Plant Biosecurity Programs and Infrastructure: Overview from Academia

Ray Hammerschmidt
Michigan State University
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
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.
NIMFFAB faculty & expertise

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)**
• 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
Stakeholder Training Events at BRI

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?

<table>
<thead>
<tr>
<th>Education</th>
<th>Diagnostics</th>
<th>Communication</th>
</tr>
</thead>
</table>
| • First detector training | • Training  
• Support for diagnostic infrastructure  
• SOP development  
• Surge capacity  
• Accreditation | • 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

NP DN News

Issue Highlights
• Recap 2012 advanced diagnostic workshops
• Citrus pests resource tool
• New website workgroup
• Cushman diagnostic methods
• Dung tip — sampling and shipping protocols for Drosophila
• Systematic internship program
• SPN workshop in Dallas
• New Plant Heroes website
• IT updates
• In Regional News: SAPW in TX

Go to www.npdn.org & choose newsletter

First Detector Network News

In This Edition:
• Update on the Invasion of the Bean Pod Borer
• Additional counties in Kentucky and New York have been added to the emerald ash borer regulated area
• Montgomery Botanical Gardens host a Florida Sentinel Plant Network Training Workshop
• Florida launches a new website featuring invasive species resources

Upcoming Meetings

Do You Tweet?
Click here for updates

Employment Opportunities
Please click here for more information

Go to www.spdn.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

Types of method used in 2011-12

APHIS Sponsored Diagnostic Training Sessions

<table>
<thead>
<tr>
<th>Method</th>
<th>Number of Training Sessions</th>
<th>Number of Diagnosticians Trained</th>
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<tbody>
<tr>
<td>Bioinformatics 1</td>
<td>6</td>
<td>43</td>
</tr>
<tr>
<td>Bioinformatics 2</td>
<td>2</td>
<td>17</td>
</tr>
<tr>
<td>Citrus Leprosis, Sweet Orange Scab, Citrus Black Spot</td>
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<td>15</td>
</tr>
<tr>
<td>Citrus Greening Disease (Huanglongbing)</td>
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<td>25</td>
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<tr>
<td>Phytophthora ramorum</td>
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<tr>
<td>Phytophthora ramorum &amp; Phytophthora kernoviae</td>
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<td>24</td>
</tr>
<tr>
<td>Plum Pox Virus, Potyvirus</td>
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<td>8</td>
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<tr>
<td>Potato Cyst Nematode</td>
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<tr>
<td>Potato Wart (Synchytrium endobioticum)</td>
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<td>15</td>
</tr>
<tr>
<td>Ralstonia solanacearum; Race 3, Biovar 2</td>
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<td>32</td>
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<tr>
<td>Soybean Rust (Phakopsora pachyrhizi)</td>
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</tr>
<tr>
<td>Soybean Rust (Phakopsora pachyrhizi) &amp; Ralstonia solanacearum; Race 3, Biovar 2</td>
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</tr>
</tbody>
</table>
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

- Plants/Weeds: 725
- Abiotics: 2,148
- Arthropods: 7,660
- Nematode: 7,432
- Pathogen: 25,098
- Other: 5,253

All Time Data Summary 2007-2012

- Plants/Weeds: 8,239
- Abiotics: 64,929
- Arthropods: 119,233
- Nematode: 56,285
- Pathogen: 391,440
- Other: 61,112
More information

• National Institute for Microbial Forensics & Food and Ag Biosecurity Research Institute
  ▫ http://entoplp.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