

# Plant Biosecurity Programs and Infrastructure: Overview from Academia

Ray Hammerschmidt  
Michigan State University

A decorative graphic consisting of several horizontal lines of varying lengths and colors (teal, light blue, white) extending from the right side of the slide towards the center.

# Four Examples

- National Institute for Microbial Forensics & Food and Ag Biosecurity
  - Oklahoma State University
- Biosecurity Research Institute
  - Kansas State University
- Emerging Pathogens Institute
  - University of Florida
- The National Plant Disease Diagnostic Network
  - Land Grant Universities

National Institute for Microbial Forensics &  
Food and Agricultural Biosecurity



Henry Bellmon  
Research  
Center

**NIMFFAB - Est. 2007**



# NIMFFAB Mission

To identify, assess, prioritize and conduct:

- Research
- Education
- Outreach

related to national needs in microbial forensic science with respect to

- pathogens of crops, forests, and rangelands
- human pathogens in fresh produce

*The **NIMFFAB** will build on, connect and enhance existing programs that support and address issues of crop and food security.*

**Jacqueline Fletcher, Ph.D., Director & Regents Professor**

Plant pathology, microbiology, bacteriology



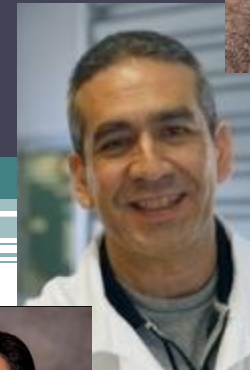
**Astri Wayadande, Ph.D., Asst. Director & Asst. Professor**

Vector-pathogen interactions for plant pathogens & human pathogens on plants



**Francisco Ochoa Corona, Ph.D., Asst. Professor**

Diagnostics & detection technology, plant virology, molecular biology



**Li Ma, Ph.D., Asst. Professor**

Produce safety, human pathogens on plants, traceback of human pathogen outbreaks



**Rakesh Kaundal, Asst. Research Scientist**

Metagenomics, bioinformatics, machine learning, artificial intelligence



# NIMFFAB Linkages

- **USDA APHIS Plant Protection & Quarantine (PPQ)**
  - MOU in preparation – Diagnostic tool development
- **National Plant Diagnostic Network (NPDN)** – part of the LAN
- **National Plant Disease Recovery System (NPDRS)** – HSPD9 mandate
- **American Phytopathological Society**
  - APS Microbial Forensics Interest Group & Food Safety Interest Group
- **IC Biological Sciences Experts Group**
- **National Biosurveillance Integration Center (NBIC)**
- **National Academy of Sciences - Institute of Medicine** – Forum on Microbial Threats
- **Defense Threat Reduction Agency (DTRA)**

Kansas State University



# *Biosecurity Research Institute*



- BSL-3 & BSL-3Ag biocontainment research & education facility
- Animal Health, Plant Health, Food Safety, Environmental Health
- Very unique research space (academic, industry, government)
- Facility-wide physical & electronic security



# Wheat Blast Research Project

- Multi-Institutional Research Team -



## Dedicated Wheat Blast Research Lab

- University-USDA Collaboration
- International collaborators – Wheat Blast Consortium
- Comprehensive Research Agenda
  - Genomics
  - Diagnostics
  - Epidemiology
  - Disease Forecasting & Management
- USDA NIFA funded





Biosecurity  
Research  
Institute  
Kansas State University

pathogen  
identification

symptom  
recognition

# Emerging Pathogens Institute

## University of Florida

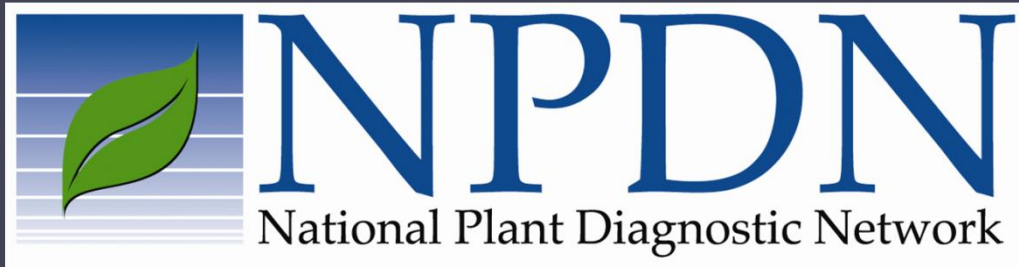
- Understand the genetic changes that lead to new pathogen emergence
- Investigate complex interaction of environmental and host factors that allow these pathogens to spread within populations
- Use these data to develop and implement interventions to minimize risk of disease transmission;
- Train the next generation of investigators in emerging diseases
- Disseminate information about emerging pathogens, and their control, to the people of Florida

# Areas of research

- Vector-Borne Diseases
  - West Nile, Malaria, Dengue
- Influenza, other viral pathogens
- Tuberculosis/drug-resistant TB/non-TB mycobacterial disease
- Enteric and Foodborne Illnesses
- Cholera, diarrheal disease
- Foodborne disease policy and control
- **Plant pathogens**
- Antibiotic Resistance/hospital infection control
- MRSA

# Plant Diseases

- Citrus canker
- Soybean rust
- Sudden oak death
- Lethal yellowing
- Maize stripe
- Citrus greening
- Pierce's disease



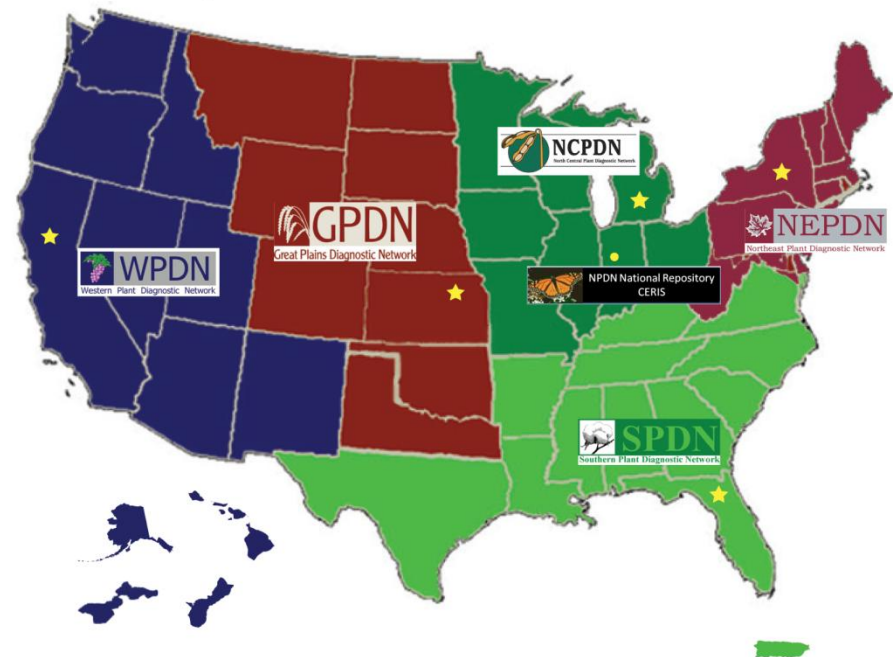
# NPDN

## The National Plant Diagnostic Network



# The NPDN By Region

- Kitty Cardwell and Marty Draper, USDA NIFA
- Jeff Jones,
  - Executive Director and SPDN Director
- Jim Stack
  - GPDN Director
- Ray Hammerschmidt
  - NCPDN Director
- March Fuchs
  - NEPDN Director
- Rick Bostock
  - WPDN Director
- Eileen Luke
  - CERIS, National Repository





# How is this Accomplished?

## Education

- *First detector training*

## Diagnostics

- *Training*
- *Support for diagnostic infrastructure*
- *SOP development*
- *Surge capacity*
- *Accreditation*

## Communication

- *Secure national data repository cataloguing pest and disease occurrences*
- *Exercise scenarios*
- *Coordination and cooperation among agencies*
- *Newsletters and public relations*

# **First Detector and FD Educators: modules and manuals**

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


# Newsletters



## NPDN

National Plant Diagnostic Network

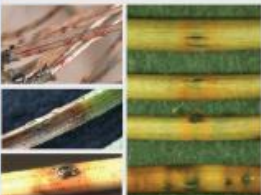
# NPDN News



**Figure 1:** Pine shoots and needles with symptoms and signs of California needle blight. Figure 1A and 1B are typical to be on the lower portions of trees in protected beds of nurseries and in the related attached age classes of seedlings.

### Issue Highlights

- Recap 2012 advanced diagnostic workshops
- Citrus pests resource tool
- New website-workgroup CPHST diagnostic methods
- Diag tip – sampling and shipping protocols for *Dothistroma*
- Systematic internship program
- SPN workshop in Dallas
- New Plant Heroes website
- IT updates
- In *Regional News*: SAPW in TX



**Figure 2:** Needle of an evergreen with signs of EPSC. Feeding tracks are black punctures that track up through the needle surface. Feeding tracks may occur in areas with "bleached," brown, or red pigmentation. They may occur in bundles at the basal end of needles, or within broad zones of needles.

Go to [www.npdn.org](http://www.npdn.org) & choose newsletter



## SPDN

Southern Plant Diagnostic Network

# FIRST DETECTOR NETWORK NEWS



**In This Edition:**

- Update on the Invasion of the Bean Plataspid
- Additional counties in Kentucky and New York have been added to the emerald ash borer regulated area
- Montgomery Botanical Gardens hosts a Florida Sentinel Plant Network Training Workshop
- Florida launches a new website featuring invasive wildlife species

### Upcoming Meetings

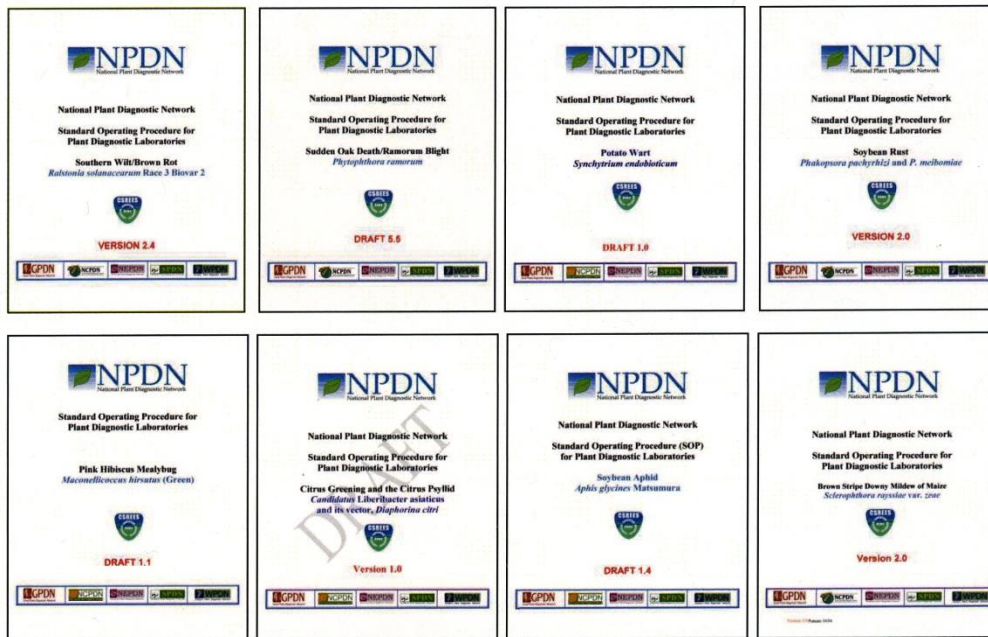
- September 13-15, 2012 - the Invasive Cardener Advanced Diagnostic Conference will be held in Pikes, MN - click here for more details.
- September 20-26, 2012 - the Florida Marine Cardener Volunteer State Conference will be held in St. Petersburg, FL - click here for more details.
- October 1-3, 2012 - the Florida Marine Cardener State Conference will be held in Lake Charles, LA - click here for more details.
- October 4-6, 2012 - the Florida Marine Cardener State Conference will be held in Nashville, TN - click here for more details.

**Montgomery Botanical Gardens hosts a Florida Sentinel Plant Network Training Workshop**

Guests from the State, University, and industry are invited to attend the training workshop. The workshop will be held at the Montgomery Botanical Gardens in Montgomery, AL. The workshop will cover topics such as: Invasive species identification, Plant health assessment, and Plant health management. The workshop will be held from September 13-15, 2012. For more information, please contact the Montgomery Botanical Gardens at [www.mbg.org](http://www.mbg.org).

Go to [www.sepdn.org](http://www.sepdn.org) & choose newsletter

# Diagnostic SOP's



Diagnostic training with  
USDA-APHIS

Regional Training and  
workshops



## Infrastructure upgrades:

- Web enabled microscopy
- RT-PCR
- Biosafety cabinets

# Diagnostics

- Proficiency panels and provisional authorization for diagnostics of high consequence pathogens
- Increased capacity for surge
  - Ramorum blight
  - Plum pox virus

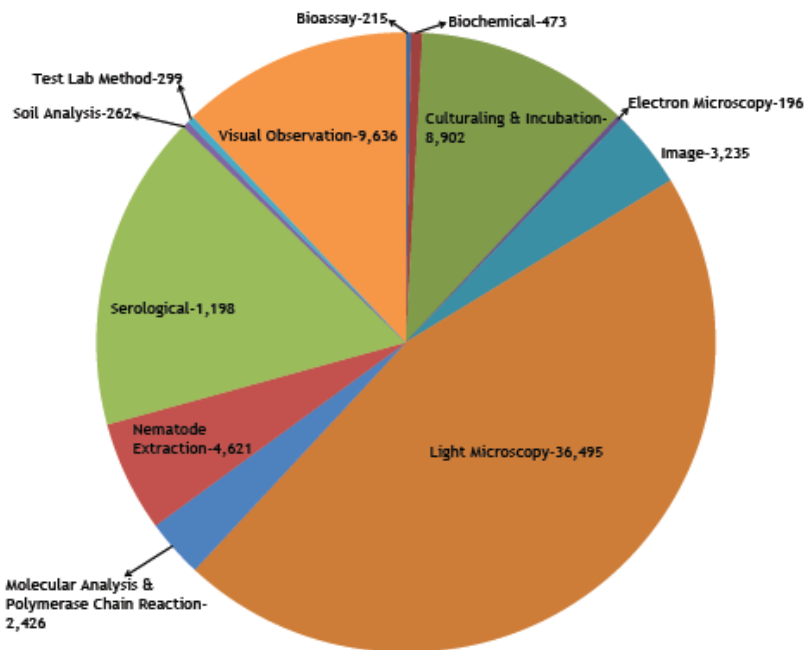


# Lab Accreditation

- Quality Management System Workshop, AALVD facility, Ames, IA
- GAP Audit and Document Review, Cornell University, Ithaca
- ISO-17025 Auditor Training, University of Florida, Gainesville
- GAP Audit with Auditor Checklist Review, University of Florida, Gainesville
- GAP Audit with Auditor Checklist Review, Kansas State University



# Diagnostics: Methods and Training



APHIS Sponsored Diagnostic Training Sessions	Number of Training Sessions	Number of Diagnosticians Trained
*Bioinformatics 1	6	43
*Bioinformatics 2	2	17
*Citrus Leprosis, Sweet Orange Scab, Citrus Black Spot	2	15
*Citrus Greening Disease (Huanglongbing)	6	25
* <i>Phytophthora ramorum</i>	6	38
* <i>Phytophthora ramorum</i> & <i>Phytophthora kernoviae</i>	4	24
*Plum Pox Virus, Potyvirus	1	8
*Potato Cyst Nematode	4	32
*Potato Wart ( <i>Synchytrium endobioticum</i> )	4	15
* <i>Ralstonia solanacearum</i> ; Race 3, Biovar 2	5	32
*Soybean Rust ( <i>Phakopsora pachyrhizi</i> )	2	34
*Soybean Rust ( <i>Phakopsora pachyrhizi</i> ) & <i>Ralstonia solanacearum</i> ; Race 3, Biovar 2	1	10

Types of method used in 2011-12

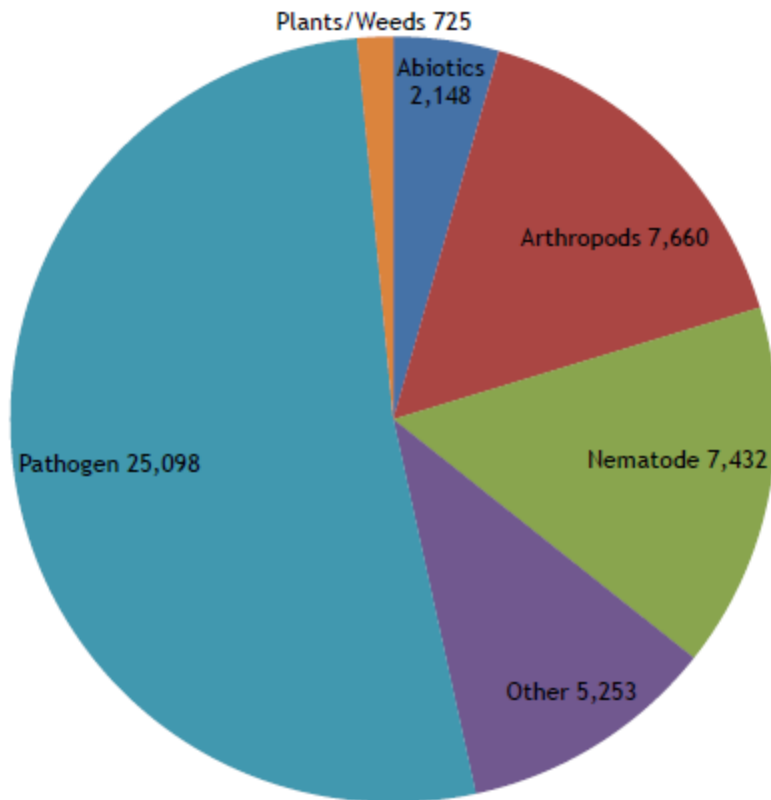
# National Data Repository

Located at CERIS at Purdue University

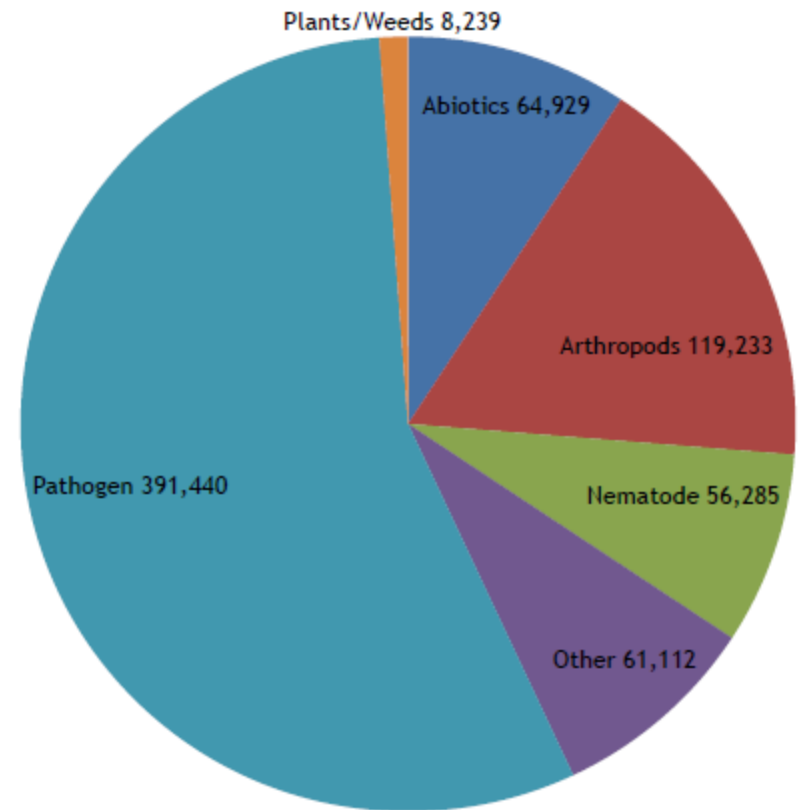
- LGU Labs in every state and many territories report diagnostics data
- Many state departments of Ag report data
- Industry labs also contribute
- Over 7,400 types of pests or pathogens reported
- 15 classes of diagnostic methods
- 769,621 records in the Repository (as of 4/14/13)

# Data in the Repository

Pest Type Data Summary 2011-2012



All Time Data Summary 2007-2012



# More information

- National Institute for Microbial Forensics & Food and Ag Biosecurity Research Institute
  - <http://entopl.okstate.edu/nimffab>
- Biosecurity Research Institute
  - <http://www.bri.k-state.edu/>
- Emerging Pathogens Institute
  - <http://www.epi.ufl.edu/>
- The National Plant Disease Diagnostic Network
  - <http://npdn.org>