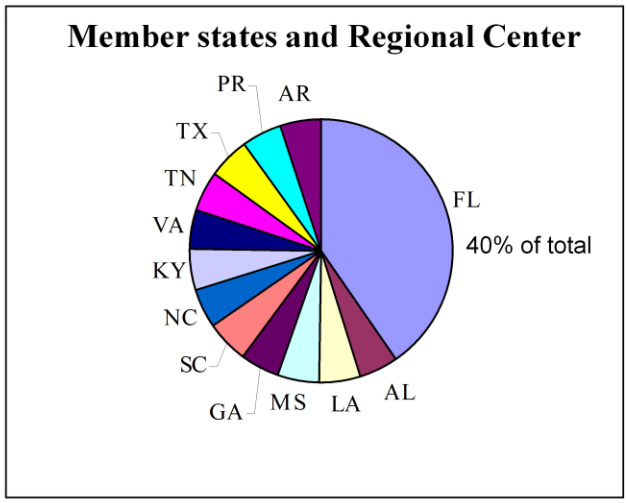
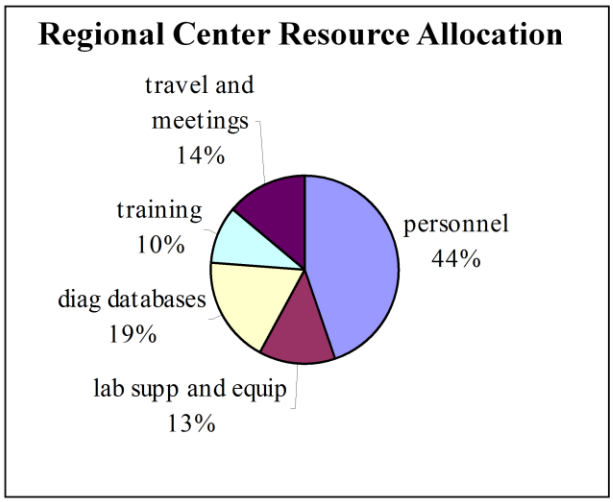


Fig. 3



the USDA-APHIS. Training assistance serves the national efforts, and IT personnel assist with XML connection of a half-dozen different state-based diagnostic database interfaces and oversee the security of the regional database.

Table 1

SPDN funding: Inception through end of this Cooperative Agreement

Project year	# months	Total annual budget	Budget per state	State subs % of total budget	Supplemental funds target	Supplemental funds amount
02-04	18	$900,000	$44,000	63.56%	SBR real-time (hub lab)	$72,000
04-05	12	$700,000	$36,000	66.86%	SOD	$48,000
05-06	12	$755,000	$37,500	64.57%	SBR, SOD	$141,080
06-07	12	$830,000	$39,000	61.08%	PIPE: SBR data entry	$166,463
TOTAL		**$3,185,000**	**$156,500**			**$427,543**

Table 1 describes the full funding picture for the SPDN from the inception of the NPDN through Autumn 2006. Annual project budgets for the region as a whole, as well as per state are shown. In addition, the percentage that was distributed to the states from the regional center is calculated. Supplemental disbursements are shown on a regional level; state-by-state disbursements are often based on things such as estimated number of survey samples, crop acreage, etc., and as such are not equal. Leveraged funding is not included in this table, but a list of grants and projects the SPDN members have been able to take advantage of are listed in the **Appendix**. In addition, it should be noted that since the agreement does not allow indirect costs or overhead; the regional center and state institutional grants management programs contributed in-kind in terms of financial management of the entire program. In all, the positive impacts of this program extend far beyond the vigorous financial injection into Cooperative Extension across the land-grant system. Multi-agency and multi-state collaboration is encouraged and necessary and the impact is felt throughout the participating institutions in the form of public outreach and increased awareness of agricultural safety. While the focus of the this and previous page is on the financial status of the regional network, the true wealth of the SPDN lies in the people who manage and participate in the southern region. The following list of primary investigators shows but a fraction of the number of people involved in making the SPDN a successful program. Please find mention of these contributors in the Appendix.

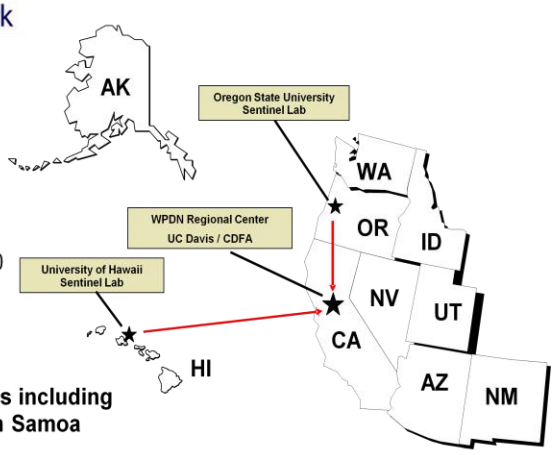
SPDN Primary Investigators

SPDN: Robert McGovern, Carrie Harmon, Amanda Hodges, Timur Momol, Howard Beck, and Pamela Roberts
Texas A&M: Larry Barnes, Joe Krausz, and Dennis Gross
LSU: Clayton Hollier
MSU: Clarissa Balbalian and Alan Henn
Auburn U: Jackie Mullen
UGA: John Sherwood
Clemson: Neil Ogg
NCSU: Tom Creswell
VA Tech: Erik Stromberg, Mary Ann Hansen and Elizabeth Bush
UK: Paul Vincelli, Julie Beale and Paul Bachi
UT: Frank Hale and Darrell Hensley
UA: Rick Cartwright and Sherrie Smith
PR: Consuelo Estevez
USVI: Kofi Boateng

WPDN
Western Plant Diagnostic Network

Regional Overview: West

The Western region is comprised of varied climates and agricultures, from Alaska in the north to the arid Southwest, and the tropical Hawaiian Islands, Guam, American Samoa and other Pacific territories. The Western region represents 26% of the US land area and 52% of the value of fruit, nut, and vegetable production in the US. More than 400 different crops are grown in the west. Every type of climate and biome is found in the region.



The Pacific Territories including Guam & American Samoa

First Detector Training and Education: The goal and mission of the WPDN First Detector program is to educate those involved in agriculture and horticulture as to the importance of their role in protecting the United States against invasive pests. Since March, 2004, the WPDN has trained 2,256 First Detectors in ten western states and several Pacific island territories. These include county agricultural commissioners, inspectors, growers, master gardeners, and other crop and plant health professionals. The classroom education consists of three modules: NPDN Mission, High Risk Pests, and Secure Sample Submission. The First Detectors continue their education by monthly email updates, by accessing resources on the WPDN/NPDN websites, and by participating in ongoing education offered by the WPDN and state agencies. The WPDN updates First Detectors with special pest and disease topics of local and national concern. These have included Sudden Oak Death, Soybean Rust, Pink Hibiscus Mealybug, Citrus Greening or Huanglongbing, and Asian Longhorned Beetle.

First Detector Training in Las Vegas

National Pest Alerts

WPDN Web page

The **WPDN Regional Group** has over 40 regular members who coordinate the western region's activities by monthly conference calls and annual meetings. The annual meetings are accompanied by an agricultural tour of the area.

The **WPDN IT** has completed implementation of a security improvement plan for the regional hub's physical and network security. These improvements address all the security issues from the initial NPDN security audit and bring the WPDN into compliance with the national standard. Along with maintaining an NPDN phase 1 compliant database, the WPDN IT has also been developing tools to enable authorized regional staff to summarize and search records stored at the regional hub. In addition to improving the functionality and security of the existing regional system WPDN IT has been leading the development of the next generation of the national database that will provide epidemiologists and other scientists expanded analysis capabilities.

Workshops. The WPDN organized two Homoptera entomology workshops in 2006. One was held at the University of Hawaii, Manoa, on January 24 and 25. The 17 participants came from California, Nevada, Hawaii, Guam, and Palau to work with mealybug and scale. Another workshop was held at the University of California, Davis, from March 23 – 26. Twelve invited speakers thoroughly covered the order Hemiptera with the 27 participants from the USDA, university extension and various state departments of agriculture.

UC Davis Workshop

The **WPDN** has national responsibility for NPDN for conducting exercises. The goal of an NPDN exercise is to practice standard operating procedures (SOPs) in a non-critical environment, so that all participants understand their roles and responsibilities, as well as how their efforts coordinate with those of the other entities. Another goal of the exercise is to improve the SOPs by identifying and removing ambiguity in the wording of protocols as well as gaps in the procedures. The WPDN, working with the other regions and the NPDN Exercise Committee has conducted forty-two exercises in 44 states and two US territories. Nine states and one territory have completed two exercises, and one state has completed three. Two states have conducted First Detector Exercises. In the West, we have conducted exercises in Hawaii, Guam, Alaska, Oregon, Washington, Arizona, and New Mexico.

The **WPDN regional center** is the Department of Plant Pathology at the University of California, Davis, in partnership with the California Department of Food and Agriculture's Plant Pest Diagnostics Center at Meadowview, south of Sacramento. The region's other sentinel labs are at the University of Hawaii, Manoa, for the Pacific islands, and at Oregon State University in Corvallis, for the Northwest. The WPDN also provides support for diagnostic laboratories at the land grant universities and the state departments of agriculture in the region. The WPDN is fully integrated and interconnected with the distance diagnosis technology.

CDFA lab - Meadowview

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Western Region – National Plant Diagnostic Network

Organizational Structure and Budget Overview 2002-07

From the inception of the WPDN/NPDN in 2002, the western regional working group, comprised of representatives from land grant universities and state departments of agriculture from ten western states and territories in the Pacific, agreed that a structure different from the other regions was critical for best addressing the mission of NPDN in the west. This resulted in the WPDN adopting a somewhat more distributed structure relative to the other four regions. We are the most dispersed of all the regions, spanning an area from the Rocky Mountains on the east to the territories in the Pacific on the west, with many ports of entry and extensive borders with Mexico and Canada. The western region also grows over 400 different crops and is comprised of a variety of biomes and ecoclines. Given the diversity of our crops and natural systems, and the variation among member states and territories with respect to the intensity and economic value of agriculture, we developed the current Network structure. This structure is comprised of three fully equipped labs capable of the most advanced diagnostics located in three states (CA, OR, HI) and labs with basic to advanced diagnostic capabilities in the other states and a few territories in the Pacific. The expert (or sentinel) labs are fully capable of handling almost any plant pest, weed or pathogen specimen, often providing surge capacity and state-level confirmatory diagnoses. These labs have the necessary permits and routinely receive specimens from neighboring states in support of diagnostics in those states. Our region also relies heavily on the distance diagnostic capabilities we have established, enabling our partners in the Pacific region to share information and collaborate on diagnoses in real-time. From the outset, we have also engaged the state departments of agriculture as full partners in the program, and in fact the California Department of Food and Agriculture lab in Sacramento serves as the WPDN Regional Center lab. Other state departments of agriculture labs receive support, which varies depending on the level of responsibility they have for statewide diagnoses. In some states, the LGU is the primary diagnostic lab for that state, whereas in other states the SDA lab provides this service. In some states, both the university and the department of agriculture share this responsibility. Both LGU and SDA staff members participate in first detector training in the WPDN.

With these considerations in mind, we adopted an allocation plan that is based on programmatic needs rather than on dividing the funds equally among all participating agencies in the region. The following figures from 2005 are representative of how we apportioned the monies with respect to the principal activity areas (Fig. 1) and to the states (Fig. 2), and Figure 3 provides the approximate percentage of our total funds allocated to the various activity cost centers over the term of the WPDN project, 2002 to date. In some states, multiple agencies received funds, but the totals are provided on a statewide/territory basis. Almost 60% of the regional budget has gone toward salaries and benefits for technical support staff. This includes full or partial support for 18 individuals with various expertises throughout the region. In some cases, this funding has enabled some diagnostic labs to continue to provide services. The support team at the Regional Center includes the deputy director, training coordinator and programmer, all full time positions administered by the Dept. of Plant Pathology at UC Davis, and partial

support for an IT specialist at CDFA. The Regional Center (UCD) also covers the subscription costs of distance diagnostics systems for 5 states within the center budget. About 16% of the budget has been expended on diagnostic supplies and equipment, computing hardware, and other expenses. The WPDN has national responsibility for leadership in conducting exercises. WPDN, working with other regions has conducted forty-two exercises in 44 states and two US territories. The WPDN also has national responsibility for epidemiology analysis of the NPDN database. Because of the extensive training and exercise programs we coordinate, as well as the need for attendance and participation at meetings to foster effective relationships with Network members, about 10% of the budget is allocated to cover travel.

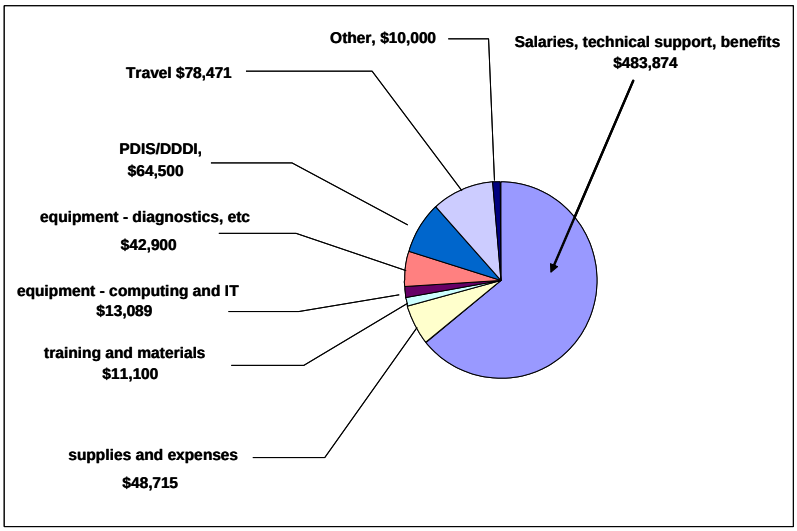


Figure 1. WPDN budget allocation by principal cost/activity centers (2005).

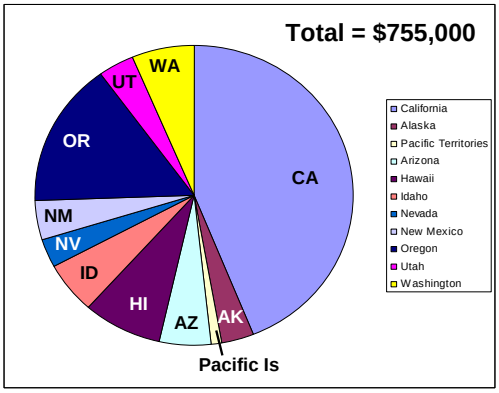


Figure 2. WPDN budget allocation by state (2005).

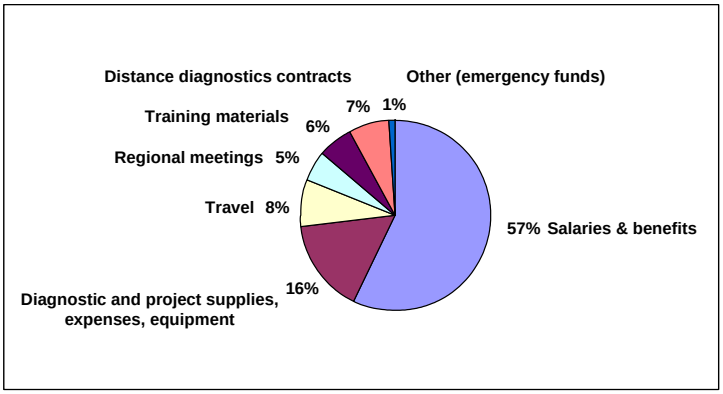


Figure 3. Allocation of WPDN budget to principal cost centers (2002-2006).

COMMITTEE REPORTS

Much of the work of NPDN is planned, coordinated, and evaluated by the operational and subject matter committees. This section of the review document contains reports from those committees. Although impossible to incorporate everything these committees accomplished, these reports give a very good account of their efforts. Please contact any of the regional directors, committee chairs, or committee members to get clarification or additional information on any of the topics presented within the reports.

Committee	Chair	Contact
Diagnostics Committee	Karen Snover-Clift	607-255-7860
Epidemiology Committee	Carla Thomas	530-304-0689
Exercise Committee	Carla Thomas	530-304-0689
Governance Committee	Jim Stack	785-564-0687
Information Technology Committee	Eileen Luke	765-494-6613
National Database Committee	Karen Snover-Clift	607-255-7860
Public Relations Committee	Ray Hammerschmidt	517-281-4113
Training & Education Committee	Amanda Hodges	352-392-1901
Website Committee	Karen Scott	607-255-7871
GPDN Director	Jim Stack	785-532-1333
NCPDN Director	Ray Hammerschmidt	517-281-4113
NEPDN Director	George Hudler	607-255-7848
SPDN Director	Bob McGovern	352-318-3004
WPDN Director	Rick Bostock	530-681-1702
NPDN Database	Eileen Luke	765-494-6613
CSREES National Program Leader	Kitty Cardwell	202-445-5609

Diagnostics Committee Summary

Overview of the NPDN Diagnostics Committee

The goal of the Diagnostics Committee members is to address issues pertaining to diagnosticians within the National Plant Diagnostic Network (NPDN) and to address issues pertaining to our interactions and collaborations with industry and governmental agencies. The committee focuses on the development of diagnostic educational materials and events. The committee has elevated key laboratory readiness by offering morphological and molecular identification training workshops, by continually updating the NPDN standard operating procedures (SOP's), and by providing instruction for how to send and what information to transmit to the National Repository. The Diagnostics Committee members have developed to a cohesive team since its creation in 2003.

Accomplished objectives will be addressed in the ***Diagnostics Committee Progress*** section and ***Success Stories*** categories. Further continuation, improvements, and plans to address future objectives will be covered in ***Future Plans.***

Committee Members

Karen Snover-Clift	Chair, NEPDN-CU, Plant Pathologist
Joy Pierzynski	Secretary, GPDN-KSU, Plant Pathologist
Phil Berger	USDA, APHIS, PPQ, CHPST
Tamla Blunt	APS Diag. President
Jan Byrne	NCPDN-MSU, Plant Pathologist
Tom Creswell	SPDN-UF, Plant Pathologist
Rick Grantham	GPDN-OSU, Entomologist
Frank Hale	SPDN-UT, Entomologist
Carrie Harmon	SPDN-UF, Plant Pathologist
Laurene Levy	USDA, APHIS, PPQ, CPHST, NPGBL
Amanda Hodges	SPDN-UF, Entomologist
Judy O'Mara	GPDN-KSU, Plant Pathologist
Sara May	NEPDN-PSU, Plant Pathologist
Mary Palm	USDA/APHIS/PPQ/PHP/PSPI
Melodie Putnam	WPDN-OSU, Plant Pathologist
Karen Rane	NCPDN-Purdue, Plant Pathologist
Timothy Tidwell	WPDN-CDFA, Plant Pathologist
Mike Tiffany	AGDIA, Plant Pathologist
Ned Tisserat	GPDN-CSU, Plant Pathologist

DIAGNOSTICS COMMITTEE PROGRESS

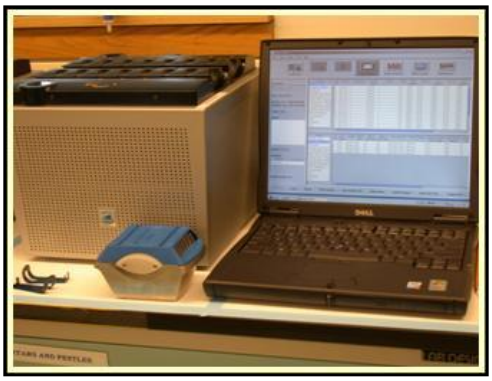
The Diagnostics Committee is a vital function of the NPDN because the Network function is to focus on early detection and identification of harmful pathogens and pests. Land grant university diagnosticians were asked to create the backbone of this Network by establishing a cohesive system of communications, recording of data, and educational efforts to improve existing diagnostic skills and learning of new techniques. Originally the focus was placed on plant pathogens (fungi, bacteria, viruses, phytoplasmas and nematodes) because the Bioterrorism Act of 2002, Select Agent listing was comprised of 10 plant pathogens. The Network has expanded to incorporate entomologists and weed scientists to cover any pest that could have a significant impact on crops and natural resources. The committee members ensure a broad overview of diagnostics by including members from industry, from USDA APHIS PPQ, and from the American Phytopathological Diagnostics Committee.

Figure 1 Kane Rane and Karen Snover-Clift reviewing real-time PCR results with Laurene Levy

SIGNIFICANT ACCOMPLISHMENTS

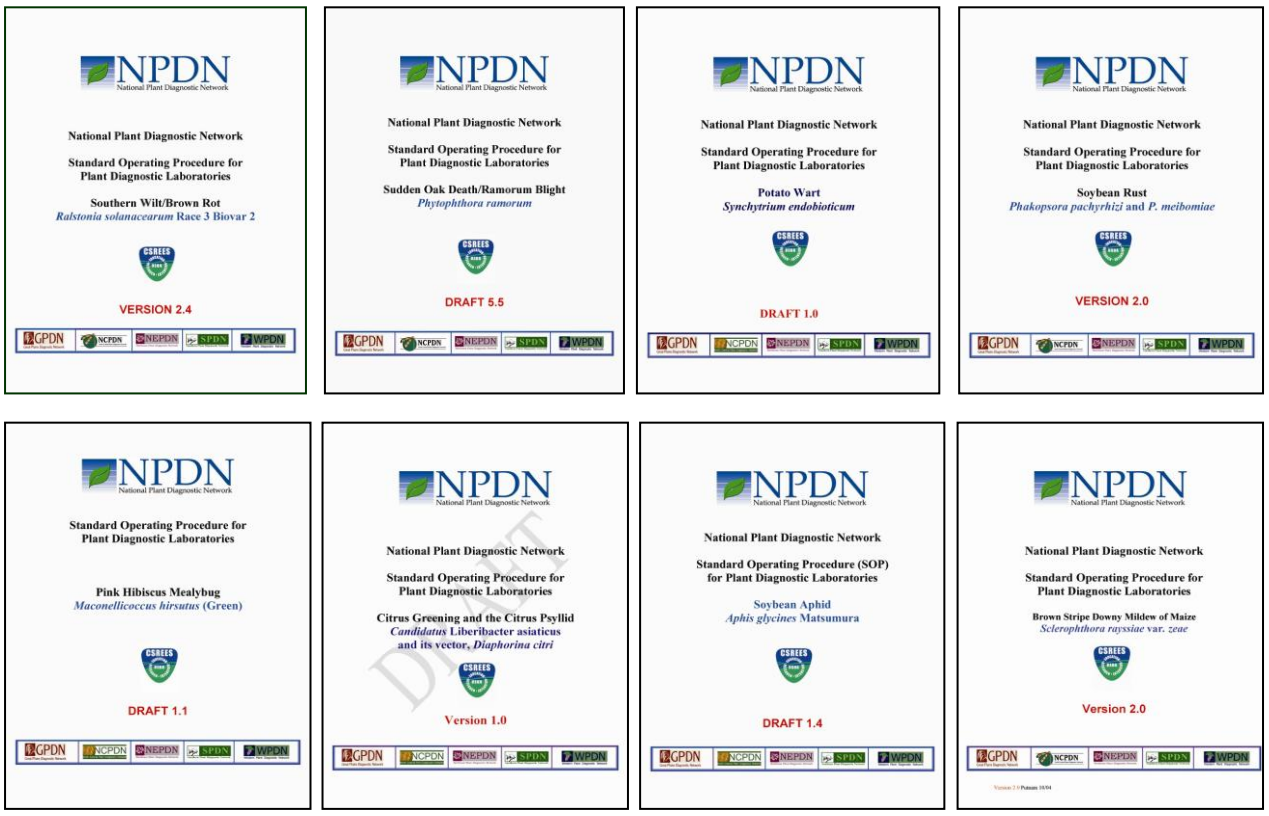
- The NPDN Diagnostics Committee was established in January 2003 to address important issues concerning protocols and processing of highly significant and select agent pathogens and how they were to move through the newly established NPDN.
- Compiled a listing of action points and a communication flow chart designed to aid members to understand the chain of custody suspect samples submitted to the Network for analysis.
- Acquisition of various permits through USDA APHIS PPQ was a significant coordination effort to allow NPDN laboratory to easily acquire permits that allowed them to receive samples from out of state area compliance with the Agriculture Bioterrorism Act of 2002, May 8, 2003.
- Created and constantly improved and updated the NPDN Standard Operating Procedures (SOP) and mailed SOP notebooks to all regions.
- Compiled “significant agent” list for plant pathogens for each region and expanded the listing to include insects and weeds, November 2003.

- Provided announcements of significant events such as the introduction of *Ralstonia solanacearum* r3b2 on January 2, 2004, the possible sudden oak death spread to a southern CA, large production nursery, March 11, 2004, and the confirmation of the soybean rust introduction on November 10, 2004.
- Coordinated the acquisition of real-time PCR equipment and training for the regional center laboratories to provide this service to their member States.



- Some members attended the Laboratory Certification meeting conducted by USDA APHIS PPQ, October 12-13, 2004 and coordinated with USDA APHIS PPQ personnel regarding NPDN laboratories and sudden oak death (SOD)/*Ramorum* blight Provisional Laboratory Testing Approval Process.
- Coordinated (with USDA APHIS PPQ CHPST personnel) real-time PCR training for sudden oak death (SOD)/*Ramorum* blight.
- Coordinated (with USDA APHIS PPQ CHPST personnel) traditional and real-time PCR training for the pathogen that causes citrus greening.

PUBLICATIONS



- Released 1st draft of Standard Operating Procedures and Picture Clues for *Ralstonia solanacearum* r3 b2, April 2, 2003.
- 3rd draft of Standard Operating Procedures and Picture Clues for *Ralstonia solanacearum* r3b2, February 10, 2004.
- Released 1st draft of Standard Operating Procedures and Picture Clues for sudden oak death (SOD)/*Ramorum* blight, sudden oak death, March 19, 2004.
- Standard Operating Procedures (Version 1.0) for *Phakopsora pachyrhizi*, soybean rust.
- Standard Operating Procedures (Draft Version 4) and Picture Clues for sudden oak death (SOD)/*Ramorum* blight.
- Standard Operating Procedures (Version 1.0) for plum pox virus.
- Standard Operating Procedures (Version 2.0) and Picture Clues for *Ralstonia solanacearum* r3b2, southern wilt and brown rot.
- Standard Operating Procedures (Draft Version 1.0) for *Sclerophthora rayssiae* var. *zeae*, brown stripe downy mildew.
- Standard Operating Procedures (Draft Version 1.0) for *Synchytrium endobioticum*, potato wart.
- Created and presented a poster at the APS sponsored Soybean Rust Symposium in October 2005.
- Standard Operating Procedures (Version 1.9) for *Phakopsora pachyrhizi*, soybean rust.
- Standard Operating Procedures (Draft Version 5.5) and Picture Clues for sudden oak death (SOD)/*Ramorum* blight.
- Standard Operating Procedures (Version 1.5) for plum pox virus.
- Standard Operating Procedures (Version 2.3) and Picture Clues for *Ralstonia solanacearum* r3b2, southern wilt and brown rot.
- Standard Operating Procedures (Draft Version 2.0) for *Sclerophthora rayssiae* var. *zeae*, brown stripe downy mildew.
- Standard Operating Procedures (Draft Version 1.0) for *Synchytrium endobioticum*, potato wart.
- Standard Operating Procedures (Draft Version 1.1) for *Maconellicoccus hirsutus*, pink hibiscus mealybug.
- Standard Operating Procedures (Draft Version 1.4) for *Aphis glycines* soybean aphid.

WORKSHOPS

- Organized diagnostic training for Soybean Rust in Fort Detrick, MD, April 30, 2003.
- Organized diagnostic training for soybean rust and *Ralstonia solanacearum* r3b2 in Beltsille, MD, February 1, 2004.
- Organized diagnostic training for plum pox virus and sudden oak death (SOD)/*Ramorum* blight in Beltsille, MD, April 26, 2004.

- Molecular and Morphological Training for the Identification of the Soybean Rust Pathogens, *Phakopsora pachyrhizi* and *P. meibomae*, March 16-18, 2006.
- Real-time PCR Training for sudden oak death (SOD)/*Ramorum* blight and real-time and conventional PCR training for the pathogens that cause citrus greening, *Candidatus Liberobacter asiaticus, Candidatus Liberobacter africanus, Candidatus Liberobacter americanus*, April 24-27, 2006.
- Real-time and conventional PCR Training for sudden oak death (SOD)/*Ramorum* blight, May 24-25, 2006.

SUCCESS STORIES

Plant Pathology Diagnostics in the NPDN

There are numerous examples of the positive outcomes by Diagnosticians in the NPDN. The first test of the system occurred in February of 2003 when *Ralstonia solanacearum* race 3 biovar 2 was discovered on geraniums from Wisconsin and Indiana production greenhouses. This find prompted holds of plant material in 489 nurseries across the country. Members of the NPDN diagnostic network worked together to process the plant material in a timely manner using validated protocols put forth by USDA APHIS PPQ CPHST NPGBL. The NPDN laboratory personnel were able to narrow down the suspects to those identified with *Ralstonia solanacearum*. Suspect samples were then forwarded to the USDA APHIS PPQ CPHST NPGBL, Beltsville laboratory for biovar identification. Subsequent finds in January and December of 2004 were handled following the same protocol. As of this date, there is no evidence of movement of this pathogen to potatoes in the United States.

The pathogen that causes Soybean Rust was identified in the United States for the first time in November of 2004. The pathogen was a member of the original Select Agent listing in the Bioterrorist Act of 2002 but was removed in early 2005 after it was identified in the country. During the growing season of 2005, NPDN diagnostic laboratory personnel processed nearly 4.500 suspect samples. Of those processed, 81 samples were identified positively using the real-time PCR protocol. The pathogen appeared to be moving slowly from the original identification sites and researchers, extension agents and NPDN members banded together to continue the monitoring of Soybean Rust through a Sentinel Plot project. NPDN Diagnostic Laboratories processed and reported 2602 samples to the National Repository in 2006.

The pathogen that causes the disease known as sudden oak death (SOD)/*Ramorum* blight was discovered outside the quarantined area of northern California in March, 2004. The discovery of this pathogen in a large production nursery in southern California prompted a huge trace forward campaign. Containerized plants that were found during the trace forward and subsequent trace forwards that developed during the 2005 calendar year were tested for the pathogen in NPDN laboratories. Over 110,000 samples were processed in NPDN laboratories with 826 of those samples being confirmed positive using validated PCR testing protocols. The magnitude of this process prompted the creation of a Provisional Laboratory Certification process.

Provisional Laboratory Certification was created by USDA APHIS PPQ CPHST personnel in order to reduce the number of suspect samples that were shipped directly to their laboratory for processing. If the NPDN laboratories could conduct some of the preliminary testing, the Beltsville laboratory could spend more time developing the protocols needed for other pathogens on the horizon. The regional center laboratories and other key laboratories submitted requests to become provisionally certified by CPHST. The process involved a laboratory inspection by three panel members and a testing panel to determine the accuracy of each of the technicians in the laboratory. Currently there are 10 laboratories and 17 diagnosticians with provisional approval and more are in the process of becoming approved.

Plum pox virus is a pathogen that was first identified in the United States in 1999 in an orchard in Adams County, Pennsylvania. The pathogen was a member of the original Select Agent listing in the Bioterrorist Act of 2002 but removed in early 2005 due to its perceived, limited ability to spread rapidly. The pathogen was detected in two locations in New York and one location in Michigan in 2006 during routine National Survey sampling. The discovery increased the numbers of samples that need processing to over 67,000 in New York. The New York samples were processed in the NEPDN Regional Center laboratory.

NPDN diagnosticians have prepared to be able to identify numerous pathogens, even those residing outside their own geographical areas. They have done this to provide support to all the diagnosticians within the Network. These examples illustrated here are just a few examples of the efforts put forth by the diagnosticians of the NPDN.

Entomology Diagnostics Training in the NPDN

Much of the NPDN's programmatic activities have been focused on plant pathogens due to the select agent list and concerns relating to agricultural bioterrorism. Nonetheless, the NPDN's mission includes a multidisciplinary focus, and several diagnostics workshops have occurred to further incorporate entomology into programmatic activities. In addition to the diagnostic workshop efforts, NPDN Standard Operating Procedures (SOP's) for identification of the pink hibiscus mealybug, *Maconellicoccus hirsutus,* and soybean aphid, *Aphis glycines* Matsumura have been developed.

Two intensive, taxonomic training workshops for general diagnosticians and extension entomologists throughout the SPDN have been a major outcome of entomology efforts. Topics covered in these training sessions included Hemiptera (*Auchenorrhycha, Sternrrhycha*) in 2004 and Coleoptera in 2006. The Coleoptera Workshop also included a field collection component.

Diagnosticians participating in these workshops have enhanced their ability to identify difficult pest groups to the genus-and species-level, increased their communication with taxonomic specialist for species confirmations, and discovered new county, state, and continental pest records. Additionally, proceedings of four new regional taxonomic keys produced for the Hemiptera (*Auchenorrhycha*, *Sternorrhycha*) workshop are available on the WWW through the December 2005 Florida Entomologist (pages 458-522) http://www.fcla.edu/FlaEnt/fe884.htm .

Subsequent to the success of the SPDN Hemiptera (*Auchenorrhycha*, *Sternorrhycha*) workshop, a similar region-specific workshop was coordinated for the WPDN during March 2006. The WPDN also hosted a workshop specifically focusing on slide preparation techniques that was held in conjunction with their regional meeting during January 2006. The GPDN also held a joint entomology and plant pathology insect vector workshop training that was held in conjunction with their regional meeting during September 2005. SPDN governance is currently in the process of collaboratively working with the North Central Plant Board to host a Coleoptera Workshop for their members as well as representatives from the NCPDN and NEPDN during 2007.

In addition to regularly scheduled annual regional workshops, organization of a couple of urgent, special needs training sessions has occurred. A national workshop in 2005 on the identification and management of the pink hibiscus mealybug based on funding from a USDA CSREES Critical Needs Grant in response to increasing concerns relating to pest distribution and spread. The grant was a collaborative effort between the NPDN, the Regional IPM Centers, USDA APHIS PPQ, and the National Plant Board. A "How to Prepare Mealybugs" slide-making video tutorial and a pictorial pink hibiscus mealybug Diagnostic Guide, published in Plant Health Progress, were products of this workshop. An urgent, special needs thrips workshop was also developed during March 2006. This workshop was scheduled due to concerns relating to chili thrips, *Scirtothrips dorsalis* Hood identification. Extension specialists, diagnosticians, industry personnel, and researchers from Florida, Georgia, Louisiana, and Alabama participated. A minimal registration fee and volunteer or local instructors (i.e. no travel costs) covered costs for the thrips workshop.

The NPDN Diagnostics Committee has also added one entomology representative per region to the member list during 2006 in order to further bridge entomology communications and address diagnostic issues specific to this discipline.

Future Plans

The NPDN Diagnostic Committee plans to expand the committee with additional representation from our entomology and weed science counterparts. As we add more members we will evaluate the needs of diagnosticians from multi-disciplines. The committee members will determine how to test our diagnostic system to ensure we are prepared for an introduction of a harmful pest or pathogen. This may be done in a similar fashion to the existing exercise program but with more focus on the laboratory function not the notification and flow through the communications tree.

An area of great significance is the laboratory accreditation and certification process that has been provisionally started through USDA APHIS PPQ. At least one member of this committee will serve on the working group and steering committee that will make the plans for how the Network will be involved in the accreditation and certification of diagnostic facilities across the country. This committee will aid in the establishment of protocols, will serve as administrators of information needed for those interested in becoming accredited and/or certified, and will play a significant role in the coordination of diagnostician training. The committee will work closely with USDA APHIS PPQ to ensure the creation of laboratory certification and accreditation is not an overwhelming process but one that can be obtained easily for network members that are interested.

The NPDN Diagnostic Committee plans to continue its creation and distribution of Standard Operating Procedures that provide guidance for all diagnosticians within the

Network. The committee members will add documents that cover the rest of the select agent pathogens and will follow with other regionally, highly significant pathogens and pests. The committee members will also continue to plan workshops with our USDA APHIS PPQ CPHST NPGBL collaborators. The training workshops will help us with surge protection within the Network. Being trained and ready for possible introductions of specific pathogens will enable the Network members and the regional center hubs to work much more efficiently with the ability to process samples for any of our Network members in need of help.

ADDITIONAL DOCUMENTS

- NPDN Diagnostics Committee Webpage: Conference call minutes and Provisional Laboratory Approval listing, http://www.npdn.org/DesktopDefault.aspx?tabindex=1&tabid=19 .
- CD-ROM of all NPDN SOPs
- CD-ROM of Conference Call Minutes and Accomplishments by fiscal year.

Epidemiology Committee Report

Overview

The mission of the Epidemiology Committee is to design, implement and maintain epidemiological analyses of the NPDN national and regional databases. The goal of the Epidemiology Committee is to design, develop and implement analyses using the NPDN diagnostic record data as well as other data from other sources, to detect outbreaks at the earliest stage possible, whether intentionally introduced or not. Outbreaks may be local, state, regional or national events. When possible, pathway analysis may also be conducted. The Epidemiology Committee has conducted analyses on legacy datasets to determine fields of interest. It has also identified seven types of outbreak anomalies. It is currently designing and developing the first analysis tools for detection of anomalies. The committee also has proposed an initial design for phase 2 database fields to expand the analysis capability of the NPDN. The design is under consideration by a national ad hoc committee of diagnosticians, IT managers, epidemiologists, and NPDN administration that are members of NPDN.

Committee Members

Carla Thomas	Chair, WPDN-UC Davis, Plant Path & Epidemiology
Andrew Coggshall,	WPDN-UC Davis, Information Technology
Paul Jepson	WPDN- OSU, IPPC Entomology and Epidemiology
Len Coop	WPDN-OSU, IPPC Entomology, GIS
Hans Luh	WPDN-OSU, IPPC Data analysis, text mining, and GIS
David Barber	SPDN-UGA, IT Diagnostic database management
Will Baldwin	GPDN-KSU, IT Diagnostic database management
Howard Beck	SPDN-UFL, IT Diagnostic database management
Forrest Nutter	NCPDN-ISU Plant Pathology and Epidemiology
Casey Estep	WPDN-CDFA, IT Diagnostic database management
Mike Hill	NCPDN-CERIS, IT Diagnostic database management
Shen Wang	NCPDN-CERIS, IT & GIS
Eileen Luke	NCPDN-CERIS, IT & Database management

Introduction

A primary function of the National Plant Diagnostic Network is to collect diagnostic records at the regional and national levels and to analyze this information to detect anomalies. This coordinated effort will allow earlier recognition of unusual outbreaks that would otherwise be difficult to detect at an early stage of the outbreak.

The **mission** of the epidemiology committee is to design, implement and maintain epidemiological analyses of the NPDN national and regional databases.

The **governance** of the NPDN Epidemiology Committee is conducted by a committee of NPDN staff and assistants who contribute to operational efforts in epidemiology. Additionally, epidemiologists who demonstrate an active involvement in NPDN activities and meetings may contribute to the Epidemiology Committee.

The **goal** of the Epidemiology Committee is to design, develop and implement analyses using the NPDN diagnostic record data as well as other data from other sources, to detect outbreaks of pests and diseases at the earliest stage possible. Outbreaks may be local, state, regional or national events. When possible, pathway analyses may also be conducted.

Definition of Anomaly Types

The epidemiology committee was formed in early 2003. The committee conducted a series of planning teleconferences and then held a workshop on March 6-7, 2003, with insect and disease epidemiologists from around the country. The workshop produced a categorical list of anomalies that could be used to identify unusual outbreaks as compared to routine plant epidemics. The list of anomaly types is:

- Geographic – appears in new place
- Climatic –appears during unusual weather conditions
- Host Characters – appears on new host or new part of host
- Pest Characters – change in pesticide resistance, virulence, etc.
- Temporal – appears at an unusual time of season
- Distribution – spreads in a new way, or at new rates
- Association – shows association with another factor that is new or unusual (i.e. this virus is usually found by this virologist, then virologist moved to new state and now it is found there; or usually is associated with airports or train depots)

It was agreed that geographic first occurrences were easier to recognize as anomalies than anomalies where a known and perhaps routine pest or disease changes and becomes unusual in behavior or distribution. The group also agreed that to measure these anomalies, NPDN data would need to be analyzed in a variety of ways, including GIS systems, text mining, etc. The committee is evaluating the type of data that has been captured historically at the state level and is comparing this to the data now being captured by NPDN. Additionally, the committee continually assesses whether new kinds of data need to be captured.

SURVEY AND ANALYSIS OF LEGACY DATASETS

Sample submission forms from 43 states were collected and fields were compiled. Most of these forms were in paper format, not available as electronic submissions at the time of the study in 2003. Now most of the NPDN laboratories use electronic sample submission forms that are web-based, entered either at the lab or entered remotely by the submitter. Fields compiled included symptomology, crop history, client information, date and location of sample collection, and host condition. The workgroup met again by teleconference and reduced the list from over 300 fields to 125 fields proposed to have value in recognizing anomalies.

The next question was to determine how frequently these terms were used in legacy databases. A project was initiated at Oregon State University and the University of California, Davis, to analyze legacy diagnostic databases to answer these questions. Electronic databases were collected from Michigan, New York, New Mexico, Arizona, Georgia, California, and Kansas. Many of the diagnostic databases examined had very limited information or very few years of data available. Most of the database fields were large blocks of free form text, rather than specific fields. Some of these databases contained only the host, pest, date and county. Only Kansas, Georgia, and California had a sufficient number of records collected from throughout the state each year with variability in pest, host, location, symptomology and collection date. These databases include one from the California Department of Agriculture with 46,264 records covering 7 years, one from Kansas State University with 19,439 records covering 9 years and one from the University of Georgia with 2,807 records covering 5 years. The Georgia database also had pictures attached to the records. Most of the records in these databases were paragraph format text entries. Therefore a text mining approach was adopted.

The analysis included use of synonyms such as “yellowing” and “chlorotic” and removal of non-relevant words such as “to”, “the”, “if”, and proper names. An interesting finding in the study showed that the top twenty words most commonly used in each of the three states were the same words each year regardless of the state of origin of the data; they included the words leaves, spot, scattered, mottled, seed, plant, yellow, fruit, burn, canker, bark, root, stem, wilting, tip, rot, large, discoloration, margin, malform, and brown. Other words appeared with varying frequency depending on state and year. This is especially surprising since these three states have very different crop types and cropping systems.

Another result from this data indicated that there are many synonyms for plant disorders and that standardization of terminology would be critical to a robust database of diagnostic records. For example, discoloration included yellow, pale, chlorotic, red, red-

yellow, yellow-red, orange-red, etc. Other synonyms included soft, deteriorated, mush, rot, etc. Plant part synonyms included many synonyms such as twigs, shoots, and stems.

PHASE 1 AND PHASE 2

Initially, a phase one database was designed to collect the minimum information needed to detect first occurrences and temporal anomalies. The fields include the name of the pest or disease, the name of the host, location where it was found (minimum resolution to county) and date that it was found. The legacy dataset and sample submission form survey studies were used to propose fields for phase 2 that would be needed in order to analyze diagnostic data for the other types of anomalies listed above.

The epidemiology committee continued to meet regularly (several times per year) to develop a relational database design and schema for the phase 2 database. The Epidemiology Committee also met jointly with the NPDN IT and Diagnostic Committees at least once per year. A committee of NPDN diagnosticians, the NPDN IT Committee, the NDPN Epidemiology Committee was formed in October, 2006 to complete the descriptions and definitions of Phase 2 fields. The group met face-to-face for two days and is continuing to work by phone to finalize the document that has been drafted. It is hopeful that the design of Phase 2 may be completed before May, 2007. Implementation of Phase 2 has not occurred yet, but is likely to begin in late 2007 or 2008.

A joint meeting between the IT / Epidemiology Committees for NPDN and NAHLN was held in April 2005. The participants recognized that strengths in each program complemented each other and there was very little duplication of expertise or software. The groups plan to continue to meet at least once every 2-3 years and to consider joint use and development of software such as the PDIS exercise and secure communication modules, the NAHLN user interface for code assignments, and relational taxonomy strategies in database design.

DEVELOPMENT OF OTHER TYPES OF DATA LAYERS FOR USE IN ANOMALY ANALYSES

NPDN has been working with Oregon State University's Integrated Plant Protection Center and Spatial Climate Analysis Center to build the infrastructure to provide a toolset (NPDN-GVIS) for use in detecting geographic, climatologic, temporal, distribution and association anomalies. Progress to date is summarized below in the areas of high resolution weather and pest/ disease risk maps, including daily crop and pest phenology maps, a degree-day mapping calculator for insect pests, a generic disease modeling system, and a new system to map dates of predicted phenological events. To add value to the investment in the system, the maps reflecting weather- and climate-based risks are also made available to IPM practitioners on a public website with free access http://pnwpest.org/US/. The same information that is useful for investigating

climatological anomalies is also useful in helping growers implement sound IPM practices. The USDA CSREES Western IPM Center also has contributed funding to this web project, therefore leveraging funds from multiple federal and state programs for synergistic benefit.

The group at Oregon State University received an NRI Biosecurity grant in 2006 to use these tools to quantify errors and uncertainties in weather and climate analysis of crop risk. These results will have significant benefit for integrated pest management, biosecurity and the NPDN anomaly analysis. The OSU group also has received a grant from the USDA CSREES Western IPM Center for 2 years to conduct weather workgroup meetings. These meetings to bring together expertise and experience to address the challenges in pest and disease modeling as related to weather and climatology. The group includes NPDN personnel, climatologists and weather forecasters, cooperative extension, and IPM specialists.

EXPANDED NETWORKS

The weather station networks that are part of the pest and disease prediction system known as NPDN-GVIS have been expanded beginning in 2006 to over 6,300 stations (up from 3,500+ in 2005) and now include the APRSWXNET network in addition to national METAR and RAWS networks, plus the local and multistate networks which include Agrimet, Hydromet, Snotel, COOP, and 3 grower-run networks. Use of a wide variety of weather data sources helps avoid problems due to single sources of failure and greatly improves geographic coverage. The database of historic average weather data was expanded by 3,838 new station records to a total of 5,876 in the system. Historical data allows comparison of models using current vs. 30-year normals to highlight anomalies and to predict long term trends.

The Oregon State University Spatial Climate Analysis Center has developed a data interpolation system for spatial climate analysis. The system interpolates between weather station measurements using geophysical principals, including elevation, slope, aspect, and distance from the ocean and other large water bodies. The system is called the PRISM system and has already been adopted by NOAA and the Weather Channel. The NPDN-GVIS system has adopted this interpolation approach as well.

Daily and hourly outputs from these stations, as well as crop risk model outputs are available on the public website for IPM purposes and biosecurity. A system which sends this information to the secure websites for NPDN located at CERIS is under development. This distributed data management approach maintains confidentiality required for NPDN records, while making weather, climate and crop model outputs available to general public. System usage for IPM and for NPDN biosecurity has grown over the past 10 years to where, in 2005, over 37,000 unique visits were made to the

website for pest phenological and plant disease information (up from 20,000 visits in 2003), and over 13,000 pest model runs were documented in 2005, compared to 10,000 model runs in 2003.

Daily Phenological Maps

A series of 48-state conterminous reference maps are created daily for several temperature thresholds (32, 41, and 50) that can be used for a variety of pest and crop analyses. These maps use temperature data from 6300+ weather stations and provide for comparison of heat-unit developments relative to geographic location, and to normals (30-year averages). These maps include a web-GIS visualization interface which allows zooming, panning, and querying of site-specific degree-day accumulations, temperature, rainfall, humidity and in some cases wind speed and leaf wetness. The system also has the ability to calculate custom degree-days and generic pest and disease models for nearest stations queried. Addition of the Hawaiian Islands and Alaska is in progress.

Degree-day Mapping Calculator

Custom degree-day maps are now available with the expanded weather data networks for all states and regions in the 48 coterminous states. With this system, an analyst may enter custom parameters unique to an invasive species to determine its spread and expected arrival date or damage symptoms within a region. For 2005-06, this system has been re-engineered to allow multiple users via a network of clustered servers. http://pnwpest.org/cgi-bin/usmapmaker.pl

Pathway Analysis

Overlays of transportation routes, municipalities, political boundaries and ecozones are also available in this system. Waterways, drainages, watersheds, lakes and ponds are included as well. This allows the analyst to look for distribution patterns and investigate possible transportation pathways during an outbreak.

Disease modeling system

A generic web-GIS plant disease risk modeling system has been developed that ties all relevant weather stations (ca. 5000+ having sufficient weather parameters) to an expanding number of generic disease risk models. This tool allows plant biosecurity personnel, epidemiologists and IPM practitioners to quickly determine numerous disease risk factors for any part of the country. Currently five disease risk models are in the system; pear scab, apple scab, Gubler-Thomas grape powdery mildew, TomCast and Hops powdery mildew. This tool has been tested by modelers while additional models and enhancements are being added to the system.

Phenological date of event prediction maps
A new pest phenology predictive tool was developed in 2005-06 that has the potential to alert users as to where and when a particular pest event is expected as predicted by degree-day analysis. This system differs from degree-day maps by converting degree-days into dates, which will allow a more rapid and less technical forecast of potential pest events. This tool incorporates weather forecasts and is in the testing stages as part of the NRI grant. Disease forecasts will be added later.

SYSTEM USAGE

The system was used to monitor the spread of soybean rust in the eastern US during 2004, 2005 and 2006. Weather conditions and model outputs were used to determine if spread of the disease occurred as would be expected or if the spread was to places or during times that were unexpected. The usefulness of this tool was compared to the USDA soybean rust website (http://www.sbrusa.net/), the Syngenta soybean rust website (http://www.farmassist.com/soybeanrust/default.aspx) and to the North Carolina State University soybean rust aerobiology website. These comparisons were documented in a white paper that was written for Lawrence Livermore National Labs and submitted to the US Department of Homeland Security describing the results of this comparison. The comparisons showed that in some cases there were some differences in forecasts and results from each system. This demonstrates the importance of having multiple tools available in estimating risk, spread, and documenting detection of pest and disease outbreaks because the expertise needed does not reside in only one group and a multidisciplinary distributed approach is more robust.

A NATIONALLY DISTRIBUTED DATABASE DESIGN

The project participants met in April 2006 with CERIS to design the interface to be developed between the GVIS and the CERIS NPDN database. Each group demonstrated current capabilities and then planned a timeline for its development and implementation. The system will allow layers for anomaly comparisons such as weather, satellite imagery, shipping routes, etc. to be ported onto a map server at the CERIS database, where access security is in place to prevent unauthorized persons to view confidential records. Analysts and data submitters in one state will not be able to overlay data from other states, but will be able to overlay their own data with state, regional or national weather or other types of maps. Authorized epidemiologists will be able to view data which they have been granted access. This system allows a distributed maintenance of widely diverse map layers by experts for those layers, but overlay viewing of authorized NPDN data by end users and analysts.

This CERIS map server approach allows other groups with expertise and datasets that have value to NPDN analyses to port their databases and /or analysis products to CERIS

where analyses can be conducted without compromising the data sharing policy of the NPDN. In the future it is possible that many types of data such as transportation routes, crop cover, and land usage could be overlaid with NPDN data on the CERIS server without incurring the full cost and expertise needed to maintain those datasets.

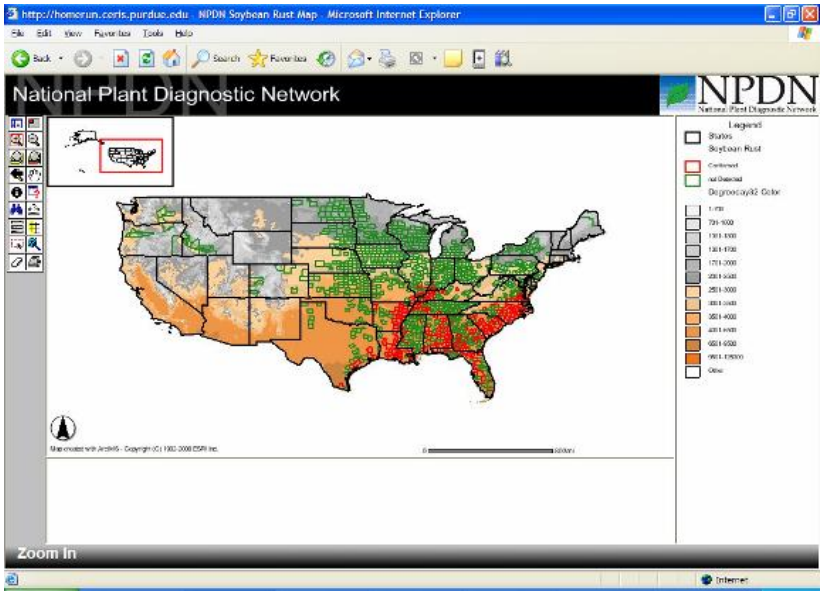


Figure 1. A GVIS degree day map generated at Oregon State University and sent to CERIS in Indiana for map server overlay with soybean rust data. Positive counties are red, negative counties are green.

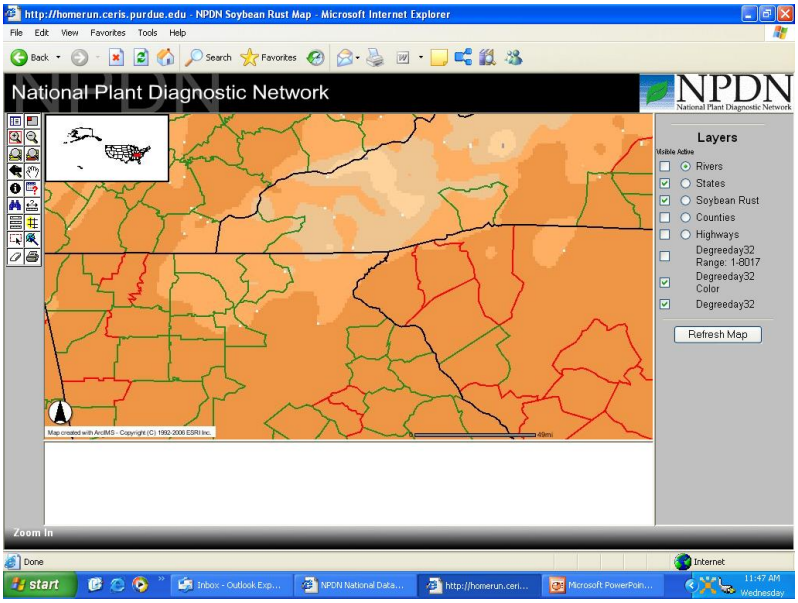


Figure 2. Close up of the junction between Tennessee, North Carolina, South Carolina, and Georgia, showing high resolution degree days using geophysical properties from the Appalachian Mountains to interpolate between weather stations. Red counties are confirmed positive for Asian soybean rust, green counties show surveyed counties with no confirmed SBR. Counties that were not sampled are not delineated.

SUCCESS STORIES

Analysis of the Phase 1 data has already revealed some anomalies which may not have been recognized without a regional NPDN database. There are several cases where a multi-state disease outbreak was detected first through the NPDN system. Day lily rust is a disease of regulatory consequence and very limited distribution in the US. In 2005, during a ten day period, three different states each reported a record for daylily rust. Daylily rust records occur from time to time, but it was very unusual for three to appear within the same 10 day period. Further investigation by the regional WPDN analyst revealed that each of three states received daylily samples from outlets of a large national retail chain. All these plants originated from the same central distribution source. Because APHIS does not consider daylily rust a federally controlled pest, these events were not reported to other states. It was only through communications from WPDN that each state learned that they were not the only state to receive infected plants. Location of other states with infected plants was not disclosed to each state due to the NPDN data sharing policy and confidentiality concerns. In 2006, a similar rash of diagnoses occurred with gladiolus rust in several states.

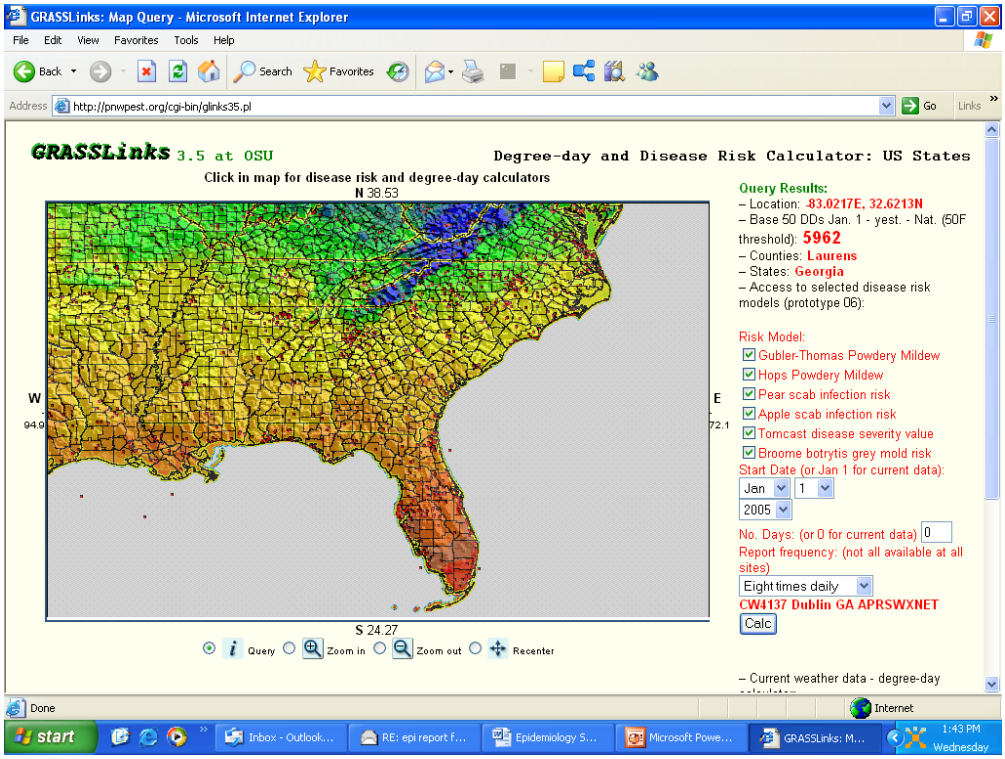


Figure 3. Screen display of the generic disease modeling tool in GVIS

CD-ROM ATTACHMENTS

- Epidemiology Committee progress reports:
  8-3-06; 12-1-05; 7-28-05; 11-24-04.
- NPDN Epidemiology Committee meeting 04-11-06
- Committee meeting minutes 7-21-03
- NPDN-NAPIS Epidemiology Workshop Mar 03 Final
- Phase 2 documents:
  - Phase 2 small group internal report 10-31-06
  - Summary phase 2 10-31-06. xls

Exercise Committee Report

Overview

The mission of the NPDN Exercise Committee is to oversee the design, development, implementation and facilitation of chain of custody - communication exercises for the NPDN. The Exercise Committee coordinates exercises to assure their quality and standardization at the national level. The goal of the Exercise Committee is to help all exercise participants (local, extension, state and federal) understand their roles and responsibilities, and how their efforts coordinate with those of the others while practicing standard operating procedures (SOPs) in a non-critical environment. Another goal is to improve the SOPs by identifying and removing ambiguity in the protocols as well as gaps in the procedures. Membership of the Exercise Committee includes representatives from PDIS, CERIS, the National Plant Board, APHIS and the NPDN Regional and National Exercise Coordinators. Forty-two exercises have been conducted in 44 states and two US territories. Nine states and one territory have completed two exercises, and one state has completed three. Two states have conducted First Detector Exercises. The Committee has partnered with other exercise programs including APHIS, NAHLN, and the Border Governor's Ag Work Table. Products of this Committee include a website dedicated to each exercise and a training manual for exercise coordinators.

Committee Members

Carla Thomas	Chair, WPDN-UC Davis, National Exercise Coordinator
Carrie Harmon	SPDN-UFL, SPDN Exercise Coordinator/ Facilitator
Will Baldwin	GPDN-KSU, GPDN Associate Director
Marietta Ryba-White	GPDN-KSU, GPDN Exercise Coordinator/ Facilitator
James Stack	GPDN-KSU, Regional Director
Mary McKellar	NEPDN-CU, NEPDN Exercise Coordinator/ Facilitator
Michael Stubbs	APHIS PPQ Western Region, Emergency Program Coordinator
Sherry Sanderson	APHIS PPQ Western Region, Assistant Regional Director
Sandy Perry	NCPDN-MSU, NCPDN Exercise Coordinator/ Facilitator
Eileen Luke	CERIS-PU, Director of CERIS (Mike Hill, alternate)
Vacant	State Department of Agriculture (previously held by Tom Sim, Kansas Department of Agriculture)

HISTORY

The NPDN Exercise Committee was formed in 2004. The **mission** of the exercise committee is to oversee the design, development, implementation and operations of exercises for the National Plant Diagnostic Network. The committee coordinates exercises to assure their quality and standardization at the national level. Members of the Exercise Committee, which includes Regional Exercise Coordinators and a National Exercise Coordinator, work with representatives from the Plant Diagnostic Information System at Kansas State University, CERIS at Purdue University, the National Plant Board, and APHIS, who review activities and provide general guidelines to the national exercise program. Committees may be established as needed.

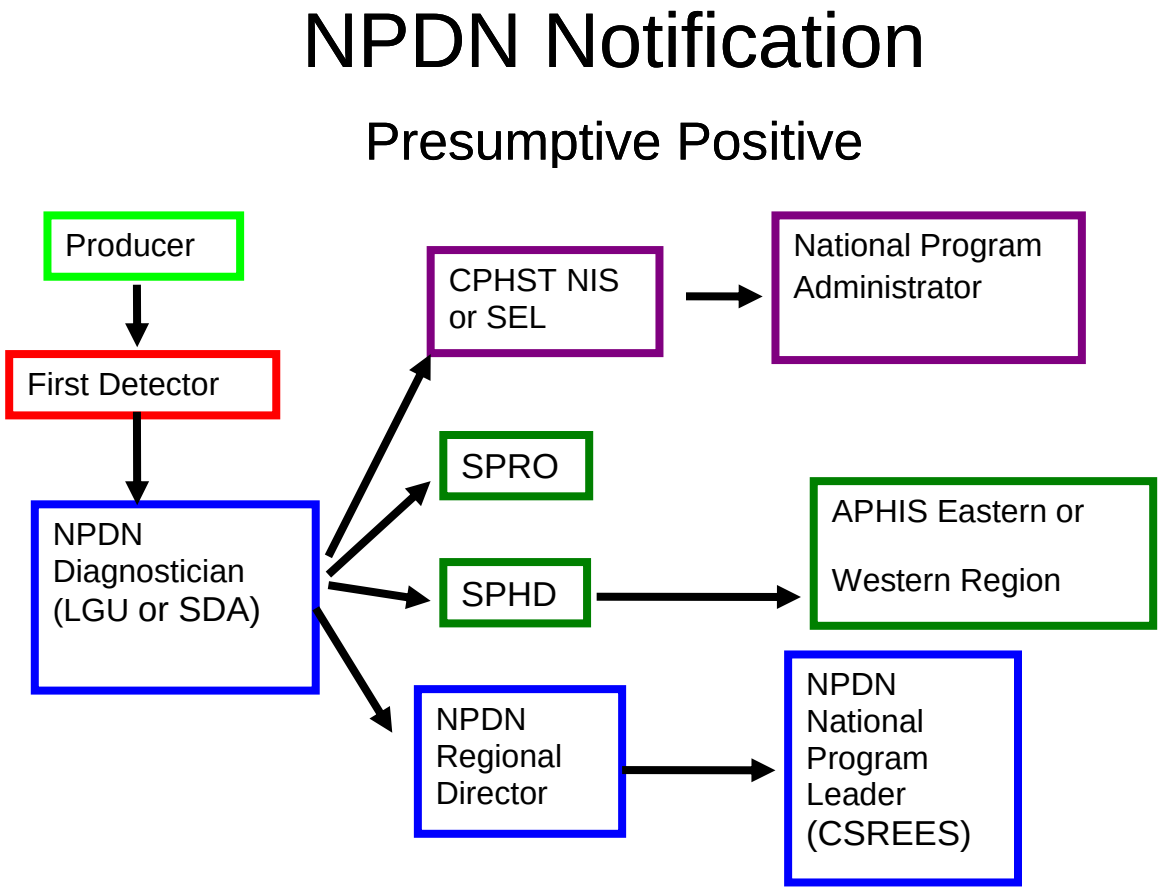
The **goal** of an NPDN exercise is to practice SOPs in a non-critical environment, so that all participants understand their roles and responsibilities, as well as how their efforts coordinate with those of the other entities. Another goal of the exercise is to improve the SOPs by identifying and removing ambiguity in the wording of protocols as well as gaps in the procedures.

The first SOP was developed during a meeting of the members of the Exercise Committee for the detection and confirmation of a suspect soybean rust sample. This protocol was the first of its kind to integrate chain of communication and chain of custody procedures from university extension, diagnostic labs at land grant universities and state departments of agriculture, federal confirming diagnostic labs, and state and federal department of agriculture response personnel. This SOP is a living document and undergoes revisions regularly on the basis of lessons learned during exercises and actual events. A secure website module for monitoring and documenting exercise activities was created within PDIS. The website provides critical contact information for the participants, a copy of the SOP to be exercised, an activity log, goals and objectives of the exercise and the photo sheet file that is used as a "plant sample". The exercise module is used for all NPDN exercises conducted to date.

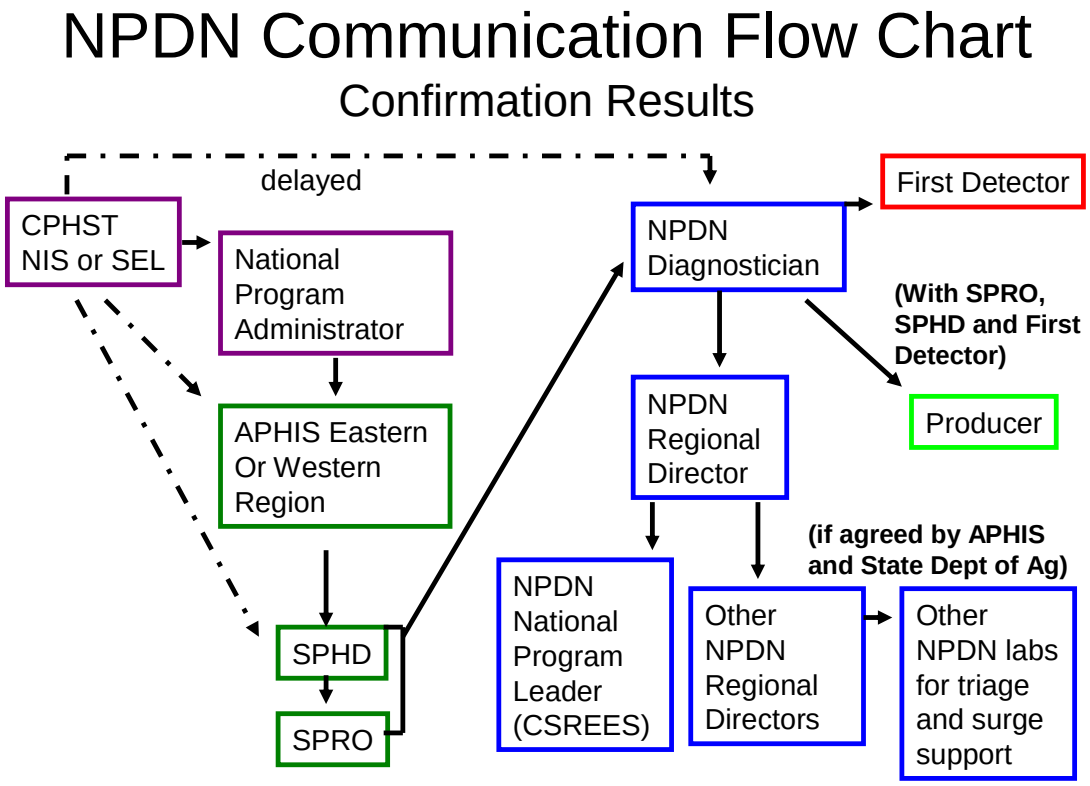
The activity surrounding a plant pest event has two principal aspects: (a) rapid detection, diagnosis and notification of the pest occurrence, the primary role of the NPDN; and (b) response and regulatory action, which is the coordinated role of the State Plant Regulatory Official (SPRO) and the APHIS PPQ State Plant Health Director (SPHD) in each state as mandated by regulatory statutes. The NPDN exercises focus on the first aspect. Forty-two NPDN exercises have been conducted in 44 states and two US territories. Nine states and one territory have completed two exercises, and one state has completed three. Two states have conducted First Detector Exercises.

METHODS

An exercise is composed of three parts: 1) a pre-exercise training session via conference call for all participants; 2) the exercise scenario where participants use the NPDN Standard Operating Procedure (SOP); and 3) a post-exercise debriefing session via conference call to evaluate the exercise and the SOP.



To prevent confusion with an actual event, participants are asked to begin every communication with "This is an Exercise Input." Participants include the APHIS PPQ State Plant Health Director (SPHD); the state department of agriculture State Plant Regulatory Official (SPRO); NPDN diagnosticians, regional staff, regional and national directors; university extension county agents and state specialists; APHIS regional and national administrators and emergency coordinators; and other university, state department of agriculture or APHIS staff. In a few cases industry also participated or observed in the exercises.



National and regional managers serve as exercise monitors and have access to view all of the exercise activity log entries as they are made on the secure PDIS website. Participants are not able to view entries other than their own until after the exercise is completed. This encourages verbal communication and problem solving through discussion by the participants during the exercise. The exercise facilitator monitors activity logs, which are made real-time or near real-time, and interjects as needed if the activity play becomes stalled or diverts onto an insignificant tangent. The activity log provides an important tool for effective documentation of exercise activities, after-action items, and for monitoring the progress of the exercise.

An exercise begins with a pre-exercise conference call of approximately two hours to introduce participants to each other if they have not met before, to discuss the pest or disease scenario, the SOP and the exercise process. The pre-exercise call is also used to familiarize all parties with the Plant Diagnostic Information System (PDIS) software which is used for the exercise. Each participant had been given a PDIS account with a user ID and password. Each participant is asked to log into the PDIS website before the first conference call in order to discover and resolve potential access problems. During the conference call, participants are able to log on and update their account contact information.

The Activity Log entries contain descriptions of the thoughts, plans, and actions relating to handling and diagnosing the sample during the exercise and to the aftermath and implications of the positive confirmation. Entries are usually very detailed and concise. The log also documents action items that need to be addressed after the exercise in after action reports and activities. The NPDN Exercise Activity log is a permanent document with visibility up to the level of the Secretary of Agriculture. It can be used by states as part of their package to demonstrate overall preparedness in the event of a pest detection of high consequence.

The exercise is launched shortly after the pre-exercise conference call with the hand delivery or overnight shipment of the securely packaged "sample" photo sheet by the first detector who is usually a county extension agent, a Department of Agriculture Inspector, or a member of agricultural industry. The first detector delivers or ships the sample to the diagnostic facilities at an NPDN laboratory for the state. This may be a university or state department of agriculture laboratory. After inspection of the symptoms and appropriate diagnostic tests are simulated for suspected pest or disease, the sample is reclassified from "suspect" to "presumptive positive". The diagnostic laboratory then hand delivers or overnight ships the sample to the National Confirming Diagnosis Designate. This is usually a diagnostician at the APHIS PPQ Center for Plant Health Science and Technology laboratory, the APHIS PPQ National Identification Service, or the USDA ARS Systematic Entomological Laboratory.

Notification of the presence of a presumptive positive sample in the system follows a chain of notification procedure described in the SOP and includes the APHIS PPQ State Plant Health Director, APHIS PPQ Regional and National Administration, State Department of Agriculture State Plant Regulatory Officials, and NPDN Regional and National Directors.

The simulated diagnostics at the National Identifier's lab is conducted using the actual time required for each step of the diagnostic process to confirm the sample. Notification of the confirmed positive results is delivered to the APHIS PPQ, the state department of agriculture and NPDN participants and then to the sample submitter. The exercise is concluded when the sample submitter, diagnostician, SPRO and SPHD have been notified of the confirming positive results of the sample.

Once the exercise is completed, access to all of the activity log entries is enabled for all participants. They log on and read them prior to a debriefing conference call of approximately one or two hours. This call is held after the exercise to provide participants and monitors with the opportunity to discuss the exercise, the SOP, communications, and to make suggestions for improvements in the exercise process or the SOP.

An after-action report is generated based on the logs, discussion and other comments submitted to the exercise facilitator from monitors and participants. Corrective measures and improvements are documented in the report as well as a summary of activities during the exercise. These reports are posted on the NPDN exercise committee website, as well as sent to all participants for input. The current SOP and the exercise coordinator training manual are also posted on the NPDN exercise committee website.

SUCCESS STORIES

In 2004, the USDA requested that NPDN conduct diagnostic exercises for Asian soybean rust in all major soybean producing states before its arrival to the US. When the disease was first detected in November, 2004, fourteen exercises had been conducted. These exercises included multiple states in many cases and included Nebraska (2), Kansas (2), Arkansas, Illinois, Iowa, Tennessee, Kentucky, Virginia, Alabama, Louisiana, Delaware, Virginia, New York, Maryland, Georgia, Texas (2), Minnesota (2), Oklahoma, Colorado, North Dakota and South Dakota, Florida, North Carolina and South Carolina (25 states). By the end of April, 2005, SBR exercises had been conducted in Wyoming, Montana, Pennsylvania, Indiana, Puerto Rico, and West Virginia.

When the first Asian soybean rust sample was found in Louisiana, it was found on a Saturday on a university extension research plot. The first detector in this case had participated in the NPDN diagnostic exercise. He expressed his appreciation for having been a participant in the exercise training and commented further that he would not have known who to call and how to reach them over the weekend if he had not been in the exercise. This prior knowledge resulted in a positive confirmation with-in 36 hours of its detection.

A National Exercise Train-the-Coordinator manual was written in 2004. This manual documented the exercise process and provided information needed in order to conduct an NPDN exercise as a coordinator, facilitator or participant. The document was revised in the September, 2006.

In the spring of 2005, the program began exercising other diseases such as citrus canker, citrus greening, Southern wilt of geranium as caused by *Ralstonia solanacearum* race 3 biovar 2, sudden oak death, oleander scorch, sigatoka of banana, and potato wart. In the summer of 2006, the program began exercises for insects including *Sirex* woodwasp, Asian longhorned beetle and glassy winged sharp shooters.

In 2004, APHIS launched a full-scale response exercise program. NPDN and APHIS have since then partnered their exercise programs. Whenever possible, the APHIS full-scale response exercise uses an NPDN diagnostic exercise to trigger the activation of the incident command system in the full-scale response exercise. Management teams from APHIS and NPDN work together to conduct both exercises consecutively. This is more realistic, since positive confirmations are often the actions that launch a response to a high consequence pest. This partnership has resulted in better integration of the roles and responsibilities of NPDN, state departments of agriculture and APHIS. Below are scenes from a full scale exercise held in Texas for citrus canker in November, 2006. Photo on

the right shows the simulated lab.

The NPDN exercise program has partnered with other agriculture exercise programs including US Department of Homeland Security Office of Domestic Preparedness exercises conducted in California in 2005 and 2006 and New Mexico in 2005. The NPDN exercise program also assisted in planning and conducting the US-Mexico Border Governor's Agriculture Worktable exercise with all US and Mexican Border States held in New Mexico in February, 2006.

The NPDN exercise program provided exercise leadership and training for the National Animal Health Network, our sister program for veterinary laboratories. The NPDN National Exercise Coordinator facilitated planning and implementation for a 5-state table top exercise in the Midwest in October, 2005. This exercise was conducted

simultaneously in each state remotely using the PDIS exercise module. The process and exercise were so successful that the NAHLN is now using the PDIS exercise and secure communication modules in its own operations.

When the NPDN was first formed, some regulatory agency personnel were concerned that NPDN might try to gain control of important regulatory activities. The NPDN exercise program has been instrumental in alleviating these concerns and in building a higher level of trust between the NPDN, university and regulatory agencies. Additionally, the exercise program was created months after an excessively lengthy delay of 45 days between the detection and the positive confirmation of a positive *Ralstonia solanacearum* race 3 biovar 2 event in the Midwest in 2002. A year later, a similar event occurred, but the confirmation was made in less than 72 hours after detection. This improvement in turnaround time is not only the result of the exercise program but also is due to an improved detection protocol, as well as the improved working relationships between NPDN labs and the labs that conduct national identification for APHIS.

In August, 2006, the program became too large for one exercise coordinator/facilitator to conduct all of the exercises for NPDN. It was decided to establish regional exercise coordinator positions and to include those positions in the NPDN exercise committee. Those individuals are being trained to organize and conduct exercises.

First Detector Exercises

Two states have conducted First Detector Exercises to follow up on training conducted in the NPDN First Detector Program developed and administered by the NPDN training and education committee. These exercises have not been widely implemented due to the large number of people and planning required to conduct them. Instead, the NRI biosecurity training grant group will be working with the exercise committee to develop an online exercise module that first detectors may conduct individually.

CD-ROM Attachments:

- List of NPDN diagnostic exercises conducted to date
- After action reports for NPDN exercises.
- Exercise Training Manual, vs. 2006
- SOP's from 2004, 2005 and 2006
- NPDN Communication Flow Chart 12-06
- Exercise committee progress reports
- Exercise committee meeting minutes

LIST OF EXERCISES CONDUCTED TO DATE

Exercise 1 Soybean Rust in KS, NE 6/11/03 to 6/13/03
Exercise 2 Soybean Rust in KS, NE 7/15/03 to 7/21/03
Exercise 3 Soybean Rust in AR, MS 8/5/03 to 8/7/03
Exercise 4 Soybean Rust in TN, NC 9/23/03 to 9/25/03
Exercise 5 Soybean Rust in IL, IA 1/14/04 to 1/16/04
Exercise 6 Soybean Rust in KY, SC and FL 3/11/04 to 3/23/04
Exercise 7 Soybean Rust in GA, VA 3/15/04 to 3/23/04
Exercise 8 Soybean Rust in S. TX, AL 3/16/04 to 3/25/04
Exercise 9 Soybean Rust in LA 4/13/04 to 4/15/04
Exercise 10 Soybean Rust in DE, MD and NY 5/25/04 to 5/28/04
Exercise 11 Soybean Rust in MN 8/31/04 to 9/7/04
Exercise 12 *Ralstonia* in MA 9/13/04 to 9/15/04
Exercise 13 Soybean Rust in MN 9/23/04 to 9/24/04
Exercise 14 Soybean Rust in CO and OK 10/25/04 to 10/27/04
Exercise 15 Soybean Rust in ND and SD 11/15/04 to 11/17/04
Exercise 16 Soybean Rust in N. TX 12/6/04 to 12/9/04
Exercise 17 Soybean Rust in WY, MT 2/1/05 to 2/4/05
Exercise 18 Potato Wart in ME 2/7/05 to 2/10/05
Exercise 19 Mystery disease on onion in NM 2/13/05 to 2/18/05
Exercise 20 Soybean Rust in IN 3/21/05 to 3/24/05
Exercise 21 Soybean Rust in PA 3/22/05 to 3/28/05
Exercise 22 *Ralstonia* in CT 3/2/05 to 4/12/05
Exercise 23 Sigatoka on Banana in Puerto Rico 3/31/05 to 4/12/05
Exercise 24 Soybean Rust in WV 4/21/05 to 4/29/05
Exercise 25 *Ralstonia* in RI 5/3/05 to 5/19/05
Exercise 26 SOD in Puerto Rico 5/12/05 to 5/25/05
Exercise 27 *Ralstonia* in NH 5/23/05 to 6/20/05
Exercise 28 Soybean Rust in NJ 6/7/05 to 6/13/05
Exercise 29 *Ralstonia* in VT 6/28/05 to 7/1/05
Exercise 30 *Ralstonia* in Washington 8/23/05 to 8/29/05
Exercise 31 Potato Wart in Oregon 10/11/05 to 10/14/05
Exercise 32 Citrus Canker in AZ 10/18/05 to 10/21/05
Exercise 33 *Ralstonia* in NY 4/10/06 to 5/1/06
Exercise 34 *Ralstonia* in MA 4/17/06 to 5/8/06
Exercise 35 *Ralstonia* in MD 4/24/06 to 5/22/06
Exercise 36 *Ralstonia* in MI 5/11/06 to 5/30/06
Exercise 37 *Sirex* in NJ 7/6/06 to 7/10/06
Exercise 38 GWSS and *Xylella* in HI, Guam 8/14/06 to 8/30/06
Exercise 39 Pathogen X on Wheat [UG99] in MT 9/7/06 to 9/13/06
Exercise 40 Exercise for SOD Potato Wart and ALB in AK 10/9/06 to 10/23/06
Exercise 41 Exercise for Citrus Canker in S. TX 11/16/06 to 11/20/06
Exercise 42 Exercise for ALB in AK 11-13-06 to 11/20-06

Information Technology Committee Report

Overview

The NPDN IT Network is a complex distributed system managing information and communications in a secure and reliable manner. The NPDN is organizing and collecting diagnostic records from designated laboratories at land grant universities, state departments of agriculture, and state and federal regulatory laboratories. This is a coordinated effort among the five Regional Plant Diagnostic Centers and Purdue University to mutually develop, maintain, and service a network of storage, management, and processing of plant diagnostic data in order to better detect and diagnose plant health problems and safeguard against newly introduced and re-emerging pathogens.

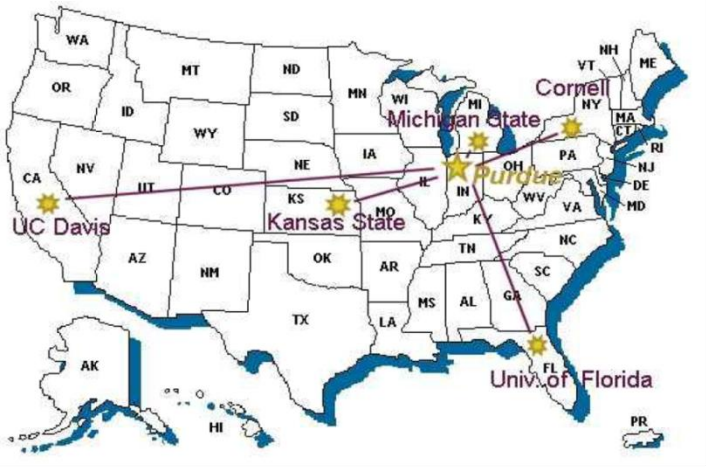


Figure 1. NPDN Regional Centers and NPDN database at Purdue University.

In addition to the IT development for the management and analysis of the diagnostic lab data at the local, regional, and national level, other IT information management components, which include such items as security assessment, secured communications, exercise scenarios, etc. which support the mission of the NPDN, have been implemented. Many of these IT developments evolved from joint discussions with NPDN committees to address a specific need in fulfillment of the mission.

Committee Members

Eileen Luke	Chair, CERIS-Purdue eluke@ceris.purdue.edu
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Carla Thomas	WPDN-UC Davis cthomas@ucdavis.edu

I. NPDN REGIONAL AND NATIONAL DATABASES

Introduction

The purpose of the NPDN was to establish a functional national network of existing diagnostic laboratories to rapidly and accurately detect and report pathogens, pests, and weeds of national interest. Diagnostic laboratories in each state have independent methods for collecting, storing, and retrieving information on submitted diagnostic samples. As a result, issues of standardization in how and what diagnostic information was to be reported had to be addressed in the regional and national systems. Each of the regional centers assessed its current state information systems and set up a regional database containing individual member state data. The Great Plains, North Central, and Northeast Diagnostic centers worked cooperatively to create a shared IT system called PDIS. (Plant Diagnostic Information System)

While the regions were working with their member states, discussions and efforts were taking place at the national level. An initial prototype for the upload was done by the Southern region and then, a joint meeting between the Diagnosticians and IT Committees was held in January, 2004 to determine the required fields that would be reported at the national level. Following the implementation of the system in 2004, major efforts took place in verifying that the diagnostic labs could upload test data and then actual production data into the national system. Concurrently, a major effort in developing standardized lists of pathogens and hosts with appropriate keyword searching was done to assist in producing reliable and consistent information.

SPDN - Southern Region

A database management system was established at the University of Florida to act as a storage location for all data collected from the states in the southern region. Included in this effort was the adaptation of PClinic, a commercial software system, for use within the SPDN network. Other states in the southern region also have or are developing software specifically for diagnostic labs with the goal of linking more existing labs into SPDN.

These data are currently forwarded to the NPDN database center at Purdue. Each state in the southern region was connected to the regional SPDN database by adapting existing diagnostics systems in each state to support an XML (Extensible Markup Language) protocol to connect and transfer data to SPDN. This was completed in March, 2004. The XML Schema fully specifies the type, nature, and format of data exchanged between the individual southern states and SPDN, and was also used as a model for other regional centers to send data to NPDN. The XML Schema has undergone several revisions since it was initially created in January of 2003. It was modified to support new "Phase I" data requirements in January 2004. An NPDN Client program has been developed and implemented for physically transferring data from SPDN to NPDN. The software communicates over a SSL (Secure Socket Layer) and includes error recovery and other security features.

GPDN, NEPDN, and NCPDN

The Great Plains, Northeast, and North Central regions developed a single web and database system. This system, Plant Diagnostic Information System (PDIS) facilitated communications and record keeping for diagnosticians, extension agents, first detectors, experts, and individual state department of agriculture personnel. This system is also responsible for transferring diagnosis data to the NPDN National database.

To start, the regions met with staff at each of the state diagnostic laboratories in their respective regions and assessed the various user needs. Request forms used, and fields that were stored at the state level were reviewed. Diverse activities were taking place in building an application that addresses the needs of all of the states. The three centers then worked to develop a system which handles all of the various user needs in diverse infrastructures. The PDIS system went live in spring 2004. Currently the system has 3,250 users, 109,258 sample records, 13,880 Sample digital images. The table below summarizes the information since the inception of the system.

Total number of sample records entered into the system per region from the inception of the system

Region	No. of sample records	No. of Images	No. of Diagnosticians
GPDN	23,588	8932	255
NEPDN	46,035	1731	82
NCPDN	32,490	1078	135

SAMPLE RECORD ENTRY:

Requesters such as extension personnel submit diagnostic requests complete with physical samples, form information, digital images etc. to the diagnostic lab. Diagnosticians send preliminary diagnostic reports back to the submitter to ensure rapid response and then a final report for accuracy and additional details. If a client sends or drops in samples, sample records for those samples can be entered into the system by the diagnostician.

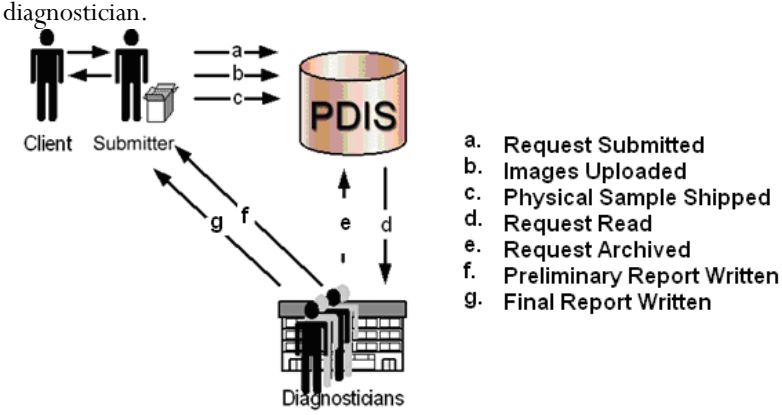


Figure 2. Diagram of PDIS sample record entry

Sample Images and Microscope Images:

Digital Images may be uploaded as elements of a request, referral, or report. The system supports the uploading of BMP (Windows Bitmap Format), JPG (Joint Photographic Group; compression technique), TIFF (Tag Image File Format) and PNG (Portable Network Graphics) image formats. Once uploaded, users are given a choice of download formats. In a similar manner, images generated from microscope digital camera systems can be captured and entered into the system. Diagnosticians can collaborate with other diagnostic labs over the internet and capture the microscope images directly to the system. Diagnosticians have the ability to enhance their reporting and record keeping capability by adding images with the reports.

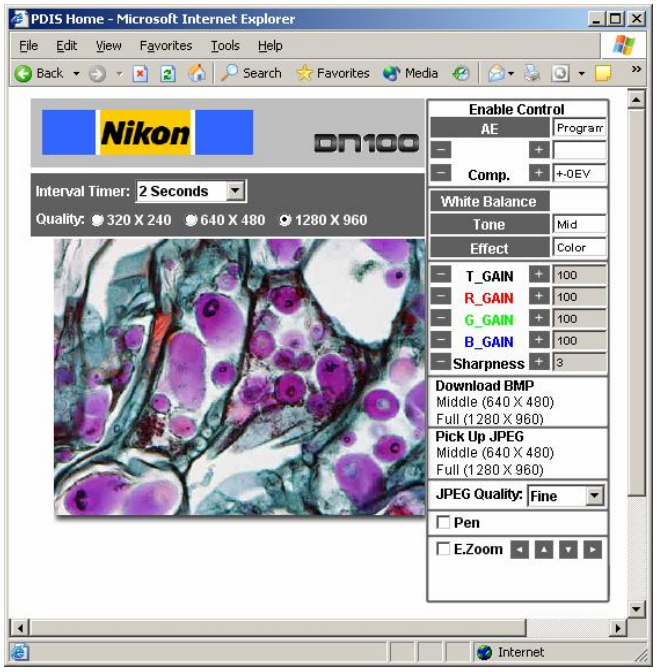


Figure 3. Image Acquisition from a Web-enabled Digital Microscopy Camera

DIAGNOSIS AND REPORTING:

Diagnosticians can send preliminary diagnostic reports back to the submitter to ensure rapid response and then a final report with accuracy and additional details. Reports pertaining to the diagnosis can be written and entered in stages. After entering a report, diagnosticians can extend their specifications by selecting the diagnosis. Diagnosticians can view, print and/or e-mail diagnostic reports back to requesters. The diagnostician determines the confidence level of the diagnosis and when to securely transfer sample data to the NPDN National database. The capability to transfer records in near real time exists.

WPDN – Western Region

Over the last five years the WPDN has developed a system that integrates data from each WPDN lab in the region into a regional database. This data is then sent to the NPDN National NPDN database. The WPDN system provides a means to quality check data before it is submitted to the National NPDN Repository, improved physical and network security compared to earlier versions, provides easy access for authorized personnel to controlled materials and information, and makes information available to regional members and the public regarding regional and national issues.

The WPDN has developed an NPDN Phase 1 compliant database allowing all WPDN lab members to fully participate in the NPDN diagnostic record collection. Through the use of a single standardized XML schema WPDN lab members can easily contribute data to the regional and national systems. The WPDN web interface allows members to submit their diagnostic record data either manually or through an automatic upload interface depending on the capabilities of their local lab information management system.

Tools were developed to allow the records submitted to be reviewed and validated, manually at the regional level before being sent to the NPDN National database at Purdue. In addition to the automated data validation performed at the time of upload, two user interfaces were developed within the web application that allow an authorized reviewer, who is a WPDN hub staff member, to check uploaded records for possible errors in content, i.e. a misspelled word or inappropriate entry into a certain field. The initial review interface enables an authorized reviewer to check the uploaded records and mark them as ready for final review, by a second WPDN hub staff member allowing for a two phase review system. The WPDN has also implemented two reporting interfaces that allow regional staff to search the database and report on the number of records present using pathogen, date, lab or host criteria.

In addition to the web data upload and review application, the WPDN IT maintains both public and secure sections on the regional website, www.wpdn.org. With the input of regional hub staff members, WPDN IT works to make available current news and event information, WPDN lab contact information, and other information useful to WPDN members and the public through the publicly accessible sections. Based on user account permissions, WPDN members can access secure sections to obtain controlled materials, such as confidential alerts about current outbreaks, training documents and presentations, and pest/pathogen biology and diagnostic protocol information which require restricted access WebPages. The WPDN will continue to make improvements in all of these areas as well as add new functionality and capabilities.

NPDN National Database

The NPDN National Database represents the 'national view' of the diagnostic lab data. The software has been developed so that the diagnosticians can only access their specific lab data, and run the queries, maps, charts, etc. The results of searches containing queried information can be output to a text file, CSV (Comma Separated Values) file, or as an XML file. Maps and charts can be generated in a real time basis and the output can easily be incorporated into other reports or documents. Access to the National Database System is very limited as required in the NPDN Security Access Policy. However, software access at the regional and national levels is implemented so that upon final approval of the data access policy, appropriate access can be granted immediately. The appendix shows samples of system queries and the tools available with Soybean Rust data which is not in violation of the security policy.

DATA DICTIONARIES – One of the major responsibilities at the national level has been the development and maintenance of the dictionaries, particularly the Pest and Host. These dictionaries are available for downloading in a real-time basis in XML format, EXCEL format, or as an ASCII file. The initial dictionaries were reviewed and edited using first the original NAPIS list and then modifying it and incorporating various 'lists' from the other regions. A National Database Committee was recently formed to have regular input and review in naming conventions, etc.

UPLOAD OF DATA TO NPDN NATIONAL DATABASE – Reviewing the quality of the data uploaded and understanding the process from the various regions has been a critical task at the national level. At the joint NPDN IT/Diagnosticians meeting held at Purdue University in 2006, revisions were made to the confidence levels reported as agreed upon by consensus. Now the diagnosticians report Confirmed, Not Detected, Suspect, or Inconclusive. In addition, a new field, Lab Method was added. The software was developed at the NPDN national database so that the 'old' fields and 'new' fields could be run in parallel in order to minimize the hassles of the diagnostic labs. In addition, more pro-active efforts have taken place in developing software which reports to each of the regional centers the results and errors in their data uploads. Figures 4 and 5 show summary information of the records uploaded as of 12/14/06.

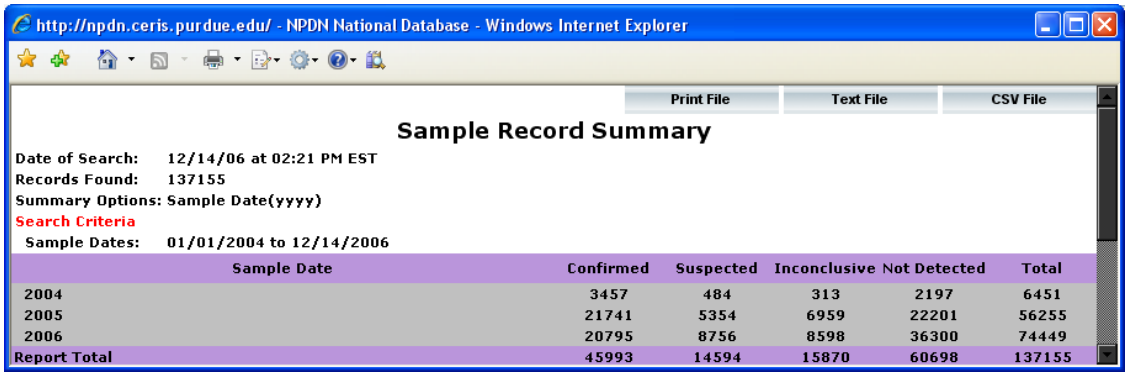


Figure 4. NPDN record totals by year

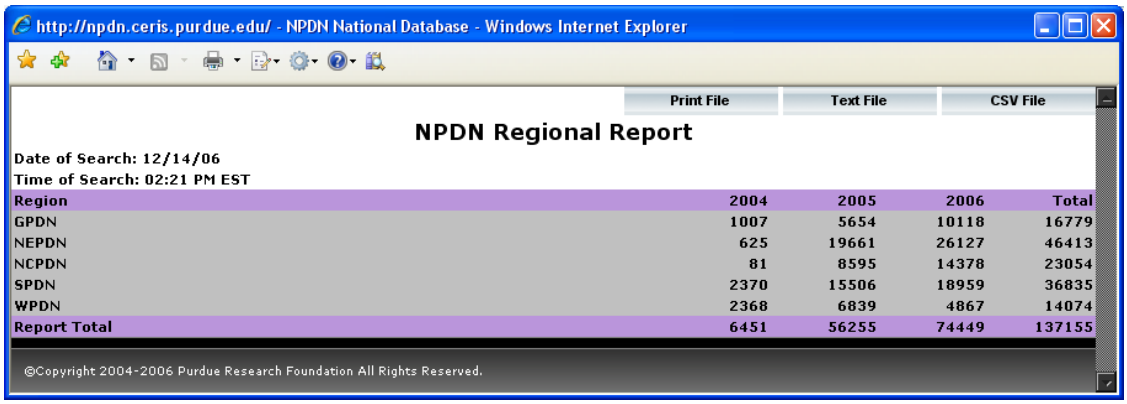


Figure 5. NPDN record totals by region

II. Security

Security has been a major component of the IT development of the NPDN. Recognizing its importance and the need to incorporate security within the developing IT activities, expertise was brought in from CERIAS, (Center for Education in Research and Information Assurance Security) at Purdue University. CERIAS' expertise and participation in this project has helped the IT staff of the NPDN to accomplish and incorporate significant security objectives and obtain greater knowledge in this area at a much faster pace.

As the first step, a CERIAS staff member traveled to each of the regional diagnostic centers and the national database site to do a security assessment. For each site, interviews with key staff members were conducted, a visual walk through of the facility was done, network infrastructure and systems were probed, and the overall security posture was assessed. Each NPDN Regional Center and Purdue received a report documenting the weaknesses and vulnerabilities discovered. In addition, an overall aggregate security assessment report was done for the entire NPDN and was distributed to the centers and the National Program Leader. The security assessment work started in late spring, 2004 and the site assessments were conducted late summer 2004 – fall 2005. The national aggregate report was completed in February, 2005 and is included in the appendix. Following the security assessment, it was determined that systems security training would significantly benefit the IT staff of the NPDN. As a result, two systems security training sessions were conducted, one at Purdue University in March, 2005 and at Kansas State University in June, 2005.

As a follow up to the Security Assessment Report that was generated for each regional center and Purdue, a second survey was created to determine overall efforts taken to address security issues. The responses were sent back to CERIAS staff in a secure fashion, and a second aggregate report was developed for the NPDN to assess the current security status. This second report is also included in the appendix.

For future security developments, systems will be developed by CERIAS and then sent to the regional sites, so that IT staff at the regional sites can utilize the security monitoring network software. Efforts were first done to secure the regional centers' access recognizing the need to protect the main hubs of information. As a logical step, a security awareness program is being developed for the diagnosticians to secure the information at the lab level.

III. Other IT Accomplishments

Content Management/Portal System

The need to change the content of web sites by different authors without requiring the immediate intervention of the Web Master or IT support contact would be extremely useful in allowing a more efficient manner in keeping information current on the regional and national web sites. The Content Management/Portal System software was implemented as a solution to this problem by three of the regions. Implementation of this software required an individual 2 day meeting between the regional IT contact and Will

Baldwin at KSU to restructure and redesign the web site to take advantage of the software features. Once implemented, individuals can be assigned specific areas of authorship. Minimal training for the individual authors is required and can be done by the regional IT contacts or web masters. This has allowed better management of the national web site and its various committees posting

Learning Management System for Training

This project, which began in May of 2004, utilized learning management system for development, distribution, tracking, and evaluation of educational training materials within NPDN.

Secure Communications

Recognizing the security issues of email, along with its potential unreliability in notifying key people of a significant outbreak, a secure communications system has been developed. The Secure Communications Module allows for communication within the system between users and provides all of the functionality of email with the addition of encryption, security, tracking, secure archiving and increased size capability. Users must authenticate their credentials to send, check, and read messages from the secure web site. All communications are encrypted using FIPS approved federally recognized Triple DES algorithms for added security. A notification system has been set up contacting via cell phone text messaging and email to check the secure web site for the critical message. Also, a complete log of who has been notified and checked the secure information site is recorded, as well as providing the necessary information of who yet remains to be notified. Special recipient groups such as the NPDN Operations Committee have been set up so that the user can quickly send a critical message.

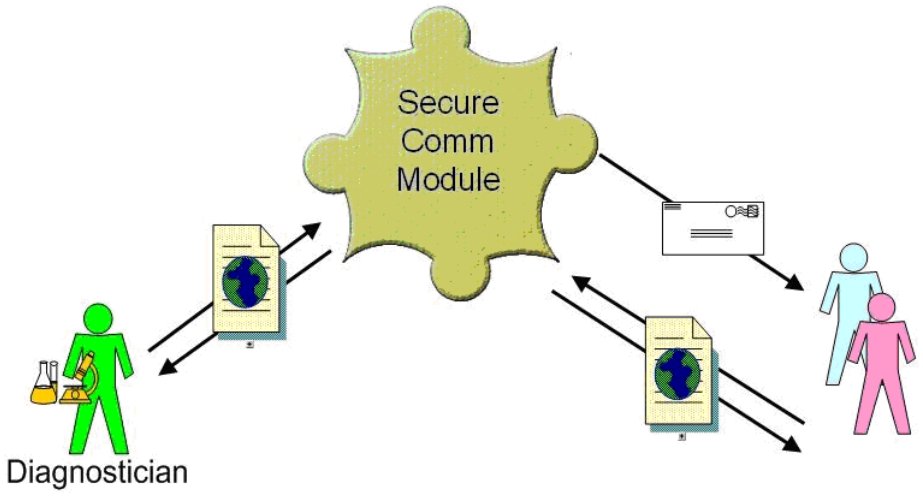


Figure 6. Secure Communications Module diagram

The key advantages of the Secure Communications Module are –

- Allows a single person to quickly send potentially sensitive information to a large number of recipients. It is very hard to accomplish this with telephone calls without leaving messages with people or machines.
- Allows the sender to keep the message consistent for a large number of recipients. It is very hard to accomplish this with telephone calling trees.
- Allows the sender to package large amounts of supporting materials up to 500 Mbytes with the message (encrypted). Traditional email can only attach 3 Mbytes of files or less (unencrypted).
- Allows the sender to audit who has not received the message in real-time and follow up with messages to backup contacts. This is impossible with traditional email and voice mail.
- Allows for after-action communication analysis.

Exercise Scenarios

The Exercise Scenario Committee was formed out of a need to rehearse a protocol (our NPDN SOP) which would be used following the detection of a suspected high risk pest and to aid in the understanding of the roles and responsibilities of all of the participants. The Exercise module is used to facilitate the NPDN National Exercise. The software was developed so that the Exercise Facilitator/Coordinator manages a particular exercise from design and implementation, to after action analysis. Participants can view the exercise instructional material and log their entries. Following the completion of the exercise, the complete log of communications can be reviewed by the committee and the participants to assess the exercise training and determine modifications needed in the communications protocol.

Image Library

The overall goal of the image library is to provide a large database of plant diagnostic related images that faculty, students, government agencies can use for publications, presentations, and reports. Images can be submitted to the library by any faculty or personnel from PDIS participating institution which has an account. A quality assurance workflow is set up at each institution to approve incoming image submissions. Diagnosticians can also submit images directly from the diagnostics module. The image library is searchable by taxonomic serial number, (TSN), common name synonyms, scientific name synonyms, disease name, pest name, photographer, county and state, description and image size.

EPIDEMIOLOGY

Initially parallel IT activities were taking place in epidemiology. Weather data layers were developed with insect and plant phenology degree day models, disease risk models, and weather information derived from over 6,200 weather stations throughout the country. Concurrently the NPDN national database was developed with data retrieval, mapping capability, and quality assurance. With both of these components developed,

significant effort took place in the merging of these products in an automated output. In the merged activities, a primary feature was that the data is retrieved from the NPDN national database and the tools developed at Oregon State University are pulled into NPDN National database development at Purdue University where security access is in place maintaining the goals of the NPDN data sharing policy. The first step was to take a static soybean rust data set and display it through an ARCIMS server. Then the next step was to create the software to dynamically retrieve the data from the NPDN national database, and pass it to the ARCIMS server for a map display. The degree day layer file developed at Oregon State University was then pulled from the OSU server and converted to raster grid, which is a format compatible with ARCIMS. Next the soybean rust layer map and the raster grid containing the degree day information were overlaid producing an epidemiology map of counties with confirmed soybean rust, counties with samples negative for soybean rust, and temperature degree days. This was a significant milestone in achieving an automated process. A diagram of this process is below.

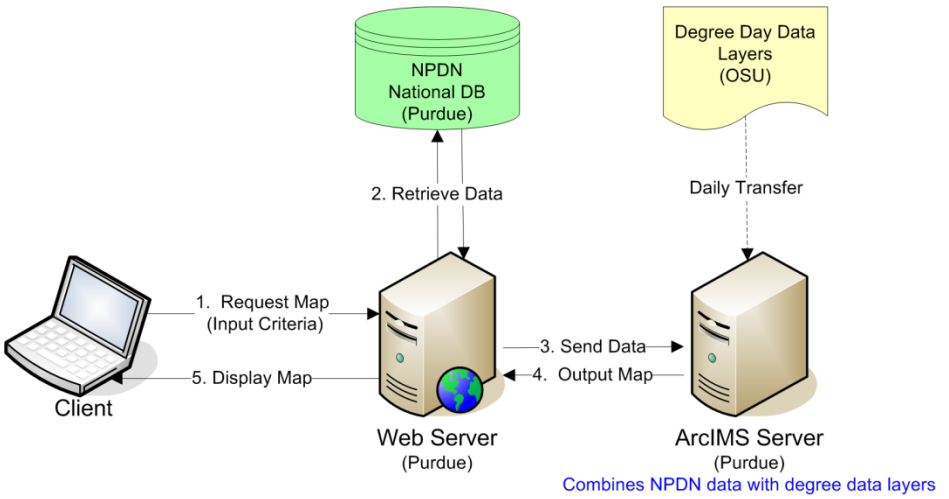


Figure 7. Diagram of automated communications processes that facilitate epidemiological analyses

Further developments in handling multiple users accessing the data are being explored with the use of ArcXML, Javascript, PERL (Practical Extraction and Report Language) and HTML (Hypertext Markup Language) in the display of these dynamic data layers. In addition, the overall efficiency of the layered map creation is being assessed. Further developments in phase 2 which will allow for the collection of more data fields so that more types of analyzes can be conducted have begun with the WPDN serving as the lead in this effort because of its lead role in epidemiology.

NPDN National Database Budget - Purdue University

Purdue University has the national responsibility for the IT expenditures of the NPDN. The main expenditures include the basic IT costs of major hardware and software, salaries and fringe benefits of CERIS staff, travel which includes travel for IT staff from other regions for attendance at key meetings and training, CERIAS costs which are primarily salaries and fringe benefits for the security assessment, training, and support of

the NPDN, epidemiology costs which are covered in the sub-contract with Oregon State University, and a small sub-contract with Kansas State University in support of the national modules that are used by all NPDN users. The chart below shows the money spent to date as of 11/30/06 covering the entire period of the cooperative agreement.

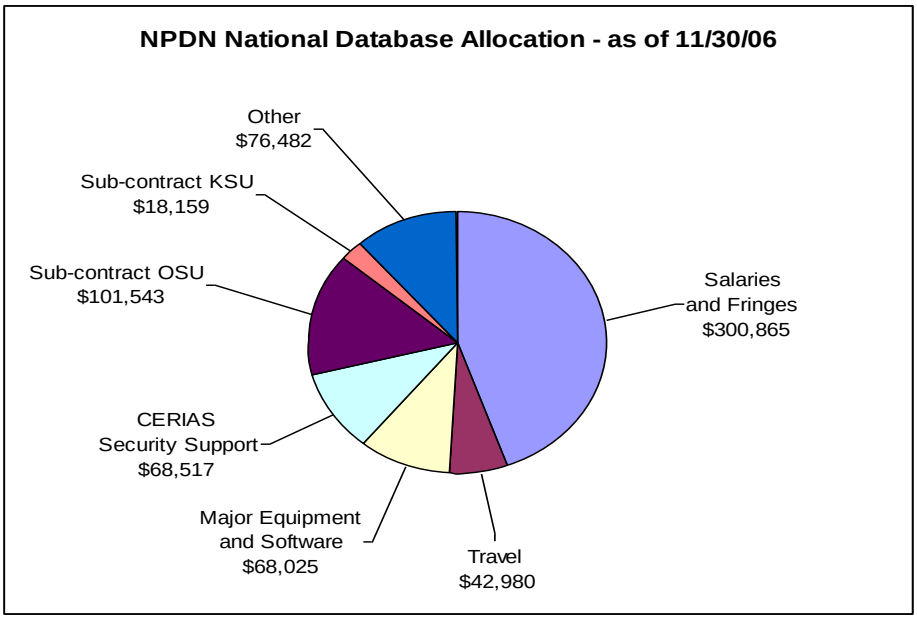


Figure 8 CERIS NPDN National Database Funding Allocations

In addition, Purdue University was recently awarded a $100,000 INFOSEC supplemental. The breakdown of the budget is:

Description	Amount
Sub-contract with Michigan State University – (Network Isolation and Control, Physical Security)	$20,000
Sub-contract with Cornell University - (Physical Security)	$10,000
Security Awareness and Training for the NPDN users and diagnosticians	$30,000
Operational Security for Regional IT Administrators	$15,000
Information Security Program and Policy for laptops and other portable devices	$1,000
Enhanced Security Training For IT Administrators (travel included)	$24,000
Total	**$100,000**

CD-ROM APPENDICES

- IT/Diagnosticians Meetings
- Miscellaneous
- Presentations
- Required Fields
- Security
- Status Reports

National Database Committee Report

Overview

The goal of the National Database Committee members is to create guidelines and review documents to instruct NPDN users how to properly use the National Repository system. Also to review existing data fields to determine if they meet current needs.

Since the creation of the committee in January of 2006, members have identified needed changes to the data fields of the host and pest codes of the National Repository, have reviewed the listings for duplications and errors, have created a guidelines document for users and have created definitions of level of confidence terms to provide a consistency for all the users of the system. Accomplished objectives will be addressed in the ***National Database Committee Progress*** section and ***Success Stories*** categories. Further continuation, improvements, and plans to address future objectives will be covered in ***Future Plans.***

Progress

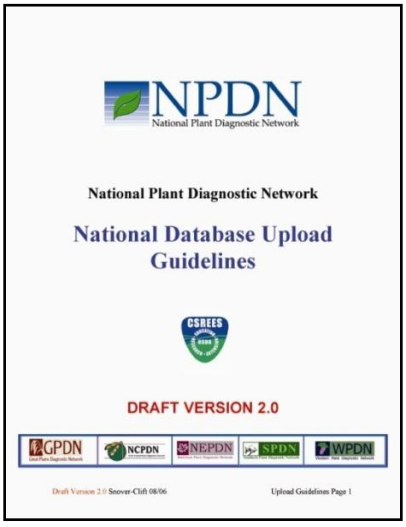
The National Database Committee was created due to address the arising need to review the existing database and ensure it meets the needs of the NPDN members. Additionally there was a need for a document that clearly provides definitions of terms and instructions for the submission of data by the users. Since its creation committee members have met on a regular basis during monthly conference calls to discuss revisions to the database, definitions of terms, and requests made by the users. The guidelines document is an enormous task as it needs to incorporate all the on-site laboratory databases that are used throughout the NPDN system. This group has taken on the task of determining if change requests are valid and should be made

Committee Members

Karen Snover-Clift	Chair, NEPDN-CU
David Barber	SPDN- UG
Andrew Coggeshall	WPDN-UC Davis
Nancy Gregory	NEPDN-UD
Will Lanier	GPDN-MSU
Mark Mayfield	GPDN-KSU
Karen Rane	NCPDN-PU
Virginia Russell	CERIS-National Repository-PU
Carla Thomas	WPDN-UC Davis
Tim Tidwell	WPDN-CA CDFA
Ann Vitoreli	SPDN-UF

ACCOMPLISHMENTS

- The Committee was created at the 2nd IT-Diagnosticians Meeting, West Lafayette, IN during January 9-10, 2006.
- Defined new level of confidence terms.
- Reviewed and recommended changes to the current abiotic EPA pest codes.
- Discussed general questions about how to handle certain situations such as…How do you report the finding of an insect when you only can identify it to the family level?
- Designed the layout and created a draft version of the NPDN Upload Guideline. This document will help diagnosticians determine what information is important and how to upload it in a consistent manner.
- Reviewed and recommended changes to the current nematode EPA pest codes.
- Created a review team to process user change requests to the EPA code listings.
- Assisted in the planned and coordination of the 3rd IT-Diagnosticians Meeting, focusing on "Phase 2" of data collection, held in Kansas City, MO on October16-17, 2006.
- Reviewed and recommended changes to the current EPA host codes.



Publication

Released 1st draft version 2.0 of National Database Upload Guidelines, August 2006.

Workshops

- 2nd IT-Diagnosticians Meeting, West Lafayette, IN during January 9-10, 2006.
- 3rd IT-Diagnosticians Meeting, Kansas City, MO on October16-17, 2006.

FUTURE PLANS

The NPDN Database Committee members need to finish the reviews of the host code listings and begin the reviews of the fungi, bacteria, viruses, phytoplasmas and insects found in the pest code listing. The committee members will continue to serve as the change management reviewers as users of the system submitted change requests. Completion of the Upload Guidelines is a high priority of the committee members.

ADDITIONAL DOCUMENTS

NPDN National Database Committee Webpage: Conference call minutes and draft documentation of the Upload Guidelines Policy, http://www.npdn.org/DesktopDefault.aspx?tabindex=1&tabid=40 .

Website Committee Report

Overview

The purpose of the National Plant Diagnostic Network (NPDN) Website Committee is to represent the efforts of Network Websites to the Operations Committee in policy and development decisions. This includes content, format, access levels, and security for both regional and national websites. The goals of this committee are to 1) develop an effective electronic communication tool for members of the NPDN, federal policy makers and funding agencies and the general public 2) establish policy and 3) maintain consistency across all regional and national websites.

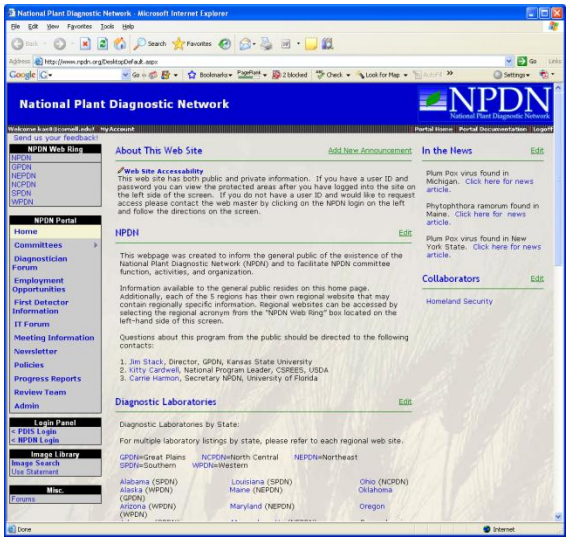
Accomplished objectives will be addressed in the ***Website Committee Progress*** section category. Further continuation, improvements, and plans to address future objectives will be covered in ***Future Plans.***

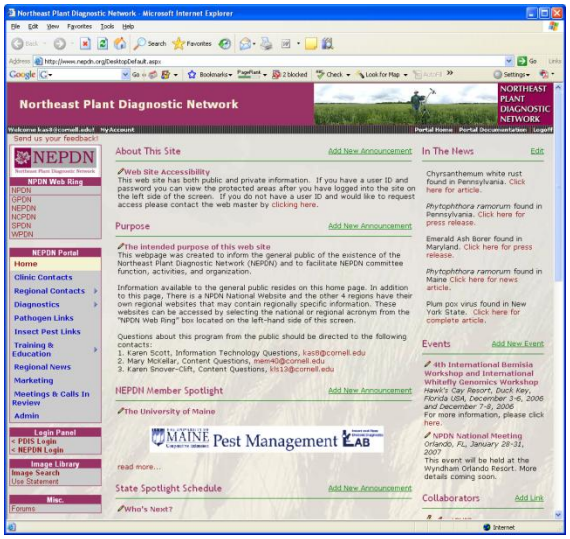
Committee Members

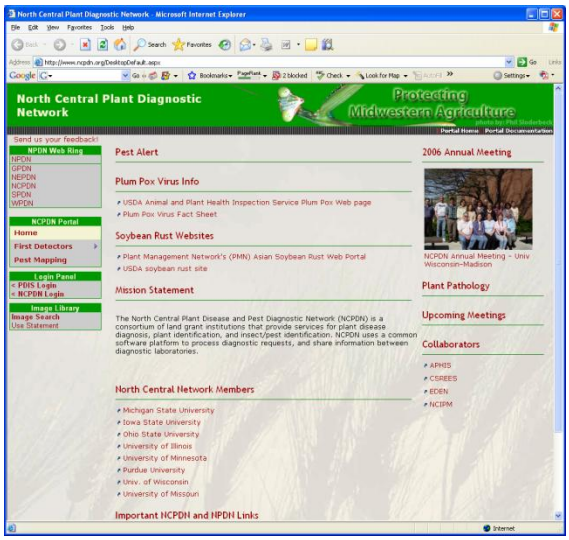
Karen Scott	Chair, NEPDN-CU, IT Support
Andrew Coggshall	WPDN- UC-Davis, IT Support
Lee Duynslager	NCPDN- MSU, IT Support
Carrie Harmon	SPDN- UFL
Eileen Luke	PU- CERIS
Mary McKellar	NEPDN- CU, Training & Education Coordinator
Judy O'Mara	GPDN- KS, Plant Pathologist
Karen Snover-Clift	NEPDN- CU, Plant Pathologist
Carla Thomas	WPDN- UC-Davis

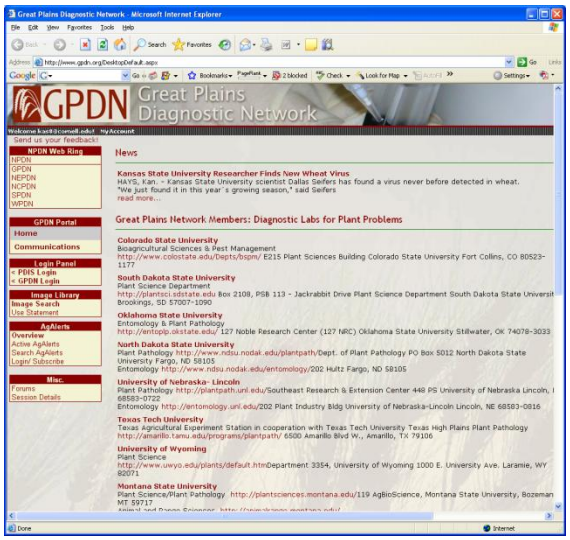
Website Committee Progress

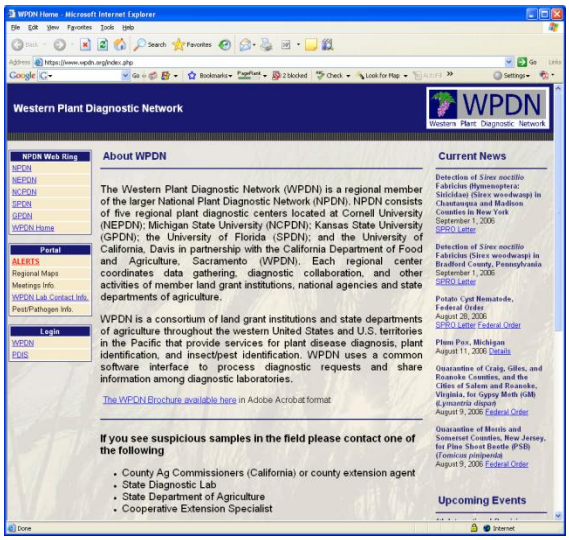
The Website Committee is a vital function of the NPDN. Web portals have been designed by programmers at Kansas State University and are in use by three of the five regions as well as the national site. The portals use a content management system that streamlines the editing process of individual pages. Chairs of each of the committees are responsible for keeping their pages up to date with meeting minutes, progress reports, announcements and membership information. The entire National web site is available to the Operations Committee.

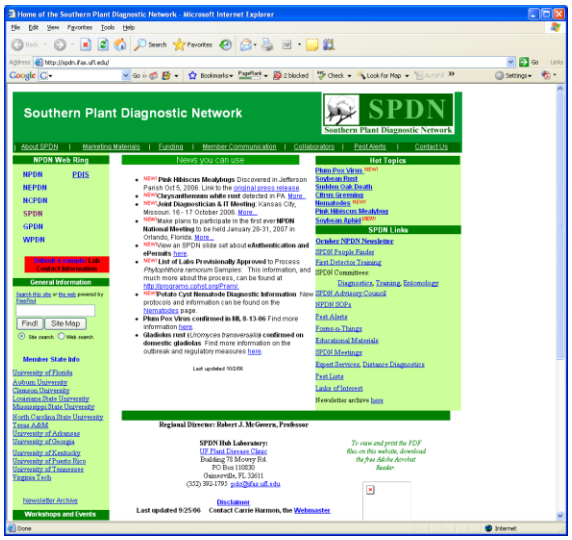

National Plant Diagnostic Network
NPDN
About This Web Site
In the News
NPDN
Diagnostic Laboratories
Collaborators


Northeast Plant Diagnostic Network
About This Site
In The News
Purpose
NEPDN Member Spotlight
Pest Management LAB
State Spotlight Schedule
Events
Collaborators


North Central Plant Diagnostic Network
Protecting Midwestern Agriculture
Pest Alert
Plum Pox Virus Info
Soybean Rust Websites
Mission Statement
2006 Annual Meeting
Plant Pathology
Upcoming Meetings
Collaborators
North Central Network Members
Important NCPDN and NPDN Links


GPDN Great Plains Diagnostic Network
News
Great Plains Network Members: Diagnostic Labs for Plant Problems


Western Plant Diagnostic Network
WPDN
About WPDN
Current News
Upcoming Events
If you see suspicious samples in the field please contact one of the following
County Ag Commissioners (California) or county extension agent
State Diagnostic Lab
State Department of Agriculture
Cooperative Extension Specialist


Southern Plant Diagnostic Network
SPDN
News you can use
Hot Topics
SPDN Links
Regional Director: Robert J. McGovern, Professor

ACCOMPLISHMENTS

The Web Committee has drafted two policies to be presented to the Operations Committee for approval. The first is to address the access rights of each web site and the second is for entries into the "presentation log" for all Network meetings, exhibits, conference calls, poster sessions, video conferencing, and promotional efforts of the NPDN. We have also put into place a standard information request to be used for anyone requesting access to secured sections of the sites. This allows us to have as much information as possible as to who is requesting access and why.

FUTURE PLANS

The web committee is in the process of creating a "site map" template to be used by all related Network sites. The goal is to standardize the content as well as the "look and feel" of each site. Users needing information from a regional site can expect to find similar information located in similar areas of other regional sites. Each region maintains it own identity but also shows the consistency as a Network member.

ADDITIONAL DOCUMENTS

- http://www.npdn.org/DesktopDefault.aspx?tabindex=1&tabid=27
- NPDN Site Map
- NEPDN Site Map
- Draft Presentation Log Policy Document
- Draft NPDN Regional Center Web Site Access Policy

Training and Education Committee Report

COMMITTEE MEMBERS

Amanda Hodges,	Chair, University of Florida
Will Lanier,	Montana State University, Co-Vice Chair
Mary McKellar,	Cornell University, Co-Vice Chair
Dick Hoenisch,	UC-Davis, Secretary
Howard Beck,	University of Florida
Steve Cain,	Purdue University, EDEN
Keith Douce,	University of Georgia
Marty Draper,	USDA CSREES
Larry Halsey,	University of Florida
Bill Hoffman,	USDA CSREES
Clayton Hollier,	Louisiana State University
Gerald Holmes,	North Carolina State University
Bob McGovern,	University of Florida
Tim Momol,	University of Florida
Cindy Richardson-Decker,	North Carolina State University
Gail Ruhl,	Purdue University
Marietta Ryba-White,	Kansas State University
Pat Skinner,	Louisiana State University, EDEN
Luther Smith,	CCA
Karen Snover-Clift,	Cornell University
Gerry Snyder,	Kansas State University
Jim Stack,	Kansas State University
Harold Watters,	CCA and Ohio State Cooperative Extension Service
Nina Zidack,	Montana State University

OVERVIEW

In keeping with the overall mission of the NPDN, to enhance the security of national agricultural and natural resources by quickly detecting introduced pests and pathogens, the Training & Education Committee provides leadership, guidelines, and direction for the national ***First Detector Training Program***. The national First Detector Training Program website concept design, user access, and content were created de novo by the committee and the program has evolved substantially since its inception in 2003. The mission of the NPDN Training and Education Committee's First Detector Training Program has consistently been driven by the following objectives:

- Objective 1: Immediately deliver First Detector training and information to critical audiences
- Objective 2: Provide a useful web interface for training session organizers to submit and review training details

- Objective 3: Development of new and updated training content first for NPDN members and then for WWW extension educators;
- Objective 4: Interface with online learning options and distance education alternatives

Accomplished objectives will be addressed in the ***How do we Train?*** and ***Success Stories*** categories. Ongoing activities, improvements, and plans to address specific objectives will be covered in ***Future Plans.***

WHO DO WE TRAIN?

The First Detector Training Program is a vital function of the NPDN because ***First Detectors*** play an important role in facilitating an effective and rapid plant diagnostic system. These individuals include anyone who in the course of their activities is in a position to notice an unusual plant pest outbreak, a pest of concern, or symptoms of a pest of concern. Pests of concern may include plant pathogens, arthropods, nematodes, weeds, or other plant pests that could have a significant negative impact on crops and natural resources. First Detectors include a wide variety of individuals from the private sector, commercial firms, academia and government such as Cooperative Extension Service personnel, crop consultants, certified crop advisors, pest control advisors, agricultural inspectors, growers, commercial seed or chemical representatives, Master Gardeners, Natural Resource Conservation Service (NRCS) staff, county agricultural commissioner staff, and others involved in plant growth or management.

An ***NPDN First Detector*** is an individual who has participated in a training course to enhance agricultural biosecurity by interacting effectively with plant diagnostic and pest management systems. First Detectors enrolled in the ***National First Detector Registry*** receive the ***NPDN First Detector Newsletter*** and pest alerts. Currently, over 3000 registered First Detectors have attended training sessions with the NPDN. County extension agents and general biologists have comprised the majority of the First Detector audiences. Crop focus areas for First Detectors have been very diverse, and have ranged from turf/ornamental, forestry, field crops, to other food crops and commodities.

Over 300 (Figure 1) basic awareness training sessions have been conducted by NPDN members since the inception of the Network. We estimate that over 12,000 individuals in First Detector audiences have received at least basic awareness information concerning the mission of the NPDN and agricultural biosecurity, and approximately 6000 (Figure 2) First Detectors have officially registered with NPDN.

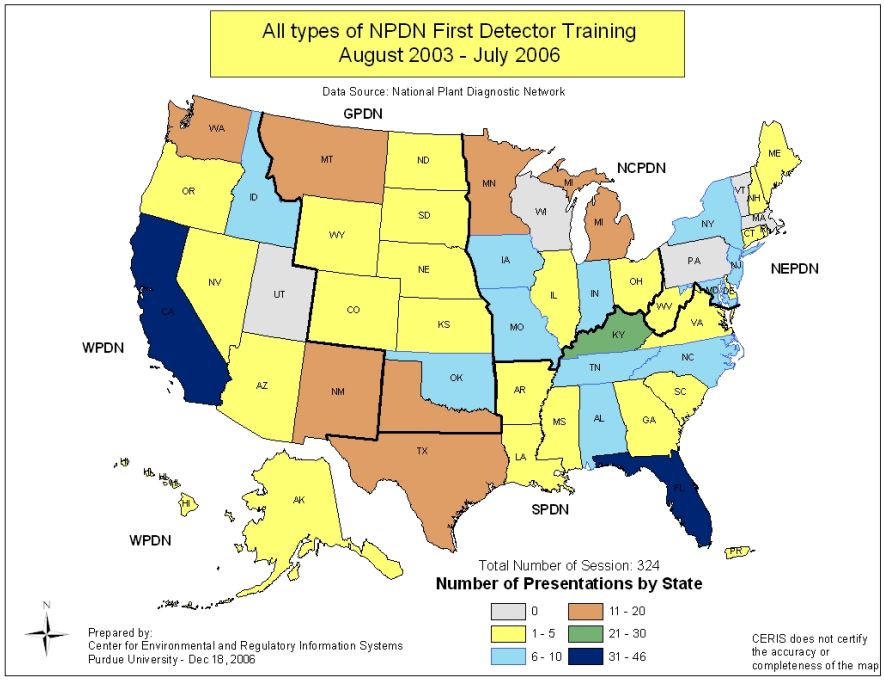


Figure 1: Number of training sessions conducted by NPDN state. Mapping provided by the Center for Environmental and Regulatory Information Systems at Purdue University. Accuracy of information is dependent upon data in the NPDN First Detector database.

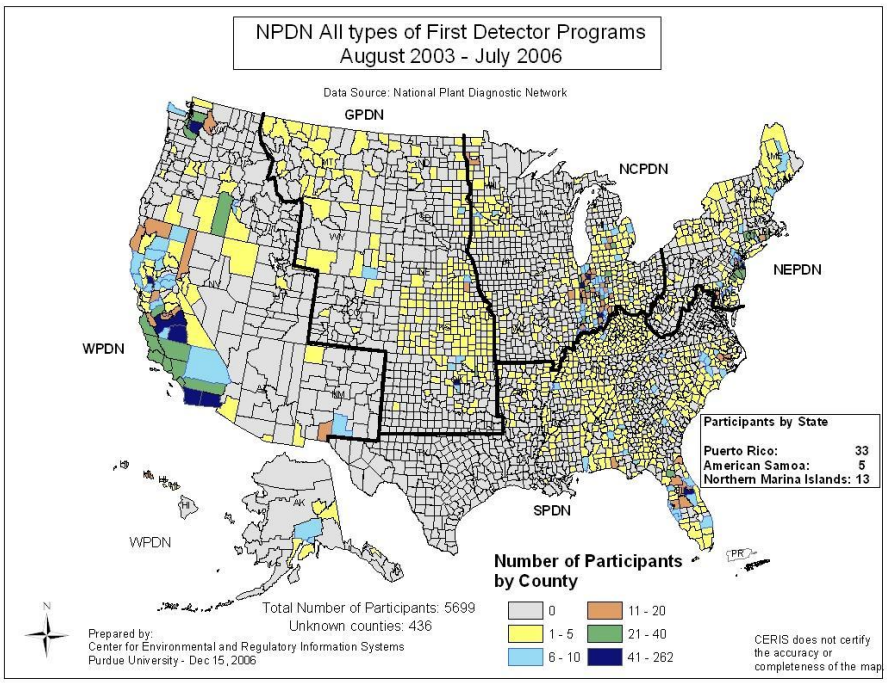
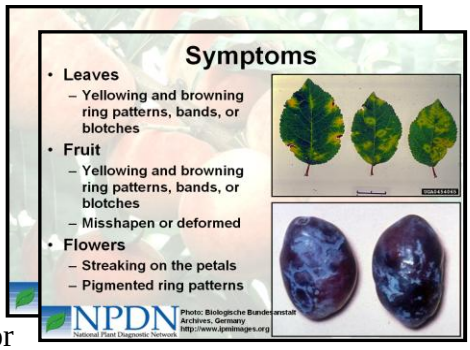


Figure 2: Number of NPDN participants by county. Mapping provided by the Center for Environmental and Regulatory Information Systems at Purdue University. Accuracy of information is dependent upon data in the NPDN First Detector database.

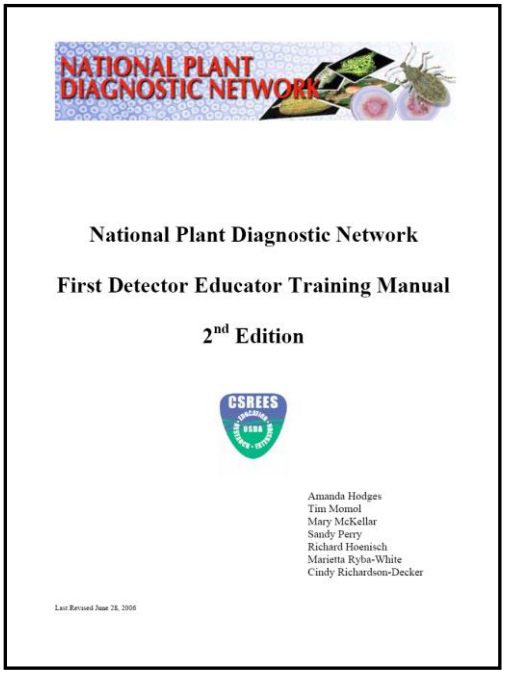
How do we Train?

Effective First Detector training and educational materials are vital to the success of the NPDN's mission to equip critical audiences with the appropriate information to detect and report high-risk plant pathogens and other pests. The development of training guidelines and core modules for First Detector educators was essential to achieving the committee's primary objective (***Objective 1***): immediate deployment of First Detector training during late 2003/early 2004. ***Core Training Modules*** were made available to all NPDN members by February 1, 2004 for the First Detector Training Program including the following:



- Module 1: The Mission of the NPDN and Agricultural Biosecurity
- Module 2: Monitoring for High Risk Pests
- Module 3: Quality and Secure Sample Submission
- Module 4: The Art and Science of Diagnosis: Plant Pathogens and Arthropods
- Module 5: First Detector Exercises
- Module 6: Effective Photography for Digital Sample Submission

Much of the core training for 2003-04 was based on the 'prototype' First Detector training conducted by the SPDN during the spring of 2003. The NPDN Training and Education Committee continued to develop and revise guidelines for the national First Detector Training Program during the spring of 2004, and the overall programmatic guidelines were formalized in a ***First Detector Educator Training Manual*** that was first released during July 2004. The training manual has been continually updated, and major revisions reflecting updated programmatic policies were completed and released during June/July 2006. Individuals conducting First Detector training sessions (i.e. First Detector Educators) are encouraged to review the latest version of the NPDN First Detector Training Manual, available on the ***NPDN First Detector Information Page*** (housed on the main NPDN page



http://www.npdn.org/ and available to the WWW under the 'NPDN Portal'), for more information prior to conducting a training session.

National implementation of a training program created a need for consistent and simple data reporting and retrieval. In addition to continuing with nationwide training program implementation (***Objective 1***), much of the committee's efforts during late 2004 to the present have involved database and web interface development for training session reporting (***Objective 2***). A web interface for training session entry and consistent reporting was available on the SPDN site during January 2005-June 2006. During July 2006, the committee transitioned to a new web interface http://cbc.at.ufl.edu/ with improved user features such as 1) the ability to review and edit participant and session information, 2) Regional Training and Education Coordinator access to data on a regional scale, 3) improved features for session organizers to encourage participants to register online in advance of a meeting, and 4) a detailed error report log with improved mechanisms for reporting errors in the system.

The NPDN has also collaboratively worked on regional or national pest alerts with the IPM Centers, USDA APHIS, USDA ARS, and others. Pest alerts are posted on the North Central IPM Center webpage: http://www.ncpmc.org/alerts/.

NPDN involvement was included for the following pest alerts:

- Cycad *Aulacaspis* scale, *Aulacaspis yasumatsui*
- Lobate lac scale, *Paratchardina lobata*
- Pink hibiscus mealybug, *Maconellicoccus hirsutus*
- Sudden oak death (SOD)/*Ramorum* blight
- The Spanish-translation of the Soybean Rust Pest Alert
- *Tospoviruses*
- Wood Boring Insects

Please see **the *Appendix*** for examples of educational products.

Success Stories

There are numerous examples of the positive outcomes of First Detector training for participants in the NPDN. First Detectors have successfully detected and reported new finds of significant pests to their local NPDN diagnostic laboratory. Some of these success stories include the following:

Alaska The Cooperative Extension Service (CES) functions as the Alaska hub for the Western Plant Diagnostics Network (WPDN). WPDN is one of the keys to our Homeland Security effort to protect agriculture and natural resources in our nation by connecting

diagnostic laboratories and experts. In 2006, CES-Alaska hosted a hands-on microscope workshop, distance diagnostics, and First Detector and Educator Training. Extension and State Department of Agriculture and USDA Forest Service staff from throughout the state attended the training. Melodie Putman, director of the Oregon State University Plant Clinic and Carla Thomas, Western NPDN Deputy Director provided information to participants.

OREGON The digital diagnosis system (purchased with NPDN funds) allowed the Oregon State University Plant Clinic to diagnose late blight of potato in Alaska during 2005, a disease which is not established there. Alaska has a small but important seed potato industry, and rapid diagnosis allowed protection of that industry. Training provided to the IPM scouts in Alaska during 2004 was instrumental in this early detection of late blight in 2005.

FLORIDA Dr. Anthony Camerino, Horticulture Agent and Master Gardener Coordinator for the University of Florida, Citrus County Cooperative Extension attended a 'High Risk Pest First Detector Training' during May 2006. In August 2006, a few homeowners talked to Master Gardener volunteers about an insect that didn't exactly look like the leaf-footed bug common to their area. The Master Gardener volunteers brought the specimen to Anthony who immediately suspected that the leaffooted bug was the recently detected *Leptoglossus phyllopus.* Specimen identification was confirmed by Lyle Buss, UF/IFAS Insect Identification Lab. This was the first find of this important plant pest in Citrus County, Florida.

MARYLAND In January 2005, following up on a call from a Maryland homeowner who had read a University of Maryland Cooperative Extension newspaper article about exotic beetles in wooden craft products, Maryland Department of Agriculture (MDA) entomologist Matthew Travis collected multiple *Callidiellum villosulum*, brown fir longhorn beetles, that had emerged from kiln dried certified artificial Christmas trees manufactured in China. Because this insect appears to be capable of attacking living trees and could survive in the southern third of the United States, it is considered to be a high-risk pest. The subsequent recall of these products from China was the fourth in six months. As a result, the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS), beginning April 1, 2005, suspended the importation of certain wooden craft items from China, such as trellises and artificial Christmas trees with wooden trunks, pending the adoption of mitigation measures by Chinese exporters.

In response to a September 2006 mailing from the Maryland Department of Agriculture (MDA) to landowners regarding the emerald ash borer and as a result of Northeast Plant Diagnostic Network (NEPDN) First Detector training efforts, a Maryland homeowner reported a dying ash tree exhibiting symptoms as described in the letter. MDA survey entomologist Dick Bean and his crew visited the homeowner's yard and found an ash tree that was heavily infested with emerald ash borer larvae and had multiple exit holes. The MDA is taking aggressive action to find and eradicate this devastating pest of ash trees in the state. Because of this homeowner's call, the MDA was able to further delimit the emerald ash borer population in Maryland, and expand their eradication buffer to include this known infested area.

MICHIGAN In 2005, all Michigan field crops extension agents attended an NPDN First Detector Educator training session with a soybean rust emphasis. Fourteen of those agents subsequently volunteered to scout twenty USDA/PIPE soybean rust sentinel plots in both 2005 and 2006. The quality of the information they received at the training session on scouting, handling, packaging and submitting suspected select agent samples to the diagnostic lab, was reflected in the samples that were received for analysis. While no soybean rust was found in either 2005 or 2006, plant samples received by the lab were consistently well selected, fresh, properly packaged and expedited for overnight delivery.

FUTURE PLANS

Although the NPDN Training and Education Committee plans to continue with face-to-face training (***Objective 1***), increased opportunities for providing training through distance education will also be developed. Training sessions that include the six original training modules will be continued on an as-needed basis, but many programs will shift towards providing more pest-specific or crop-specific training. In order to support this effort, the NPDN will continue to increase the number of pest and crop-specific modules that are available for training (***Objective 3***). NPDN members will be encouraged to submit such training modules to the program. We will also continue to improve database and interfaces, and other aspects of the system on an as-needed and time-permitting basis. (***Objective 2***).

The NPDN Training and Education Committee is currently evaluating further testing options for training, and future plans will include testing First Detectors online, and/or conducting a post-training survey of participants to determine the overall outcomes and benefits of training (***Objective 4***). Initial beta-testing of online evaluation will occur during ***December 2006/January 2007***. Transitioning the First Detector training program towards official certification will be contingent upon the testing options selected. Some of these web-based options for testing may also be done in conjunction with or following the completion of the NRI Crop Biosecurity Project (G. Holmes, G. Snyder, and H. Beck—PIs are members of the Training and Education Committee). This training program is converting the six original NPDN training modules to online learning through content and learning management systems. Online testing will be available through this effort, and the project is scheduled to be completed by ***April 2007.***

Public Relations Committee Report

The Public Relations Committee has functioned primarily in the development and presentation of information on the NPDN at National Meetings. Over the past several years, the NPDN has had a PR presence at the American Phytopathological Society, The Entomological Society of America, and the Weed Science Society of America.

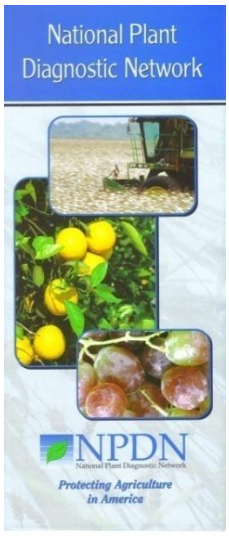
At national meetings, the NPDN has had an information booth that functions to distribute informational brochures, handouts on NPDN accomplishments, and a short PowerPoint presentation on the Network that runs continuously. The booth is staffed by members of the NPDN Operations Committee as well as volunteers from NPDN states. Expertise in both diagnostics and IT are always present at the booth to assist in answering questions and describing the NPDN. The posters that are used in the booth, a print out of the PowerPoint and an example of an update handout are attached. There are also national and region specific brochures that have been used at a variety of meetings and functions.

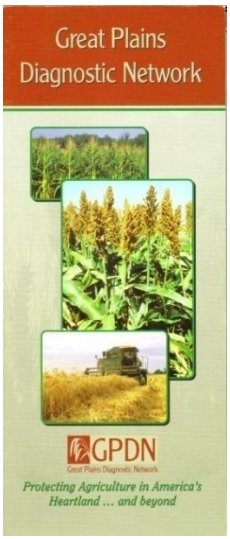
At the national meetings, an open discussion meeting is also held to provide updates and build connections among those involved in the NPDN or would like to become involved. These noon-time discussions are open to all who attend the national meetings (such as the American Phytopathological Society). A flier (an example is attached) is sent by email to all regional representatives and others who may be attending the meeting. In addition, the time and date of this meeting is listed in the meeting program book. At this year's APS meeting in Quebec City, approximately 70 people attended the session. Brief update presentations were made by Kitty Cardwell, Jim Stack, Amanda Hodges, Karen Snover-Clift and Carla Thomas. The session was moderated by Ray Hammerschmidt. We were also joined by representatives of the Canadian Food Inspection Agency who are interested in developing a diagnostic network in Canada. The meeting allows time for question and discussion. The open forum setting also provides time for individuals with interests in diagnostic networks and to discuss items in small groups.

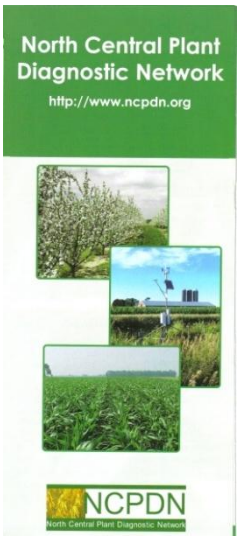
The Public Relations Committee also keeps track of presentations on the Network given by NPDN members. Many NPDN members participate in PR work through a variety of presentations that are given to a wide range of audiences (some of these presentations can be found at the NPDN web site). For example, in FY 2004 nearly 70 presentations on the nature and function of the NPDN were given around the country. Over the years, presentations have been given to a wide range of audiences. For examples, audiences have included land grant university officials, members of state and federal agencies, elected officials, cooperative extension agents, crop consultants and growers.

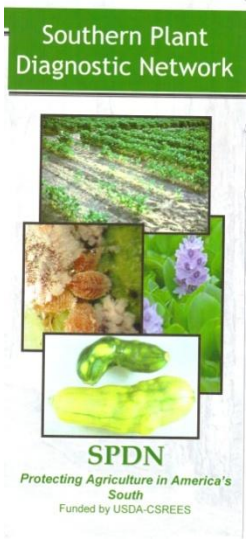
The NPDN IT committee has recently developed an on-line form to allow presenters to enter presentation information into a data base so that the data can be stored in a form that can be sorted and examined in more detail.

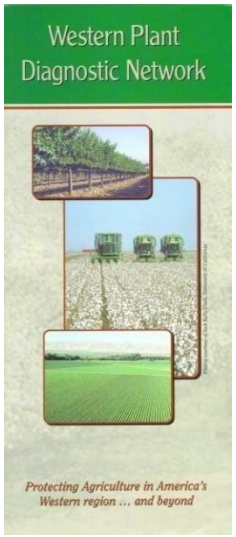
NPDN Brochures: National and Regional



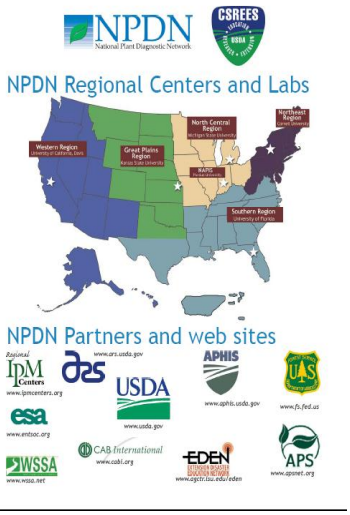








NPDN Accomplishments Handouts



NPDN Noon-time Discussion Flier

NPDN National Plant Diagnostic Network CSREES

NPDN Noontime Discussion

The NPDN National Operations Committee is hosting an informal get together for state NPDN reps

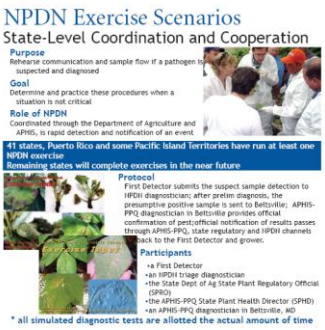
When: July 30 ---- 12:30 - 2 pm
Where: Ste-Foy/Portneut - Hilton
Feel free to stop by any time

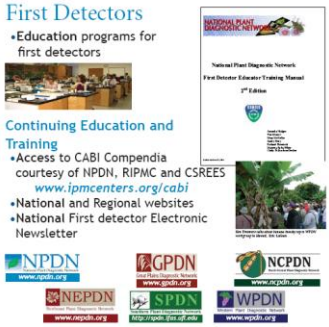
- Hear about current status of the NPDN
- Learn about and discuss future directions of the Network
- Provides an opportunity to interact with the national NPDN operations committee and other state reps
- Hear about plans for the National NPDN meeting in January 2007

Light refreshments will be provided

NPDN National Plant Diagnostic Network CSREES

Examples of Posters Used at National Meetings





Governance Committee Report

Since the inception of NPDN in June 2002, the Network has been managed by an operations committee composed of individuals from the land grant universities, federal agencies, state departments of agriculture, and at times industry. It was recognized early on that to become sustainable, NPDN would require a formal process of governance. Consequently, a process was undertaken to develop rules of governance by which the NPDN would operate that ensured efficient function, established mechanisms for decision making, and provided for the transfer of leadership.

This was accomplished through a long series of communications that included face-to-face meetings, conference calls, and exchanges of emails. Drafts were authored, edited, discussed, and approved by members of the NPDN Operations Committee and NPDN Executive Committee. Because of the federal source of funding for the Network, input was sought from those with knowledge of the many legal issues regarding committee memberships and Network relationships with outside entities.

NPDN Governance: Purpose and Structure

The National Plant Diagnostic Network will operate by rules of governance established and approved by the NPDN operations committee with input from individuals and agencies to ensure compliance with federal regulations. An NPDN Executive Committee will review and amend the rules of governance as needed to ensure continued and effective operations of the Network. The NPDN governance structure will be composed of an NPDN Council, NPDN Executive Committee, and an NPDN Operations Committee.

NPDN Advisory Council

Membership: The NPDN Advisory Council will be composed of representatives of stakeholders, partners, members, and customers (see Appendix A for descriptions and definitions of terms). NPDN Advisory Council members will be designated by their respective organizations with concurrence by the NPDN Executive Committee and serve for a period of three years (off set terms to ensure continuity). The core council will have a maximum membership of ten; the council can add members as needed to address critical Network issues. The NPDN Advisory Council will appoint a secretary.

Responsibility: To develop a broad vision for the National Plant Diagnostic Network. To serve as a liaison and to facilitate communication between NPDN and agencies and organizations involved in agricultural biosecurity. To provide the guidance necessary to keep NPDN focused on its mission, to prioritize issues, and to identify potential partners and customers.

Authority: The NPDN Advisory Council will provide guidance only. The NPDN Operations Committee will have final authority over operations and funding.

Reporting: The NPDN Advisory Council will report to the Executive Committee of the National Plant Diagnostic Network. The NPDN Council will generate and deliver an annual assessment of strengths, weaknesses, opportunities, and threats to the NPDN Executive Committee.

Meetings: The NPDN Advisory Council will meet in person annually (or as needed to address critical issues) and conduct quarterly conference calls. Minutes of all meetings and conference calls will be provided to the NPDN Executive Committee within one week of the meeting.

NPDN Executive Committee

Membership: The NPDN Executive Committee will be composed of the NPDN Regional Directors, National Database Repository Director, CSREES National Program Leader to NPDN, and chaired by a member of the committee.

Committee Responsibility and Authority: The NPDN Executive Committee will serve as an interface between the Network and the NPDN Council, ensure the effective operation of the NPDN, and will guide it's evolution to maintain NPDN as a key component of the national plant biosecurity infrastructure. The NPDN Executive Committee has the authority to appoint ad hoc, temporary, standing, or new permanent committees to facilitate Network function or to address critical Network issues.

The NPDN Executive Committee has the responsibility and authority for issues of governance. The NPDN Executive Committee will be responsible for developing, ratifying, and amending NPDN policy. The NPDN Executive Committee will appoint a temporary NPDN Policy Committee to draft an NPDN policy manual that will guide NPDN function and activities. The NPDN Executive Committee will be responsible for developing and implementing a ratification procedure.

Responsibility and Authority by Office:

1) NPDN Executive Director: The NPDN Executive Director is nominated from the NPDN Executive Committee and is elected by the NPDN Operations Committee to serve for a period of two years. The appointment shall commence at the NPDN summer annual business meeting. The NPDN Executive Director has the responsibility and authority to ensure that operations of the NPDN are conducted in a timely, efficient, and effective manner. The NPDN Executive Director has the authority to implement decisions made by consensus vote of the NPDN Operations Committee or by majority vote of the NPDN

Executive Committee. The NPDN Executive Director has the responsibility to represent and advocate for NPDN.

2) NPDN Deputy Director: The NPDN Deputy Director is nominated from the NPDN Executive Committee and is elected by the NPDN Operations Committee to serve for a period of one year. Assists NPDN Director in assigned tasks. Acts in supportive role to NPDN Director, with no specific authority except as delegated by NPDN Executive Director.

3) NPDN Immediate Past Director: Provides guidance and support to ensure continuity. Acts in a supportive role with no specific authority except as delegated by NPDN Executive Director.

4) NPDN Executive Committee Secretary: Provides administrative support and documentation of NPDN activities for the NPDN Executive Committee and the NPDN Operations Committee. Acts in a supportive role with no specific authority except as delegated by NPDN Executive Director. NPDN Executive Committee Secretary is appointed by the NPDN Executive Committee.

5) Other Members of the Executive Committee: Support the NPDN Executive Director by attending meetings and conducting tasks as directed by the NPDN Executive Director.

Reporting: The NPDN Executive Committee serves as the top reporting entity for NDPN and will be responsible for interim and final reports to the USDA regarding funding and cooperative agreements.

Meeting: Meets quarterly by conference call or as needed to address critical Network needs.

NPDN Policy Committee [Temporary]

Membership: The NPDN Policy Committee will be composed of members of the NPDN Operations Committee and the NPDN Executive Committee. Subject matter experts may be enlisted as needed to address critical Network issues. A chair of the committee will be designated by the NPDN executive committee.

Responsibility: The NPDN Policy Committee will be responsible for drafting the initial NPDN policy manual upon which Network functions and activities will be based.

Authority: The NPDN Policy Committee will have the authority to solicit input as needed from all NPDN members to help draft the NPDN policy manual.

Reporting: The NPDN Policy Committee reports to the NPDN Executive Committee. The NPDN Policy Committee will publish to the NPDN portal new policies, changes,

and amendments to existing NPDN policies and notify NPDN committees and members by e-mail of all such changes.

Meeting: The NPDN Policy Committee will convene annual conference calls or as needed to address critical Network issues.

NPDN Operations Committee

Membership: The NPDN Operations Committee will be composed of the NPDN Executive Committee, an Associate Director from each of the five NPDN regions plus one representative from each of the following agencies: USDA CSREES National Program Leaders (Plant Pathology, Homeland Security, Entomology/IPM), NPDN Committee Chairs, five at large state representatives (one per each NPDN region, NPDN Regional Center states not eligible, 3 year term), APHIS Designee, Regional IPMC Director (3 year term), State Department of Agriculture representative (3 year term), Extension Disaster Education Network, representative (3 year term), Chair of the NPDN Advisory Council, and at large members as needed to address critical issues (see Appendix C for descriptions and definitions of terms).

NPDN Operations Committee members will be designated by their respective organizations with approval by the NPDN Executive Committee and serve for a period of three years.

Responsibility: The NPDN Operations Committee is responsible for the development, implementation, and maintenance of programs necessary to fulfill the NPDN mission. The NPDN Operations Committee is responsible for the preparation and execution of the USDA CSREES cooperative agreement, the submission of funding requests, and the compilation of reports of accomplishments.

Authority: The NPDN Operations Committee has the authority to develop and implement annual plans of work, set priorities, devise implementation strategies, and allocate resources required to carry out NPDN operations. Non-consensus decisions are made by majority vote of NPDN Executive Committee.

Reporting: The NPDN Operations Committee will issue an annual report to the NPDN Steering Committee detailing progress made toward NPDN objectives and identifying critical Network issues.

Meeting: The NPDN Operations Committee will convene semi-annual planning and evaluation meetings. The NPDN Operations Committee will convene conference calls monthly or as needed to address critical issues. A quorum shall consist of 60% of the current designates to the NPDN Operations Committee.

NPDN Program Area Committees

Membership: Each NPDN Program Area Committee (Appendix D) has a chair, vice chair, and secretary. Members include at least one representative and one alternate from each region and the National Plant Disease and Pest Database. The chair of each NPDN Program Area Committee is a member of the NPDN Operations Committee. If an NPDN region has a regional committee for the same purpose as an NPDN Program Area Committee, the chair of the regional NPDN committee should also be a member of the NPDN Program Area Committee with the same function (e.g., a regional training committee chair will serve on the national training committee).

Responsibility: Each NPDN Program Area Committee has responsibility to direct the committee's operations and procedures, maintain web updates on committee activities and products, develop and revise committee mission statements, document committee activities, and make recommendations on NPDN policy to the NPDN Policy Committee.

Authority: Each NPDN Program Area Committee has the authority conduct operations delegated to that committee by the NPDN operations committee. The NPDN Program Area Committee can make recommendations to the NPDN policy committee on NPDN policies.

Reporting: NPDN Program Area Committees will report to the NPDN Executive Committee. On July 1st of each year, NPDN Program Area Committees will prepare and deliver to the NPDN Executive Committee and NPDN Operations Committee an annual report of accomplishments and critical issues.

Meeting: NPDN Program Area Committees should convene quarterly conference calls and meet as needed to address critical Network issues.

NPDN Regional Networks

Membership: Each NPDN regional network will have a regional director and the supporting structure deemed necessary to fulfill the NPDN mission. All regional staff will be appointed by the host institution. The director of each regional network will serve on the NPDN Executive Committee. Regional network staff may serve on NPDN Committees at the discretion of the host institution and the NPDN Executive and Operations Committees.

Responsibility: The responsibility of each NPDN Regional Network is to fulfill the mission of the National Network. NPDN Regional Networks will provide diagnostic data to the national repository and information necessary to compile reports of accomplishments and other reports as requested.

Authority: NPDN regional networks will have the authority to execute the annual plans of work and to manage regional network affairs to ensure the completion of Network objectives.

Reporting: Each regional network will establish a reporting system appropriate to the needs of that region. Member states will comply with the established reporting system.

Meeting: Each regional network will meet at least once per fiscal year to establish plans of work consistent with the national plan of work, to report on progress, and to discuss issues important to the region. The annual regional meeting will be convened at a location to be determined by the regional center. Additional meetings may be convened to address critical issues as they arise or to provide training.

APPENDIX A: DEFINITION OF TERMS

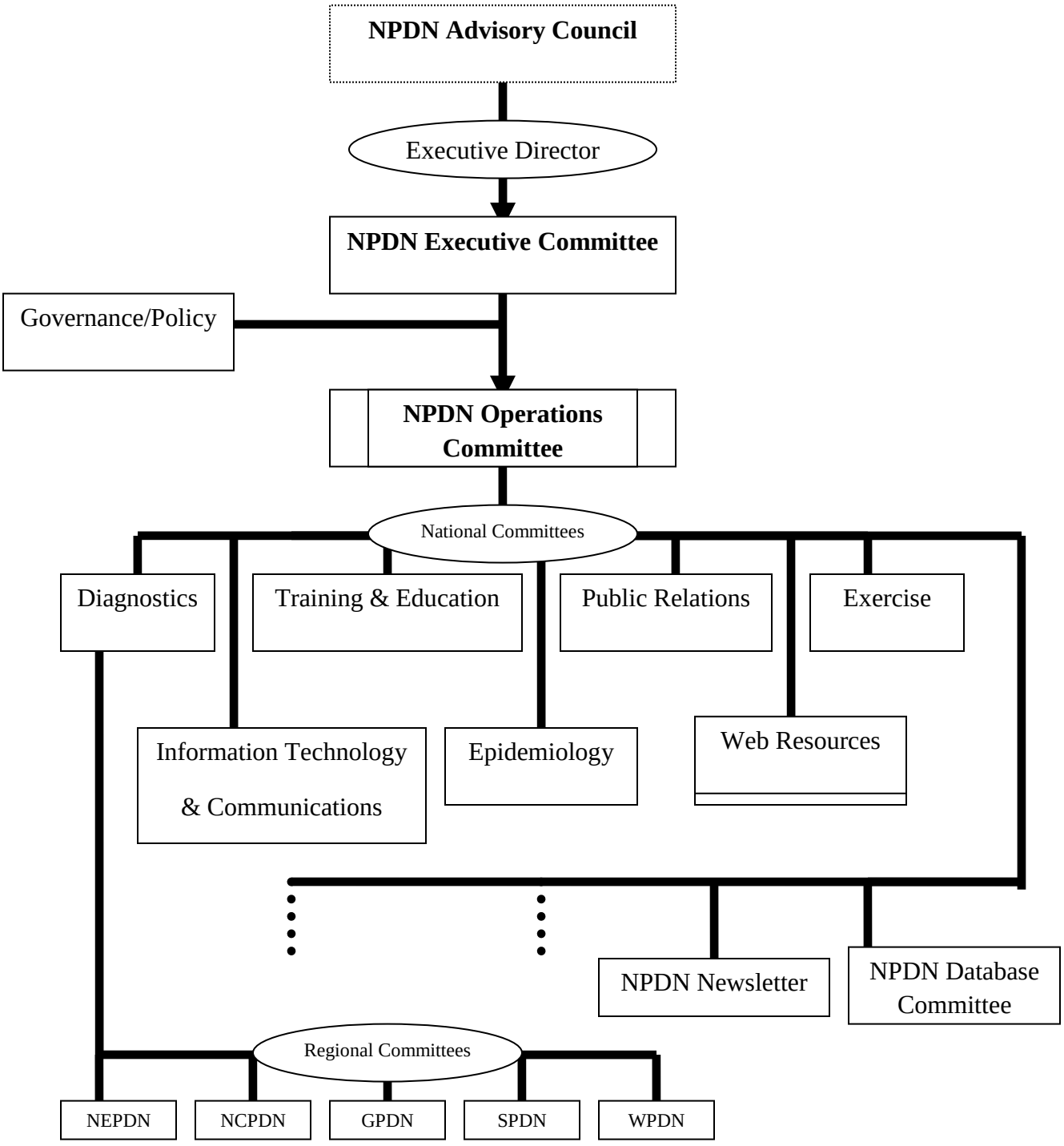
Customer: An individual, agency, or organization that utilizes the physical or intellectual services and results of the National Plant Diagnostic Network. Examples: USDA APHIS (NIS, PPQ, CPHST, PHP, SPHD}, Law Enforcement (FBI, DHS CBP), NAHLN, State Departments of Agriculture, Industry (ASTA, chemical, advising/consulting), USDA ARS (FDWRL).

Member: An individual, agency, or organization that directly contributes to fulfilling the mission of the National Plant Diagnostic Network. Examples: NPDN Leadership (Executive Director, At-Large Regional Director), CSREES National Program Leaders (Plant Pathology, Homeland Security, Entomology), Sea Grant and Land Grant (1862, 1890, 1994) Institutions (diagnosticians, specialists, and administrators), State Departments of Agriculture (diagnosticians and administrators), Private company laboratories.

Partner: An individual, agency, or organization that works with the National Plant Diagnostic Network in fulfillment of the NPDN mission. Examples: Extension Disaster Education Network, Integrated Pest Management Centers, National Animal Health Laboratory Network, Scientific Societies (APS, ESA, CSSA), State Departments of Agriculture (individual?, NASDA?), Industry (ASTA, chemical, advising/consulting), USDA ARS (FDWRL).

Stakeholder: An individual, agency, or organization who has a vested interest in the success of the National Plant Diagnostic Network. Examples: USDA APHIS (NIS, PPQ, permitting, CPHST, PHP, SPHD}, CSREES, LGU (Experiment Station Directors, Extension Directors, NUSALG,), Law Enforcement (FBI, DHS CBP).

APPENDIX B: GOVERNANCE ORGANIZATIONAL CHART



National Plant Diagnostic Network

A LOOK TO THE FUTURE

While much has been accomplished in the short history of NPDN, there remains much to do. Our vision for NPDN is one of optimism and excitement. The Network has only begun to tap the vast capability of our greatest asset, the people. As NPDN matures, more individuals are contributing to its development and the shared sense of accomplishment encourages greater participation. We have made significant efforts to expand our insect pest programs and have begun the process to interact with invasive plant programs.

The global nature of agricultural trade ensures that introductions of plant pathogens and insect pests will continue for the foreseeable future. Some of these introductions will threaten trade while others may threaten production or ecosystem stability. We must be prepared to minimize the impact from such introductions. NPDN is an important component of our national plant biosecurity infrastructure. The concept of a national plant network was formulated in 1918 by the APS War Advisory Board. However a major distinction today is the availability to NPDN of advanced technology to achieve the objectives of early detection, accurate diagnoses, and secure communications. As technology becomes more sophisticated, professional development programs that ensure adoption of that technology will be required.

In 2006, NPDN in partnership with USDA APHIS PPQ CPHST initiated a lab accreditation and protocol certification program. NPDN hired a manager to oversee the creation of a lab quality management manual to be used by NPDN labs. This program will ensure the highest level of capability and competence among NPDN labs. We have only just begun to integrate the enormous capabilities of geographic information systems for mapping disease distribution and spread. As our database of diagnostic data increases, the interest of epidemiologists in accessing those data for model development and validation will increase. This brings the prospect of better predictive models for many of the recurring diseases that affect our plant systems as well as increased potential for predicting the occurrence of newly introduced pests and pathogens.

NPDN's contributions to the detection, diagnosis, and response for recent introductions including, *Ralstonia solanacearum* r3b2, pink hibiscus mealybug, plum pox virus, Asian soybean rust, and sudden oak death (SOD)/*Ramorum* blight attest to the benefit of sustaining this Network. NPDN's preparedness exercise program is and will remain

essential in helping states achieve a state of preparedness. NPDN's education programs raised the awareness of first detectors nationwide to the threats to plant systems. A registry of first detectors that can assist during an outbreak was established and is being maintained.

In many states, NPDN is credited with stimulating a reversal of a decades-long decline in support for applied plant science, in particular, the maintenance of state plant diagnostic clinics. NPDN has raised the stature of diagnosticians and has provided a platform for interaction by plant diagnostic professionals. The creation of NPDN was and remains a great idea.

NPDN

Its history is one of accomplishment; its future, one of promise.

APPENDICES

The attached appendices are not intended to be a complete collection of all NPDN work products but rather representative examples of the array of NPDN outputs. Additional support materials can be found on the CDs included with this review document. Please contact me (Jim Stack: jstack@ksu.edu, 785-564-0687, 785-532-1333) if you need clarification for any of the materials contained within the appendices or would like additional information not contained within the appendices.

***Appendix I*: Letters of Comment**. For the benefit of the review panel, letters of comment were solicited from representative collaborators and stakeholders.

***Appendix II*: Training Modules**. PowerPoint presentations were produced to support each of the training objectives and made available to those providing the training. This appendix contains print outs of two such modules.

***Appendix III*: NPDN Project Planning Matrix FY 2005**. An example of NPDN's planning vehicle for the development of annual plans of work.

***Appendix IV*: Relevant Publications**. A list of publications resulting from NPDN work and collaborations in presented.

***Appendix V*: Newsletter**. An example of the monthly NPDN newsletter and the SPDN newsletter are included in this appendix. Additional issues can be found on the accompanying CD.

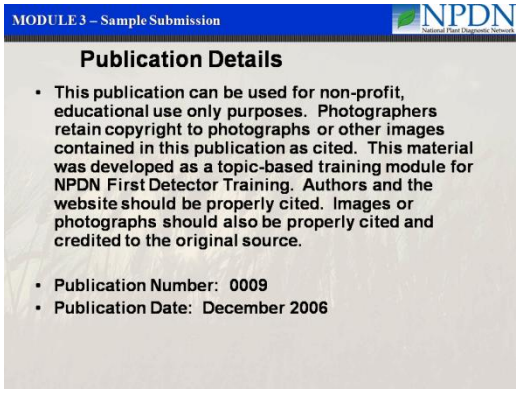
Appendix I: Letters of Comment

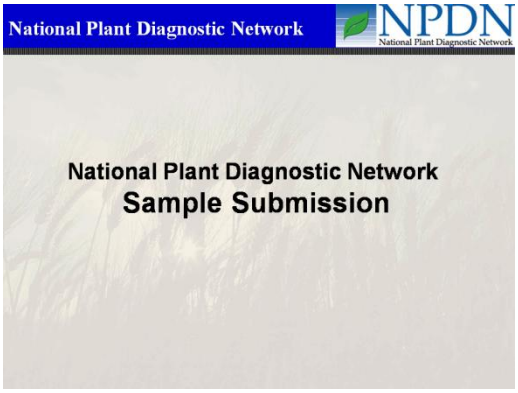
Collaborators and stakeholders were invited to submit a letter of comment regarding their direct or indirect experiences with NPDN. These letters of comment are as submitted and were not edited in any manner. The review panel is encouraged to solicit additional input from NPDN members, collaborators, and stakeholders.

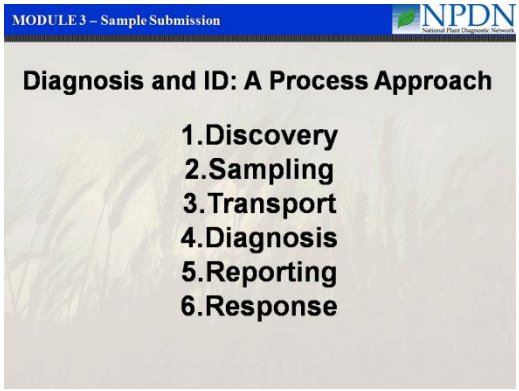
Appendix II: Training Modules

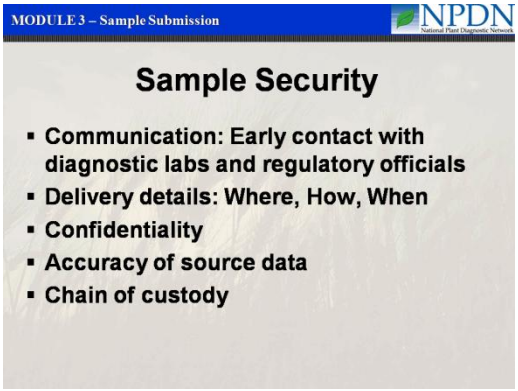
This Appendix contains the training manual generated to assist those offering NPDN training programs. It is a train the trainer document to facilitate wide-scale dissemination of the NPDN training materials. The second document is an example of an NPDN PowerPoint-based training module available nationally to trainers.

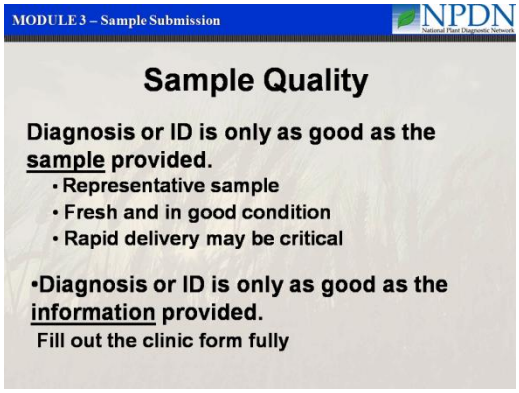
MODULE 1: EXAMPLE OF A CORE MODULE

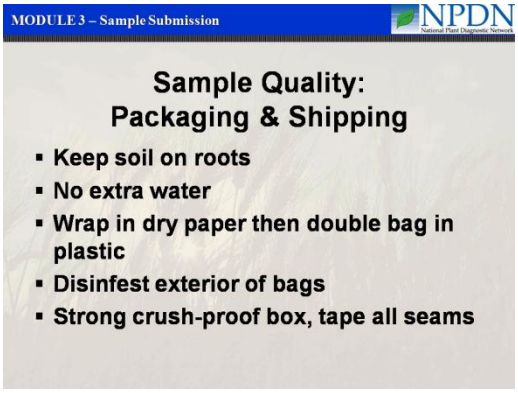












MODULE 3 – Sample Submission NPDN

Samples must contain the right material: an entire plant or several plants if practical.

Foliage diseases

Diseases may show up on any part of the plant.

Keep most roots and soil intact if possible

Check for injuries, disease on the main stem/trunk

MODULE 3 – Sample Submission NPDN

Dead Plants Tell no Tales

- Avoid dead plants
- Choose plants which show a range of symptoms: moderate to severe

Photo: Ron Jones, North Carolina State University, www.forestryimages.org

MODULE 3 – Sample Submission NPDN

Good Packaging

- Plastic bag to keep soil on roots
- Dry paper towels to protect leaves from contact with plastic bag

Photos: Tom Creswell, North Carolina State University, www.forestryimages.org

MODULE 3 – Sample Submission NPDN

Packaging & Shipping

Good Intentions

Actual Results

MODULE 3 – Sample Submission NPDN

What Every Clinic Wants to Know….

Who? -Who sent the sample? Client contact information?

What? What is the host? Your main concern? Symptoms observed?

When? When did it show up?

Where? Where in the field, Distibution, % affected?

How? How has the site been treated? Pesticides, Fertilizer, Rainfall…

MODULE 3 – Sample Submission NPDN

Field patterns may be clues to: Chemical injury? Nematodes? Root diseases?

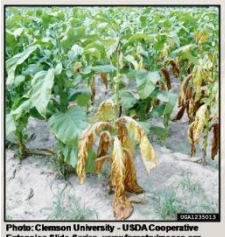


Photo: Clemson University - USDA Cooperative Extension Slide Series, www.forestryimages.org

Tobacco: Phytophthora root/stem rot

Photo: Linda Haugen, USDA Forest Service, www.forestryimages.org

Fraser Fir: Phytophthora root rot

MODULE 3 – Sample Submission NPDN

Incidence VS. Severity

Incidence: Percent of the crop affected

Photo: Andrej Kunca, National Forest Centre - Slovakia, www.forestryimages.org

Severity: a measure of impact on a plant or the crop

Photo: Clemson University - USDA Cooperative Extension Slide Series, www.forestryimages.org

MODULE 3 – Sample Submission NPDN

What Every Entomologist Wants to Know…..

- Who collected the sample? Include their contact information.
- Location on Host Plant? Roots, Stems, Flowers, Buds, Leaves, etc.
- Where was the insect found?
  - Field Crops, Greenhouse, Residence, Landscape
  - Location: Address, Nearest intersection, GPS data
- Degree of infestation, extent of damage

MODULE 3 – Sample Submission

Insect Samples

Poor Packaging = Body Parts!

Properly Packaged Mailing Tubes Protect Samples!

MODULE 3 – Sample Submission

Insect Samples

Most insects can be preserved in a vial with 70% isopropyl (rubbing) or ethyl alcohol.

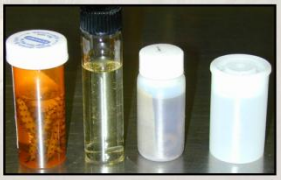


Photo: Scott Bauer, USDA Agricultural Research Service, www.forestryimages.org

MODULE 3 – Sample Submission

Insect Samples

- Caterpillars should be placed in boiling water for 1 minute prior to preservation.
- ***Don't Microwave***
- Include some caterpillars live on host plant foliage.

Photos: Clemson University - USDA Cooperative Extension Slide Series, www.forestryimages.org

MODULE 3 – Sample Submission

Insect Samples

- Scales, mealybugs and other tiny arthropods may be submitted on the host.
- Wrap plant material in dry paper towel before placing in bag.
- Double bag suspected exotics.

Photos: Florida Department of Agriculture & Consumer Services, Division of Plant Industry

MODULE 3 – Sample Submission

Insect Samples

- Collect multiple samples of all available life stages.
- May need extra samples available if a new record.
- May need specific life stage or both sexes for ID.
- Which whitefly life stage is used for ID?

<<< Pupa

MODULE 3 – Sample Submission

Insect Samples

- Digital photos of damage and insect assist with identification.
- Describe the level of infestation on the plant.

Top Photo: Tom Cresswell, North Carolina State University, www.forestryimages.org

Bottom Photo: William M. Ciesla, Forest Health Management International, www.forestryimages.org

MODULE 3 – Sample Submission

Piercing/Sucking

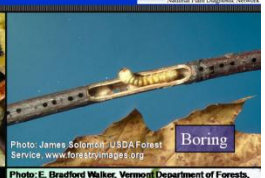


Photo: James Solomon, USDA Forest Service, www.forestryimages.org

Boring

Photo: William M. Ciesla, Forest Health Management International, www.forestryimages.org

Leaf mining

Photo: E. Bradford Walker, Vermont Department of Forests, Parks and Recreation, www.forestryimages.org

Skeletonizing

MODULE 3 – Sample Submission

Insect Samples: DOs

- Collect multiple samples
- Collect portion of the infested plant
- Send Pictures
- Preserve as needed
- Ship quickly
- Exotics? notify specialist, ship next day air
- Include complete and accurate collection data
- Double bag specimens containing suspected exotic species.

MODULE 3 – Sample Submission

Insect Samples: DON'Ts

- Crush samples in tissue or plastic wrap
- Tape them to paper
- Overcrowd them (dead or alive)
- Send them without complete and accurate information
- Collect broken body parts

MODULE 3 – Sample Submission

Weed and Plant ID

- Also for ID of insect or disease host (if unknown)
- Collect intact specimens.
- Preserve and package sample properly.
- Exotics? Seal box inside and out, double bag.

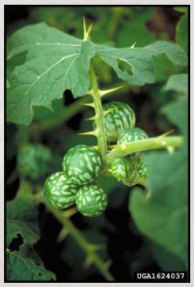


Photo: Jeffrey Mullahey, University of Florida, www.forestryimages.org

MODULE 3 – Sample Submission

Weed and Plant ID

- Include: Flowers, Fruits, Stems, Leaves, Roots
- May preserve samples by pressing and drying in newspaper

MODULE 3 – Sample Submission

Weeds: We want it all

- stems
- roots if possible
- whole leaves attached to the stem
- flowers, fruits, or seeds.

All Photos: John D. Byrd, Mississippi State University, www.forestryimages.org

MODULE 3 – Sample Submission

Weeds: What Every Botanist Wants to Know……

- Where did it come from?
  - Pasture? Greenhouse? Home landscape? Field?
  - Location: Address, Nearest intersection, GPS data
- Digital photos can be useful if they are close-ups and very clear.
- Be specific on collection information! The more information you can give, the better, and faster, the diagnosis will be.
- Where was the sample found?

MODULE 3 – Sample Submission

If you have a sample…

- Please submit it to your local NPDN lab
- A list of local labs can be found at http://www.npdn.org

MODULE 3 – Sample Submission

Additional References

- NPDN http://www.npdn.org
- Iowa State University, Department of Plant Pathology. http://www.plantpath.iastate.edu/pdc/?q=node/2
- Michigan State University Diagnostics Services http://www.pestid.msu.edu/services/howto.html
- Purdue Plant and Pest Diagnostic Laboratory http://www.ppdl.purdue.edu/PPDL/physical.html

MODULE 3 – Sample Submission

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MODULE 2- EXAMPLE OF A SPECIAL TOPICS MODULE

Publication Details

- This publication can be used for non-profit, educational use only purposes. Photographers retain copyright to photographs or other images contained in this publication as cited. This material was developed as a topic-based training module for NPDN First Detector Training. Authors and the website should be properly cited. Images or photographs should also be properly cited and credited to the original source.
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NPDN National Plant Diagnostic Network

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NPDN National Plant Diagnostic Network

Acknowledgments Editorial Review

- Dr. John Foltz, University of Florida, Entomology & Nematology Department
- Dr. Mike Thomas, Florida Department of Agriculture, Division of Plant Industry

NPDN National Plant Diagnostic Network

Additional Information Available Online

- Mayfield, A. E. and M. C. Thomas. 2006. Pest Alert: The Redbay Ambrosia Beetle, Xyleborus glabratus Eichhoff (Scolytinae: Curculionidae). http://www.doacs.state.fl.us/pi/enpp/ento/x.glabratus.html
- Rabaglia, R. 2005. Exotic Forest Pest Information System for North America. *Xyleborus glabratus*. http://spfnic.fs.fed.us/exfor/data/pestreports.cfm?pestidval=148&langdisplay=english
- Florida Division of Forestry – FDACS, Redbay Ambrosia Beetle Information http://www.fl-dof.com/forest_management/fh_insects_redbay_ambrosiabeetle.html
- HISL – PEET Xyleborini. Key to the females of the species of Xyleborus, North of Mexico. http://xyleborini.tamu.edu/keys.php

NPDN National Plant Diagnostic Network

Photo: Thomas, M. C. Florida Department of Agriculture, Division of Plant Industry. http://www.insectimages.org

If you suspect a problem…

- Contact your local cooperative extension service
  - http://www.csrees.usda.gov/qlinks/partners/state_partners.html
- Contact a NPDN diagnostic lab
  - http://www.npdn.org

Photo: Thomas, M. C. Florida Department of Agriculture, Division of Plant Industry, http://www.insectimages.org

NPDN National Plant Diagnostic Network

Control

- No tested or proven treatments for the control of *X. glabratus* and its associated fungus
- To reduce the spread of *X. glabratus*, do not transport wood or chips from infested trees to other areas

Funnel trap used to monitor *Xyleborus glabratus* flight activity.

Photo: A. E. Mayfield, Florida Department of Agriculture & Consumer Services, Division of Forestry http://www.insectimages.org

NPDN National Plant Diagnostic Network

Importance of Host Plants

- Wildlife browse and fruit
- Larvae of the Palamedes swallowtail feed on Redbay

Photo: Payne, J. A. USDA Agricultural Research Service http://www.insectimages.org

Redbay

Photo: Evans, C., The University of Georgia, http://www.forestryimages.org

UGA2149001

NPDN National Plant Diagnostic Network

Hosts Trees

- In the US, redbay and sassafras are known hosts
- Pond spice is a suspected host

UGA1380355

Sassafras

Photos: Evans, C., The University of Georgia, http://www.forestryimages.org

UGA1330066

NPDN National Plant Diagnostic Network

Life Cycle

- Females
  - Capable of flight
  - Leave when mature in search of new host
  - Believed able to fly 2-3 km to find host
- Males
  - Dwarfed size
  - Flightless
  - Rarely encountered outside

Photo: Thomas, M. C. Florida Department of Agriculture, Division of Plant Industry. http://www.insectimages.org

NPDN National Plant Diagnostic Network

Life Cycle

- Adult females inoculate galleries with a fungus from the genus *Ophiostoma*, a vascular wilt pathogen
- Adults and larvae feed on fungi, not wood

Example of the fruiting bodies of a similar fungus, *Ophiostoma piceae*, from the Norway spruce

Photo: Kunca, A. National Forest Centre – Slovakia http://www.insectimages.org

NPDN National Plant Diagnostic Network

Life Cycle

- Little is known, but assumed to be similar to other species in the genus
- Adult females construct galleries where eggs are laid and young develop

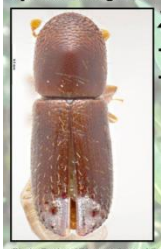
Photo: Johnson, J., Georgia Forestry Commission http://www.insectimages.org

Photo: Mayfield, A. E., Florida Department of Agriculture & Consumer Services, Division of Forestry http://www.insectimages.org

NPDN National Plant Diagnostic Network

Comparison to similar species

Xyleborus ferrugineus



X. ferrugineus
-Hairs present
-Rounded end

X. glabratus
-Smooth
-Pointed end

Xyleborus glabratus

Photo: Pest and Diseases Image Library, www.forestryimages.org

Photo: Thomas, M. C. Florida Department of Agriculture, Division of Plant Industry. http://www.insectimages.org

NPDN National Plant Diagnostic Network

Comparison to similar species

-Hairs on Elytra
-Rounded Slope

Xyleborus affinis

Photo: Almquist, D. T., University of Florida , www.forestryimages.org

-Smooth Elytra
-Sharp Slope

Xyleborus glabratus

Photo: Thomas, M. C. Florida Department of Agriculture, Division of Plant Industry. http://www.insectimages.org

NPDN National Plant Diagnostic Network

Description and Identification

- Difficult to distinguish from other species, specialist should identify
- Some key characteristics
  - Smooth, shiny surface
  - Sharp slope at the rear

Photos: Thomas, M. C. Florida Department of Agriculture, Division of Plant Industry. http://www.insectimages.org

NPDN National Plant Diagnostic Network

Description and Identification

- Adult Females
  - Small, only 2 mm long
  - Slender
  - Cylindrical
  - Brown-black color

Photos: Thomas, M. C. Florida Department of Agriculture, Division of Plant Industry. http://www.insectimages.org

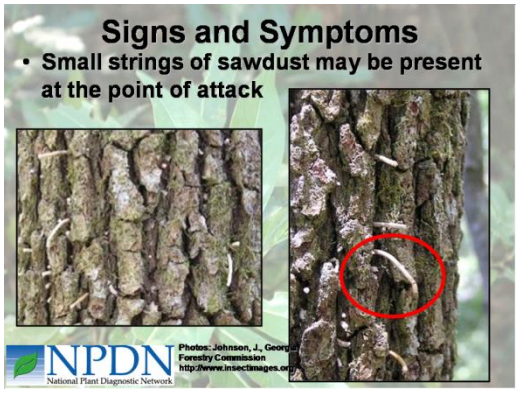
NPDN National Plant Diagnostic Network

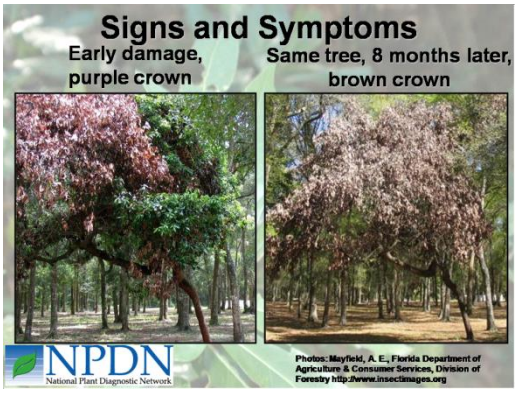
Signs and Symptoms

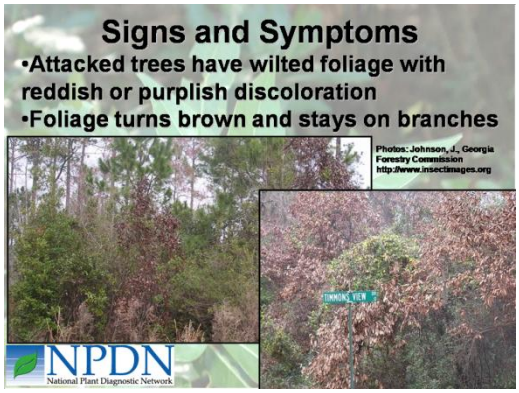
- Adult gallery construction – entrance holes
- Staining – the tree's response to the fungal infection

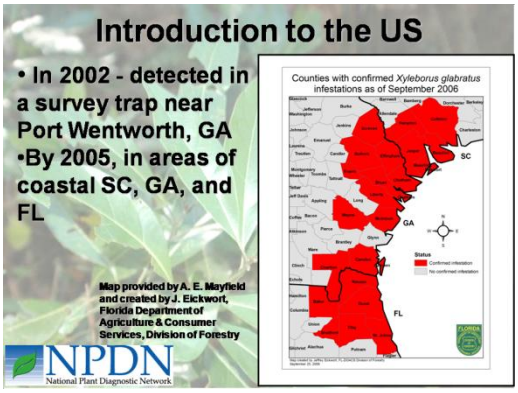
Photos: Mayfield, A. E. Florida Department of Agriculture & Consumer Services, Division of Forestry http://www.insectimages.org

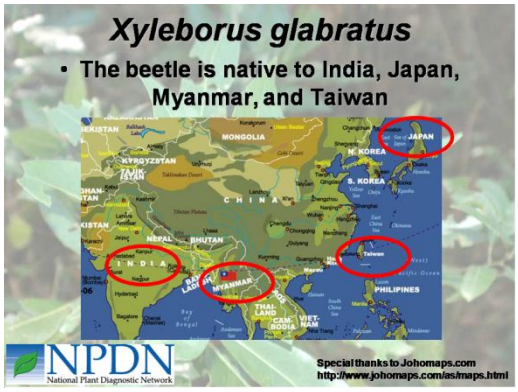
NPDN National Plant Diagnostic Network

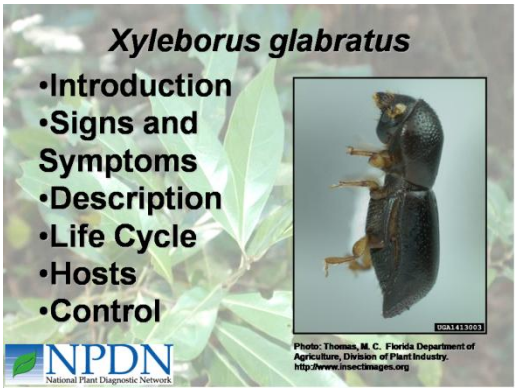

Signs and Symptoms
• Small strings of sawdust may be present at the point of attack
NPDN
National Plant Diagnostic Network
Photos: Johnson, J., Georgia Forestry Commission http://www.insectimages.org

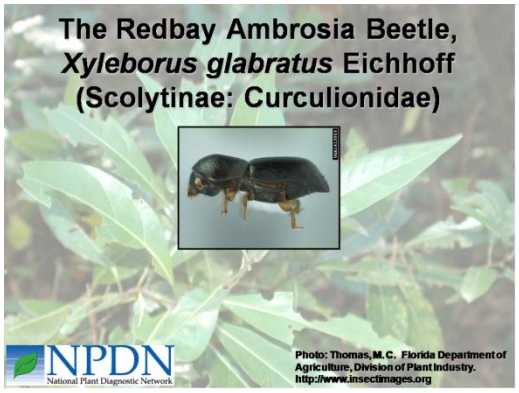

Signs and Symptoms
Early damage, purple crown
Same tree, 8 months later, brown crown
NPDN
National Plant Diagnostic Network
Photos: Mayfield, A. E., Florida Department of Agriculture & Consumer Services, Division of Forestry http://www.insectimages.org


Signs and Symptoms
•Attacked trees have wilted foliage with reddish or purplish discoloration
•Foliage turns brown and stays on branches
Photos: Johnson, J., Georgia Forestry Commission http://www.insectimages.org
NPDN
National Plant Diagnostic Network


Introduction to the US
• In 2002 - detected in a survey trap near Port Wentworth, GA
•By 2005, in areas of coastal SC, GA, and FL
Map provided by A. E. Mayfield and created by J. Eickwort, Florida Department of Agriculture & Consumer Services, Division of Forestry
Counties with confirmed Xyleborus glabratus infestations as of September 2006
SC
GA
FL
Status
NPDN
National Plant Diagnostic Network


Xyleborus glabratus
• The beetle is native to India, Japan, Myanmar, and Taiwan
MONGOLIA
JAPAN
N. KOREA
S. KOREA
CHINA
NEPAL
BHUTAN
INDIA
MYANMAR
Taiwan
PHILIPPINES
THAI LAND
CAM-BODIA
VIET-NAM
NPDN
National Plant Diagnostic Network
Special thanks to Johomaps.com http://www.johomaps.com/as/maps.html


Xyleborus glabratus
•Introduction
•Signs and Symptoms
•Description
•Life Cycle
•Hosts
•Control
NPDN
National Plant Diagnostic Network
Photo: Thomas, M. C. Florida Department of Agriculture, Division of Plant Industry. http://www.insectimages.org


The Redbay Ambrosia Beetle, Xyleborus glabratus Eichhoff (Scolytinae: Curculionidae)
NPDN
National Plant Diagnostic Network
Photo: Thomas, M.C. Florida Department of Agriculture, Division of Plant Industry. http://www.insectimages.org

Appendix III: NPDN Project Planning Matrix FY 2005

NPDN adopted a project planning matrix approach to develop five year goals and objectives from which to formulate the annual plans of work and to provide a benchmark by which to evaluate progress. Annual meetings were convened to review and update the matrix. The matrix was used to track accomplishments.

Output 1: Coordination and Governance mechanisms are established for the regional and national networks.

Activities Ongoing Complete New activity in 2005 Insufficient progress for 2004 Insufficient funds
Before a-1) Governance personnel for regional and national responsibilities
Before a-2) Regional center operations
a) Establish national operations committee with defined functions
a.1) Maintain national operations committee with defined functions
a.2) Engage industry in operations committee; funds needed for this
a.3) Establish regional operations committee with defined functions
a.3) Choose LGU based national operations committee chair
a.3.i) Establish budget for operations committee/chair
Establish budget for 1982 Land Grant University; additional funds needed
b) Establish regional operations committee with defined functions
b.1) Maintain regional operations committee with defined functions
c) Develop national task forces
d) Establish and regional Advisory committee
f) Work plans, and quarterly reports generation
g) Improve interface with: This portion is 80% complete
• State Departments of Agriculture, National & Regional Plant Boards
• Cooperative State Extension Service Director & Ag Experiment Station Director
• RIPMC, Extension Specialists, County Faculty/Staff
• State Diagnostic Labs
• Between regions & sub-committees
• Private Crop Consultants; additional funding needed up to $10,000 for modules, travel
h) Public is informed. Recognizes need for a diagnostic and response system (ongoing)
NACAA 2004; complete
ESA 2004; complete
APS 2004; complete
REGIONAL IPM MEETINGS; complete
PR OTHER: SOD, Camellia Society, EPA DHS, SNA (Southern Nsymen Assn), HIS. State legislators "Gator Day", Southern Plant Board
i) Conduct a public relations campaign to inform and educate key legislators & USDA personnel (ongoing); additional funds needed, up to $10K

Output 2: Educated/capable first detectors ready to notice unusual events and take appropriate action.

Activities Ongoing Complete New activity in '05 Insufficient progress for '04 Insufficient funds*
a) Hold stakeholder meetings/teleconferences with 1st detectors in each region – purpose to obtain buy-in
b) Develop and deploy educational materials on NPDN purpose and function (mission); Always in progress
b.1) Deploy educational materials (mission)
c) Develop educational materials (monitoring for HRP)
c.1) Deploy educational materials (monitoring for HRP)
d) Develop educational materials (quality & SSS)
d.1) Deploy educational materials (quality & SSS)
e) Develop educational materials (Art & science)
e.1) Deploy educational materials (Art & science)
f) Develop educational materials (exercises)
f.1) Deploy educational materials (exercises)
g) Develop educational materials (DAD)
g.1) Deploy educational materials (DAD)
develop prototype of DAD using CLMS for demo purposes
h) ~~h)~~ Deploy educational modules on recognition of unusual pest and disease occurrence; PHM, SOD, SBR
i) additional funds needed for production of additional modules, up to $10K
i) Develop new modules with EDEN on communications; plans for this are in effect
j) Develop Pest Alert on Soybean Rust w/ RIPMC
j) ~~j)~~ Develop new modules on pests and pathogens w/RIPMC & APHIS; collaborations are in effect
need funding for new modules and to pay participants an honorarium
l) Train 2500 first detectors for five regions; need to imcrease national participation
m) Train 10000 additional first detectors for five regions w/supplement…2500 w/o supplement
n) Entomology – Phase 1 regional training: ongoing
o) Entomology – Phase 2 national training workshops – specific pests: Funding needed; $150K
Oi) Weed Science – regional training
p) Pre & Post test development/implementation for first detectors
q) Develop a real time mapping registry of first detectors
r) Complete a first detector certification program; "certificate of completion" and training manual complete
Develop Spanish translation of modules, posters, picture clues that target "immigrant populations and tourists
Develop web site for source of educational materials, modules, tests, manual for training, etc.; ONGOING
Assistance needed for support of Plant pathology coordinator.
S) DEVELOP A National competitive MINI-GRANT PROGRAM FOR NEW, IN-DEPTH MODULES ON SELECT AGENTS, NEW TOPICS, AND SPANISH TRANSLATION. 20 GRANTS AT $5,000 EACH
EXPAND CURRENT TRAINING PROGRAM NATIONALLY TO INCREASE NUMBERS OF FIRST DETECTORS
DEDICATED STAFF (0.25 fte) TO COORDINATE REGIONAL TRAINING PROGRAMS

Output 3: Data Systems and Networking (Functional data management systems and integrated network).

Activities Ongoing Complete New activity in '04 Insufficient progress for '04 Insufficient funds*
3.a. Establish regional databases:
PDIS
3.a.1. Adapt and deploy web-based distance diagnostics
3.a.2. Pilot adoption in selected states and agents (year 1)
3.a.2.i. Deliver the tested product to all states (year 2)
3.a.2.ii Train county agents in use (year 2)
3.a.2.iii. Build software for recording samples and managing clinic/diagnostics lab reports (phase 1)
3.a.2.iii. Build software for recording samples and managing clinic/diagnostics lab reports (phase 2)
3.a.3. Develop a communication protocol for sharing critical data w/NAPIS (phase1)
3.a.3. Develop a communication protocol for sharing critical data w/NAPIS (phase 2)
3.b. Develop policies, procedures and protocols for access to reported data
3.b.2. Define confidentiality guidelines and SOP's
Exercise scenario monitoring system (phase 1)
Exercise scenario monitoring system (phase 2)
3.c. Develop national communications infrastructure. Develop interface with NAPIS.
3.c.2. Develop regional communications infrastructure
3.c.2.ii. Establish comprehensive national voice, video, and data communications infrastructure
3.c.2.iv. Designate 'duty officer' at each state to communicate within the national communications infrastructure, respond to requests, and enter data
3.c.2.v. Designate 'duty officer' at each regional hub to monitor data flow, analyze data patterns, make and receives notifications, and coordinate responses
3.d. Develop and maintain a web-site.
3.d. Develop and maintain web-based newsletter.
3.e. Develop Secure Communications System
3.f New Content Mgmt system for regional and national websites
3.g. Data Systems & Networking aspects of Training
3.h. Learning Content Management for bio-security training
3.i. Automated event notification system
3.j. Develop an Image Library System
3.k. Assess compliance with NIS-INFOSEC guidelines @ regional centers & NAPIS
3.k.1 Implement compliance w/ NIS-INFOSEC guidelines @regional center & NAPIS
3.l. Develop national bar-coding system with APHIS
3.l.i Purchase bar-coding equipment
3.l.i Deploy national bar coding system

Output 4: Functioning diagnostic systems.

Activities Ongoing Complete New activity in '05 Insufficient progress for '04 Insufficient funds*
4.a. Create a regional diagnostics and archival system
4.a.1. Assess current diagnostic capabilities, specific expertise and reference collections within Regions
4.a.1.i Assess expertise and reference collection (entire pest spectrum)
4.a.2. Create a multi-state distance diagnostics and archival system for plant pests and diseases
4.a.3. Assure linkages of plant diseases and pest diagnostic labs in all states
4.a.3. Establish minimum diagnostic capability of state labs across the region
Additional funds needed for entomology lab upgrade; ID materials, resources for training (8K per state)
4.b. Identify, standardize test formats and train on high priority pests nationally and regionally
4.b.1. Identify a list of regionally high priority pest problems/vulnerable crop systems for known organisms
4.b.2. Standardize operating procedures for targeted pests
4.b.3. Coordinate diagnostician training activities for high priority pest detection (each region has one or more)
4.b.4. Make web-based reference materials available for targeted pests
4.b.5. Maintain and update web based reference materials: national web committee needs help and coordination through a central person
4.c. Upgrade laboratories
4.c.1. Assess the need for laboratory upgrades
4.c.2. Upgrade facilities with equipment and reagents to routinely conduct newer diagnostic tests
4.c.2.i Regional Center Equipment & Supply Budget (ongoing)
4.c.3. Upgrade regional labs to ISO certifications
4.c.1 Thermocyclers & PCR training & positive controls in regional labs (SBR)
4.c.1 Thermocyclers & PCR training & positive controls in regional labs (Ralstonia)
4.c.1 Thermocyclers & PCR training & positive controls in regional labs (SOD)
4.c.1 Thermocyclers & PCR training & positive controls in regional labs (PPV)
4.c.1 Thermocyclers & PCR training & positive controls in regional labs (KB)
4.c.1 Thermocyclers & PCR training & positive controls in regional labs (Citrus Greening)
4.c.1 Thermocyclers & PCR training & positive controls in regional labs (Potato Wart)
4.c.1 Thermocyclers & PCR training & positive controls in regional labs (Citrus Canker)
4.c.1 Thermocyclers & PCR training & positive controls in regional labs (Xyllela Strains)
4.c.3.i Bio-safety upgrade (must have Bio Safety cabinets)
4.c.4. Determine certification criteria for new laboratories
4.c.5 Obtain Bar-coding equipment for each state laboratory
4.d. Coordinate within the region and nationally
4.d.1. Identify areas of expertise within states and the region
4.d.2. Plan for coordination of plant diagnostic expertise within the region
4.d.2.i Coordination of plant diagnostic expertise within the region (ongoing)
4.d.3. Plan for interfacing with other regions
4.d.5. Initial mechanism in place to utilize key diagnostic laboratories in the region

Output 4: Functioning diagnostic systems (Continued).

4.d.5. Re-evaluate & refine mechanism to utilize key diagnostic laboratories in the region based on emerging needs
4.e. Develop testing and identification procedures, tools and management protocols
Identify additional labs for expert status.
4.e.1. Based on APHIS evaluations, continue validation of rapid analytical procedures such as ELISA and Real Time-PCR for potential as standard (ongoing) tools in diagnostic laboratories
4.e.2. Evaluate training needs of diagnosticians (SBR, SOD, Ralstonia)
4.e.2. Determine the need for training materials for diagnosticians
4.e.2. Deploy training courses and materials for diagnosticians
4.e.2.i Evaluate training needs of diagnosticians (Plum Pox, Potato Wart, Citrus G.)
4.e.2.ii Determine the need for training materials for diagnosticians (Plum Pox, Potato Wart, Citrus G.)
4.e.2.iii Deploy training courses and materials for diagnosticians (Plum Pox, Potato Wart, Citrus G.)
4.e.2 .iv Develop & Distribute Notebooks (for all states for all 2003-04 select agents)
4.f. Train and provide support resources to diagnosticians in techniques and systems
4.f.1. Train diagnosticians in the use of digital cameras and basic image editing techniques, on the Distance Diagnostics System, Image Library System, First Responder System, data management procedures
4.f.2. Provide web-based training and support resource for use of telecommunications equipment and software distributed diagnostics system
4.g Train and provide support resources to diagnosticians in diagnostic skills
4.g.1. Prepare web-based help resources for diagnosticians to perform their appropriate role
4.g.2. Train diagnosticians in identification of target pathogens through internships, on-line and hands-on modules, videoconferencing and face-to-face workshops
4.g.3. Provide resources to enable them to confirm identity or set up sites within the region to confirm identity.
4.g.3. Provide bulletin board with list serve for diagnosticians (Threaded discussion platform)
4.h. Permitting through APHIS
4.h1 Select Agent Letter
4.h.2 Number of states with permits (form 526)
4.h.3 Regional Center 526 permitted
4.i. Establish lab security standards
4.j. Implement lab security standards
4.k Salary diagnosticians per states
4.o Entomology-SPDN Intensive training for diagnosticians
4.p Entomology-Increase Laboratory capacity
4.q Entomology-SPDN Additional entomology training
Hire additional personnel for idenfitication and taxonomic studies
Develop a second entomology workshop on beetles affecting plants
Supplies and emergency operations
4.r Emergency operations funding

Output 5: Data analysis processes for event detection.

Activities Ongoing Complete New activity in '05 Insufficient progress for '04 Insufficient funds*
5.a. Study background data for patterns
5.a.1. Examine several years of background data from several state LGU laboratories
5.b. Develop analysis methods to detect new event from background pest profile
5.b.1. Have workshop of national experts: epidemiologists, insect population dynamicists
5.b.2. Workshop with client decision makers to understand required response support
5.b.3. Test analysis methods
5.b.4 Build linkages with other databases needed for analysis
5.b.5 Expand GIS capabilities
5.c. Establish data analysis methods for phase 1 in all regional labs and at NAPIS
5.d. Data analysis for phase two data records
5.d.1 Data analysis for phase two data records (develop methods)
5.d.2 Data analysis for phase two data records (analyze data)

Output 6: Response activation and decision support mechanisms: decision support mechanisms are functioning.

Activities Ongoing Complete New activity in '05 Insufficient progress for '04 Insufficient funds*
6. Response activation and decision support mechanisms are functioning
6.1. Identify types of event response
6.1.i Run type 1 exercises in each state on appropriate pathogens & other pests
6.1.ii Run type 2 exercises in each state on appropriate pathogens & other pests
6.1.iii. Broaden & further develop scenario training activities (ongoing)
6.1.iv. Maintain exercise team
6.2. Identify reporting chains and call lists for each type of event
6.2.i. Establish communications with the pest management infrastructure for each state
6.2.ii. Facilitate the educational response capabilities of extension by providing diagnostic services, informational guidance, and decision support when applicable (ongoing)
6.2.iii. Establish a clear reporting chain with receipt and acknowledgement criteria
6.3 Develop rule/role based notification system
6.4 Develop Implement rule/role based notification system

Appendix IV: Relevant Publications

In this Appendix are five examples of publications that represent the tangible outputs that have resulted from NPDN cooperation and collaboration. The first was a Feature Article published in Plant Disease to provide an in-depth at the mission, structure, and function of NPDN. The second and third publications resulted from collaboration with the National IPM Centers; one is a fact sheets on a high consequence insect pest while the other is for a high consequence pathogen. The fourth example is an on-line publication in Plant Health Progress that resulted from a collaboration of several NPDN labs with the USDA ARS lab at Fort Detrick to validate a diagnostic protocol for Asian soybean rust. The last example is a publication in Plant Health Progress that resulted from a research collaboration between an NPDN regional center lab and the USDA APHIS expert lab in Maryland. Also provided is a list of publications from other projects and training programs.

Additional publications can be found on the accompanying CD.

Appendix V: Newsletter

NPDN developed and routinely distributes an array of information vehicles in the form of digital newsletters and communications. In this appendix are two examples of digital newsletters: the national NPDN newsletter and an SPDN newsletter. A more complete compilation of past issues can be found on the accompanying CD.