Trade Issues and Risk Analysis

Exotic Pest Information Collection and Analysis (**EPICA**, https://www.gpdd.info/public/epica.pdf). EPICA provides PPQ programs with early warning of exotic plant pest events through weekly e-mail reports, allowing recipients to identify emerging pest threats before they reach the United States and to respond in an appropriate and timely manner. Through a unique combination of technology and human expertise, EPICA achieves a wide, systematic, and efficient coverage of open-source plant health information, which it then analyzes and communicates within a PPQ-relevant context. In addition, EPICA actively supports further integration of biosurveillance efforts into a comprehensive safeguarding strategy for PPQ. (Contact Ron Sequeira)

EPICA
Exotic Pest Information Collection and Analysis

Global Pest and Disease Database (GPDD, www.gpdd.info). The GPDD is a secure electronic repository of scientific information about potentially invasive pests of concern to U.S. agriculture. This database is maintained and operated by the National Science Foundation's Center for Integrated Pest Management. CPHST provides oversight and input on the content and direction of the database. Compiled data is brought together from public and secure electronic sources, primary literature, expert correspondence, and internal APHIS documents. Currently there is information on more than 2,300 pests. Over 1,700 clients use the system, including risk assessors, program managers, port inspectors, and state survey coordinators. New linkages and content from APHIS projects continue to be added. For example, new tools for risk assessors and advanced search queries are in progress. (Contact Ron Sequeira)

Data Archival and Reporting Tool (DART). CPHST is developing a Pest Risk Analysis (PRA) data archival system within the Global Pest and Disease Database (GPDD). The tangible products so far include the ability to conduct "country x commodity" queries to identify pest species contained in the GPDD. This ability enables a risk analyst to generate a "first guess" pest list at the touch of a button. In the future, queries will be further customized to add pest data from past risk analyses. Tools in development include a query to compare pest's risk ratings between different PRAs and analytical techniques to predict probability of pest establishment and host range expansions. (Contact Ron Sequeira)

Micronesian Pathway Risk Analysis and Biosecurity Plan. CPHST is participating in a risk analysis cooperation of unprecedented scale, working with groups in APHIS Veterinary Services, Wildlife Services, and PPQ Plant Health Programs to produce a) an assessment of the risks to animal and plant health in the Micronesian Region expected as a result of a planned military build-up on Guam, and b) to develop a biosecurity plan for mitigating identified risks. CPHST is playing a leadership role in this cooperation. The APHIS team is also coordinating with the Smithsonian Institution and the U.S. Geological Survey. The project was requested by the U.S. Department of Defense to provide information required for an Environmental Impact Statement. (Contact Ron Sequeira)

Trade Support - Risk Assessments for Fruits and Vegetables. CPHST risk analysis staff are responsible for scientific documentation in support of trade decisions regarding the importation of commodities. Risk analysts prepare pest risk assessments, identify potential mitigations, and review pest risk assessments prepared by other countries and/or their contractors. Staff members also identify and develop improvements in the pest risk assessment and risk management process. (Contact Ron Sequeira)

Risk Analysis Support for US agriculture exports. This aspect of risk analysis is designed to provide support to export opportunities that are blocked by technical barriers. A dedicated staff works to prepare *Export Risk Analysis Products*, which is focused on pest lists of arthropods and plant pathogens associated with various commodities for export to foreign countries. This work has resulted in market access for dozens of new commodities and protected markets of other commodities worth billons of dollars. (Contact Ron Sequeira)

CPHST provides scientific support for Plant Protection and Quarantine regulatory decisions and operations.

New Pest Advisory Group (NPAG). This unit constitutes one of APHIS' first lines of defense against invasive species when they are first reported on the U.S. mainland or territories. NPAG assesses new and imminent pest introductions into the United States. NPAG evaluates dozens of pests each year and makes recommendations to PPQ management regarding appropriate agency responses to exotic plant pests including arthropods, mollusks, pathogens, and weeds. (Contact Ron Sequeira)

Plants for Propagation (Q-37) Analyses and Regulatory Overhaul. APHIS is undertaking a major initiative to revise and update 7 CFR 319.37, the quarantine that regulates the import of plants for planting.

Currently, all plants for planting that are not specifically prohibited are enterable. The Plant Epidemiology and Risk Analysis Lab (PERAL) is assisting the regulatory process through the development of methodologies and analyses to support the Agency's decision-making processes associated with the evaluation of pest risk prior to authorizing the entry of propagative material into the United States. (Contact Ron Sequeira)

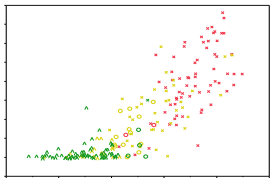
Regulatory Science Curriculum. The scientific foundations for phytosanitary systems are taught through cooperative agreements between CPHST and NC State University, Univ. of Florida, Florida A&M Univ.,

Univ. of Kentucky and Virginia Tech. The cooperative initiative includes a Minor in Plant Biosecurity and Regulatory Science. The CPHST-taught classes within the Minor have already provided the organization with a professionally trained workforce that enters the Agency with a good understanding of PPQ's mission and activities. CPHST scientists also engage in cooperative online courses (international standards and risk management) as part of a second regulatory curriculum program at Michigan State University. (Contact Ron Sequeira)

Risk Analysis Mentoring Program. CPHST PERAL's doors are open to risk analysts from other countries.

Visitors typically stay for 2-3 weeks and work on a Pest Risk Analysis document of their choosing. Assistance and mentoring is provided by our risk analysts. In the last few years PERAL has hosted scientists from Argentina, Mexico, Colombia, Uganda, Kenya, South Africa, Madagascar, Uruguay, Japan, Vietnam, Senegal, Zambia, Jamaica, Honduras, Thailand, Chile and Peru. (Contact Ron Sequeira)

Development of a Predictive Weed Screening Model. As part of the Q-37 regulations overhaul, CPHST is developing a screening tool to identify plants that are likely to be weedy or invasive in the United States. This tool or weed risk assessment considers not only biological traits such as reproduction and dispersal,

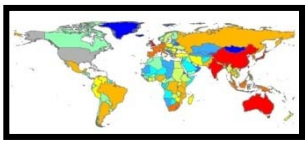


but also impacts to agricultural, natural, and anthropogenic systems, and history of invasiveness elsewhere in the world. CPHST is testing different models with a set of U.S. species with known invasive behavior to determine which models are most accurate. In the future, staff will incorporate a procedure into the screening process that will help us evaluate the consequences of uncertainty on the outcome of the screening procedure for any given plant. (Contact Ron Sequeira)

IPPC and NAPPO. CPHST scientists provide scientific expertise to the IPPC and NAPPO by participating in international working groups to draft new international and regional standards for phytosanitary measures (ISPMs and RSPMs). The topics covered in the expert working groups include pest risk analysis (PRA) for weeds, PRA for plants for planting, PRA for Asian gypsy moth and topics related to risk management for fruit flies to name a few. CPHST supports APHIS standards development by providing technical and scientific review and comments on draft standards and by suggesting new topics for standards that would be beneficial to the agency. Over the past 5 years, CPHST has coordinated a multidisciplinary team of scientists from across PPQ that has provided substantial reviews of draft standards. (Contact Ron Sequeira)

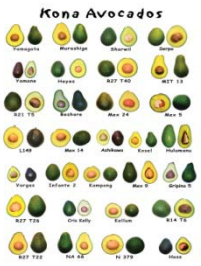
Phytosanitary Alert System. CPHST PERAL scientists manage and maintain the website for the Phytosanitary Alert System (PAS) Panel, which provides current information on pest situations of significance to North America. The official pest reports on the website serve as the official communication for the country of origin and fulfill the obligations of the IPPC Standard on Pest Reporting (ISPM No. 17). During 2009/10, PERAL scientists have posted official pest reports for the United States concerning new detections of pests including the European grapevine moth, European oak borer, spotted wing drosophila, and cotton seed bug as well as the removal and expansion of quarantine areas for various other regulated pests. Pest alerts regarding pests of potential concern to North America were also developed and posted. (Contact Ron Sequeira)

Country plant pest risk ratings. A team at PERAL is developing, for the first time, plant-risk based ratings for individual countries. These rankings will be used by Customs and Border Protection to improve agriculture inspections at ports-of-entry. Previous country ratings were based exclusively on animal pest risks. Rankings will be developed for the cargo, maritime, and air passenger pathways. The ranking value will depend on the number of high-risk plant pests in particular countries and the volume of trade or traffic from those countries. (Contact Ron Sequeira)



Airline passenger flight risk ratings. PPQ developed a model for assigning risk ratings to passengers on particular airline flights. The model uses AQIM (Agriculture Quarantine Inspection Monitoring) data to estimate the rate of quarantine materials (QM) per flight (approach rate), which are weighted by the type of QM found. The product of the weighted approach rate and passenger volume estimates the number of annual QM per flight. These values can be ranked for enhanced targeting of riskier flights, and reducing inspections on flights with less risk. The ratings apply to more than 25 large U.S. airports (e.g., Miami, JFK). PPQ is providing Customs and Border Protection (CBP) with these rankings, as well as enhanced targeting information for several of the top-ranked flights at each airport. (Contact Ron Sequeira)

Broad Risk Analysis. The concept of broad risk analysis is being advanced as an optimization tool. The intent is to ensure that economies of scale are investigated as complex risk analysis products are engaged. This approach is appropriate when multiple requests for importation can benefit from pooled resources. The categories for broad risk analyses include: 1. *Taxonomic generalization*: A risk analysis requested for one commodity is broadened by developing a risk analysis for an appropriate taxon (e.g., an entire genus). 2. *Geographic generalization*: A risk analysis requested for one country is generalized for an entire region when a region shares common pests, a common ecology and climate, or other natural geographic or environmental feature. 3. *Generalization due to production conditions*: A risk analysis requested for a given country is generalized to a larger geographic region if the conditions for production are common. 4. *Generalization due to management*: Risk analyses is broadened for a given commodity when the key management option is common (e.g., irradiation) across different countries. 5. *Generalization due to executive priorities*: Risk analysis is conducted for a given region that is the focus of an executive mandate. (Contact Ron Sequeira)



Maritime Pathway Analysis. The maritime pathway is an increasing concern as a means of introducing invasive species. Dirty containers constitute up to 10 percent of all containers that arrive in the United States. A "dirty" container carries an average 400 pounds of soil and water contaminants. Soil may be a pathway for invasive weeds, soil-borne insects and diseases and even pathogens of humans and animals. This analysis characterizes the maritime and inland cargo movement and analysis mechanisms to slow down the invasive species introduction rate. We expect that if unchecked this pathway will lead to the introduction of Asian gypsy moth within five years and additional pests and diseases within one year. (Contact Ron Sequeira)

Trade Support - Risk Assessments for Controversial or Significant Rules. Risk analysis staff are responsible for leading the development of scientific documentation in support of controversial or significant rules related to trade in plants and plant products. This includes the following documentation types: risk assessments, risk management analyses, briefings for legal counsel and OGC, development of response to comments as part of rulemaking, and review of rules for scientific accuracy. Issues such as Mexican avocados, Argentine citrus, Spanish clementines, Hawaiian orchids and many other rules have survived challenges due to the credibility and robustness of the scientific documentation. Additionally, when there are Presidential priorities or priorities identified by USDA executives, CPHST analysts provide timely analysis products in support of these initiatives. Recent examples have been linked to support trade agreements and other initiatives in the NAFTA region, Japan, Colombia, India, the EU, sub-Saharan Africa, and others. (Contact Ron Sequeira)

Climate Change Initiative. CPHST scientists are leading a PPQ team to analyze climate change as it impacts APHIS PPQ regulatory programs, and are developing a framework that describes PPQ plans for managing invasive species under global climate change scenarios. Additionally, CPHST is leveraging partnerships with universities to seek extramural funding to address key elements of the regulatory climate change framework. In cooperation with the National Science Foundation's Center for Integrated Pest Management at NC State University, PPQ plans to develop an epidemiological forecasting system that integrates climate change scenarios into PPQ response programs for invasive plant pests. (Contact Ron Sequeira)

Treatment Technology

Development of International Standards for Phytosanitary Treatments. The International Plant Protection Convention (IPPC) is an international treaty of member nations whose purpose is to prevent the spread and introduction of pests of plants and plant products and to promote appropriate measures for their control. Scientists with CPHST are participating in the development of a compendium to the IPPC standard entitled "Phytosanitary Treatments for Regulated Pests," which will contain all phytosanitary treatments that have been approved by the IPPC. CPHST submitted fourteen irradiation treatments proposed by the United States, including a generic dose of 150 Gy to be used for neutralization of all fruit flies in the family Tephritidae, for member consultation under the fast-track standard setting process. Furthermore, a 100 Gy irradiation treatment for Mediterranean fruit fly was recently approved by the IPPC Technical Panel on Phytosanitary Treatments and will be forwarded to the Standards Committee for further consideration. CPHST will submit a generic dose of 400 Gy for all insects excluding lepidopteran pupae and adults during the next call for treatments. Approval of these proposals will serve to harmonize treatments and facilitate international trade. (Contact Mike Hennessey)

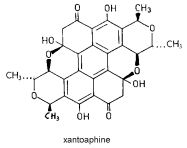
Development of Technology for Remote Monitoring and Tracking of Quarantine Treatments. Scientists with the Treatment Quality Assurance Unit (TQAU) are developing the Commodity Treatment Information System (CTIS), a system capable of collecting, analyzing, and reporting data from quarantine treatments performed at remote locations, including ships at sea. The CTIS integrates specialized data recording and transmission equipment, satellite communications, and advanced software architecture to allow APHIS staff to track treatments in real time. These systems will track cold, irradiation, hot water, vapor heat, and hot air treatments. The Irradiation Reporting and Accountability Database (IRADS), a component of the CTIS, allows APHIS to electronically audit irradiation treatments; track commodities based on grower, packer, treatment, and shipment information; and automatically produce summary reports. (Contact Mike Hennessey)

Irradiation as a Phytosanitary Treatment. The Treatment Quality Assurance Unit (TQAU) has been key in the development of policies and procedures to develop the use of ionizing irradiation as a phytosanitary treatment. TQAU has worked closely with ASTM International, the US National Institute of Standards and Technology (NIST), and the irradiation industry to create the regulatory and technical infrastructure necessary to support irradiation treatments. In addition, TQAU staff have been instrumental in implementing new irradiation preclearance programs in Thailand, India, Viet Nam, and Mexico, serving as facility certification specialists and providing technical support. In the near future, the use of irradiation as a phytosanitary treatment is expected to increase as methyl bromide is phased out. (Contact Mike Hennessey)

Technical Support for Quarantine Treatments. The Treatment Quality Assurance Unit (TQAU) provides technical treatment expertise and support for domestic and foreign PPQ programs. This support falls into several broad categories: treatment review and development, facility certification, and treatment audits / failure analysis. Treatment review and development focuses on developing new treatment solutions for emerging pests and new commodities imported into the United States. Along with this development work, TQAU continually reviews treatments already in use to verify efficacy. TQAU staff work closely with PPQ domestic and preclearance programs to certify treatment facilities. These may include Niger seed, fumigation, hot air, hot water, cold treatment, and irradiation facilities. After facilities are certified, TQAU continues to monitor treatments using onsite audits and inspections and electronic audits. These quality assurance activities are done on a periodically or when problems occur with treatments. Failure analysis is a critical function of TQAU and the information gained from these analyses can be critical in treatment development and modification. TQAU performs this work as a support function of PPQ as an independent audit group. (Contact Mike Hennessey)

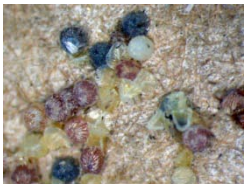
Fruit fly Treatments: Cold Treatment. Schedules for cold treatments were developed eight decades ago. Recently, their effectiveness was questioned after treatment failures associated with Spanish clementine imports. CPHST is working cooperatively with scientists in South Africa, Argentina and Kenya to develop new schedules for different commodity-species combinations. There is special interest in developing new schedules for highly invasive fruit flies like *Bactrocera invadens*. (Contact Mike Hennessey)

Trace Element Analysis. CPHST assists in conducting trace element analysis of commodities, especially fruits and vegetables, to determine country of origin. Through chemical analysis, we are able to identify commodities, pests, noxious weeds, diseases, and pathogens. These methods are currently in developmental stages. CPHST reports routine results to the PPQ-EDP-Environmental Monitoring Team (EMT), which prepares reports for stakeholders. Results of non-routine sample analysis are reported directly to program contacts. (Contact Mike Hennessey)



Invasive Snails. The CPHST Otis Lab, with cooperation from a Swiss chemical manufacturer and University of Milan, is evaluating various formulations of molluscicides on invasive snail species of concern in the field in Italy. Work continues in the laboratory on efficacy of sulfuryl fluoride against invasive snail species with the hope of replacing methyl bromide for treatment of imported ceramic tile. (Contact Mike Hennessey)

Phosphine Fumigation Treatments. The CPHST Otis Lab developed methodology to accurately measure phosphine (PH_3) concentrations by gas chromatography in small-scale fumigations conducted in a controlled laboratory setting. CPHST initiated small-scale fumigations to evaluate the efficacy of low temperature PH3 fumigation on various insects. Preliminary work focused on the egg stages of gypsy moth, *Lymantria dispar*, *Copitarsia* spp. and light brown apple moth, *Epiphyas postvittana*. Current and future work on this project will support the development of fumigation schedules for imported fresh fruit and produce. (Contact Mike Hennessey)



Treatments for Emerald Ash Borer. CPHST continues research to determine the thermo tolerance of emerald ash borer larvae, *Agrilus planipennis*, in firewood. CPHST, PPQ, and the US Forest Service Forest Products Laboratory are developing a program to train PPQ officers to conduct certifications of commercial heat treatment facilities to treat firewood in emerald ash borer and gypsy moth quarantine areas. (Contact Mike Hennessey)

Development of Treatment for Wood Infested with *Sirex noctilio*. Scientists at the CPHST Otis Lab are in the process of conducting studies on *Sirex* infested softwood to determine survivability of larvae. Due to the volume and risk of fuel chips leaving New York State for co-generation plant in Vermont and in out -of-state landscaping practices, the lab is studying *Sirex* infested softwood to determine the survivability of larvae after the wood is chipped. A chemical pressure treatment of *Sirex* infested Scots pine is being conducted to determine survivability of larvae post treatment in cooperation with the log home industry in New York State to mitigate potential movement of *Sirex* in log home kits sold outside of New York. Conventional heat treatment of *Sirex* larvae in softwood will confirm whether the universal heat treatment standard of 56°C / 30 minutes is effective. Radiofrequency treatment of *Sirex* larvae in round wood will determine a suitable treatment schedule. (Contact Mike Hennessey)

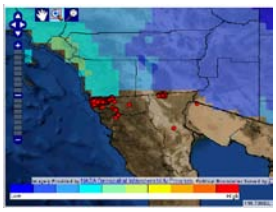
Light Brown Apple Moth Treatments. CPHST, in cooperation with researchers in Australia at the South Australian Research and Development Institute, initiated work to develop novel insecticide treatments for light brown apple moth (LBAM) on nursery stock. The goal of this project is to identify alternatives to the current treatments that are equally effective and less acutely toxic. Work to date has shown promising results for treatments using foliar applied oils, insect growth regulators and some newer “softer” synthetic organic insecticides. An LBAM culture is established in the Otis quarantine facility to allow complementary laboratory studies to be conducted. (Contact Mike Hennessey)

Pest Detection

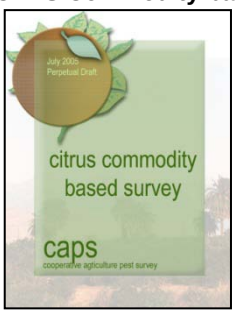
CAPS Survey and Diagnostic Methods. CPHST scientists developed an interactive table of approved methods for survey and identification/diagnostics for Cooperative Agricultural Pest Survey (CAPS) target pests. The information was compiled by performing comprehensive literature searches and consulting with U.S. and international subject matter experts. The table includes 119 pest datasheets; each datasheet includes specific survey and identification information and relevant references for each pest. Cooperators at Purdue University developed the table into a web-based format which is posted on the CAPS website. The interactive table will provide guidance to CAPS surveyors by providing the most effective methods for an early detection survey and will increase the homogeneity of the CAPS survey dataset. In addition, the information can be used by the National CAPS Committee and CPHST to identify gaps in survey and diagnostic tools. (Contact Melinda Sullivan or Lisa Jackson)

Revision of Exotic Wood Borer and Bark Beetle (EWB/BB) National Survey Manual. CPHST is in the process of revising the EWB/BB Survey Manual, which is a key survey for the Cooperative Agricultural Pest Survey (CAPS) program. The revision includes a review of the pest list, including the addition of 12 new pests. CPHST is providing additional information to the pest datasheets within the manual, including developing species-specific visual survey protocols for target pests that do not have chemical attractants identified. In addition, CPHST is adding new sections to the existing pest datasheets to provide more detailed information to the surveyors. (Contact Lisa Jackson)

NAPPFAST Update. CPHST and cooperators from North Carolina State University are developing advanced tools and capabilities for the NCSU/APHIS Plant Pest Forecast (NAPPFAST) System. These include new tools for the creation of habitat risk maps and for exotic pest targeting. The new tools will allow surveyors to combine risk maps with other types of data such as pest observations and satellite imagery to plan survey activities. In addition, new risk maps for hosts, biology and points of entry have been created and updated for CAPS pest targets and are available at http://www.nappfast.org (Contact Daniel Borchert or Lisa Jackson)

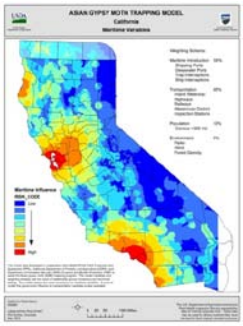


CAPS Commodity-based Survey Documents. A series of survey references and survey guidelines are being developed for the Cooperative Agricultural Pest Survey (CAPS) program. The Commodity-based Survey References consist of a series of pest sections containing detailed information on the biology, host-range, distribution, survey, and identification of the pest in appropriate detail for CAPS surveyors. The second document, the Commodity-based Survey Guidelines, provides guidelines for survey and identification for a smaller number of pests, determined by a subcommittee of the CAPS National Committee. The methods are intended to increase homogeneity of the national data set and increase the statistical confidence in negative data (e.g., demonstration of "free from" status). Commodity documents for cotton, potatoes, and stone fruits are currently under development. (Contact Melinda Sullivan or Lisa Jackson)



Trap and Lure Statements of Work for CAPS Target Species. CPHST scientists completed statements of work for five lure combinations and four trap designs for target species in the Cooperative Agricultural Pest Survey (CAPS) program. Statements of work outline product specifications that ensure that the correct product is being purchased for the program and that quality assurance and quality controls are met. Scientists at the CPHST Gulfport Lab are in the process of developing chemical testing protocols to ensure the quality of lures used by PPQ. CPHST will continue to write statements of work for new products and review older documents to ensure that CAPS and other PPQ programs have effective products for surveys. (Contact Lisa Jackson)

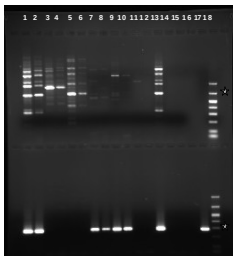
Asian Gypsy Moth Trapping Survey. Asian gypsy moth (*Lymantria dispar* ssp., AGM) is an exotic pest that has been detected, but not established in the United States. The threat to American agriculture is significant due to AGMs broad range of host plants, including 500 species of trees and shrubs, and the female moths' ability to fly. A primary pathway of introduction into America is via ship and cargo traffic from the Far East. These trade patterns place the western United States in high risk of AGM introduction. The states of Washington, Oregon, and California has comprehensive surveillance systems in place to identify (and eradicate if necessary), any moths prior to establishment. The trapping system is organized and managed with expert local knowledge, and places higher trap densities near major shipping ports and population centers. To enhance the placement of traps in these states, a geospatial model has been developed to predict areas with the highest AGM introduction risk based on maritime, transportation, population, and environmental variables. (Contact Lisa Kennaway or Lisa Jackson)



Identification and Diagnostics

National Plant Pathogen Laboratory Accreditation Program. The National Plant Pathogen Laboratory Accreditation Program (NPPLAP) was developed for labs performing PPQ diagnostic tests so that diagnostic determinations are recognized by USDA regulatory programs. Currently, the participating labs of NPPLAP test for the causal agent of *Ramorum* blight (a.k.a. Sudden Oak Death) and the citrus greening pathogen (*Candidatus* Liberibacter asiaticus) using; validated protocols, trained diagnosticians, quality assurance and proficiency testing components for the diagnosis of these pathogens. The NPPLAP Coordinator has been filled to forward the program as new diagnostics and participating labs are added to the program. (Contact Pat Shiel)

Training and Proficiency Testing of Diagnosticians for National Diagnostic Capacity. Scientists at the CPHST Beltsville Lab train National Plant Diagnostic Network as well as State and US Regulatory Agency diagnosticians in molecular biological techniques using USDA validated diagnostic protocols and procedures. Training sessions occur for *Phytophthora ramorum*, *Ralstonia solanacearum* Race 3 biovar 2, plum pox virus, and the pathogens that cause citrus greening, citrus canker, and potato wart. The Beltsville Lab also develops and produces proficiency test (PT) panels for use in NPPLAP and ICLN requirements. Proficiency test panels for *Phytophthora ramorum* and citrus greening pathogens are already deployed, and similar panels for other high-consequence regulatory pathogens are currently being developed. (Contact Pat Shiel)



Integrated Consortium of Laboratory Networks. The Integrated Consortium of Laboratory Networks (ICLN) is a U.S. government spanning organization developed to coordinate the delivery of timely, high quality, and interpretable results through inter-network communication and information sharing, resource optimization, resource coordination, and strategic planning. The ICLN cuts across Federal agencies involved in law enforcement, food safety, and human health. APHIS PPQ is a full member of the ICLN as a representative for the National Plant Diagnostic Network. The ICLN have ongoing sub-committees to coordinate lab capacity, quality assurance and proficiency testing, sampling logistics, information technology, training, and analysis of biological outbreak scenarios. The charge and charter, as well as sample procedure documents have been ratified. Response architecture documents, interoperability guidelines, and discussion of resource leveraging issues are currently under development. (Contact Pat Shiel)

Enhanced Molecular Diagnostic Systems: New diagnostic tools have been deployed to counter the increasingly complex challenge to achieve refined detection and identification of pests to fulfill the mission of APHIS. Use of molecular methods allows rapid, sensitive, and specific identifications that previously could not be realized. One goal is to adapt and develop molecular diagnostic tools for rapid identification of intercepted, immature fruit fly species of economic importance. An example is the use of sequence-specific, mitochondrial DNA variation in *Anastrepha ludens* as a means for identifying the origins of intercepted Mexican fruit fly. A similar project is aimed at economically important (but very difficult to identify) thrips species. Rapid identification of a variety of pests can be assisted by new detection technologies such as CANARY (Cellular Analysis and Notification of Antigen Risk and Yield). One important outcome of this development for PPQ will be high throughput, rapid diagnostic capability for screening material passing through Plant Inspection Stations. (Contact Pat Shiel)

ID Source. The Internet holds a vast and continually changing collection of identification-themed websites. ID Source will be a gateway into this collection, providing ongoing access to those websites containing identification aids such as keys, fact sheets, screening aids, and image galleries (ID Aids) specifically for identifying pests, weeds, and diseases of concern to PPQ. ID Source will be a searchable database allowing users to quickly search for and then zero in on those ID Aids useful to them. In addition, users will be able to rate and write comments about ID Aids and suggest potential ID Aids. ID Source is being developed cooperatively with Colorado State University. (Contact Lisa Jackson or Julia Scher)

ID Source

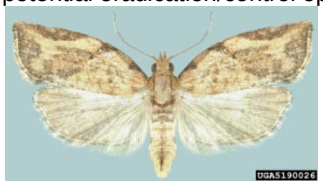
Dried Botanicals Interactive Tool. *Identification of Imported Dried Botanicals*, an interactive digital diagnostic tool, will soon be available to APHIS and cooperators. This tool represents the Identification Technology Program's first foray into emphasizing the use of images to support identification of these often highly modified plant products. It includes 244 different dried botanical products, an extensive image gallery, and fact sheets for each species represented in the tool to help support identification. The tool was developed through collaboration among PPQ's Center for Plant Health Science and Technology, PPQ Eastern Region, and Delaware State University. (Contact Lisa Jackson or Amanda Redford)

Citrus Commodity Lucid Identification Tool. The first part of a new interactive internet resource to assist APHIS and cooperators with identification of pests and diseases for the cultivated citrus commodity, *Pests and Diseases of Cultivated Citrus in the United States,* will soon be available. *Part I, Diseases and Disorders of Cultivated Citrus*, is closely associated with PPQ's Citrus Health Response Program (CHRP). This media-rich tool, complete with a symptomatic-based key, fact sheets, and image gallery, will provide identification as well as training support for individuals responsible for detecting citrus diseases during commodity-based surveys. *Part II: Pests of Citrus* will be available in 2011, and *Part III: Citrus Cultivars and Relatives* is planned for 2012. The entire resource is a collaborative effort among CHRP, PPQ's Center for Plant Health Science and Technology, University of Florida, and Broward College. (Contact Lisa Jackson or Amanda Redford)

Arthropod Pests

European Grapevine Moth. EGVM, *Lobesia botrana*, is a significant pest primarily of grapes in areas outside of the U.S. where it is established. In the fall of 2009, EGVM was detected in California. Survey activity has shown that the moth is present in several grape producing counties in California. A CPHST led Technical Working Group provides information and feedback on issues regarding trapping, lures, mating disruption, treatment and hosts. During 2010, effect of treatments and population limiting strategies, along with matching phenology to predicted generations will be assessed in order to further optimize the management of prevention of spread of EGVM in and outside California. CPHST is producing lures and monitoring survey activities through the course of the growing season to detect and delimit EGVM in and around production areas. (Contact Mike Stefan or Vic Mastro)

Light Brown Apple Moth. The light brown apple moth (LBAM)*, Epiphyas postvittana,* was detected and confirmed in Alameda County, CA, in March 2007. If left uncontrolled, LBAM could cause significant damage to many different crops, including stone fruits, pome fruits, grapes, and citrus. CPHST chairs a Technical Working Group of scientists from the United States, Australia, and New Zealand to look at potential eradication/control options, develop management recommendations and research needs, and provide ongoing scientific input to program operations. In 2009, CPHST established a rearing facility in California to develop sterile insect release technology for LBAM, conduct experiments, and support the control and management goals of the program. In November of 2009, the first release of irradiated sterile adult LBAM occurred in Napa County. Initial results are encouraging and 4 additional rearing units were delivered and installed at the California facility. (Contact Mike Stefan or Greg Simmons)



Fruit Fly Introductions. The APHIS exotic fruit fly program prevents the establishment of these significant pests of fruits and vegetables through early detection, offshore programs to reduce introduction pressure, release of sterile flies in high risk areas of the U.S., and rapid and effective response to introductions. CPHST plays a vital role in ensuring the effective and efficient implementation of these activities. Studies on ecology, chemical control, detection methodology, and sterile insect release for Medfly has led to the implementation of the very successful Gradual Advance Plan in Guatemala moving the pest further from the U.S. border. Quality assurance efforts and new technologies for emergence has saved significant funds in California for use on emergencies and allowed expansion of the sterile release area in Florida. CPHST also chaired a TWG review of the Mexican fruit fly eradication program in the lower Rio Grande Valley of Texas. Drosophila suzukii (spotted-wing drosophila) was first detected in California in 2008, and then found in Florida, Oregon, and Washington. Currently there is no regulatory action being taken for this fruit fly,

however CPHST continues to collect and track information regarding host preference, its spread and impact. (Contact Mike Stefan)

Emerald Ash Borer Biological Control. The emerald ash borer (EAB) is a non-native wood-boring beetle

that is devastating ash trees in the north-central United States. Since its discovery in Michigan in 2002, APHIS, in conjunction with state, local, and other federal agencies, led an aggressive campaign to slow the spread of this pest with quarantines, surveys, tree removal, and public outreach programs. In spite of these efforts, the range of EAB has expanded to 14 states due to natural spread and accidental introductions. In order to control the pest, the CPHST Otis Lab has been working together with the FS and ARS to implement an EAB biological control program. To date, three parasitoids highly specific to EAB have been identified from China, evaluated in the laboratory, and have been released in small plots in Michigan. CPHST is supporting a mass-rearing operation in Michigan in order to facilitate wide-spread field releases of the parasitoids. Additional parasitoids from Korea and the Russian Far East have subsequently been found and are under evaluation by CPHST scientists. (Contact Ken Bloem or Mike Stefan)

Sirex Woodwasp Biological Control. The sirex woodwasp was discovered in New York in 2005. Since the first discovery, the wasp has been detected in New York, Ohio, Pennsylvania, Vermont, Michigan, and in Ontario, Canada. Sirex has the potential to cause great harm to native pine forests as well as severe

economic losses for the lumber industry. Scientists from the CPHST Otis Lab have been conducting controlled release experiments of the nematode biocontrol agent, *Beddingia siricidicola.* CPHST also led a technical working group to discuss pest status and spread, survey, control, and research needs. CPHST, working together with Forest Service, continues to develop survey tools and evaluate the effectiveness of the biological control agent and its relationship with native species for open field releases. (Contact Ken Bloem, Vic Mastro, or Mike Stefan)

Asian Citrus Psyllid Biological Control. The Asian citrus psyllid (ACP), *Diaphorina citri*, is the primary

vector of the bacterium that causes Huanglongbing or greening disease, which is one of the most important diseases of citrus world-wide. *Tamarixia radiata* is recognized as the most important natural enemy of ACP in several geographic areas around the world. Collections of a strain of *T. radiate* from Punjab, Pakistan, were recently received into the PPQ Arthropod Quarantine Laboratory in Mission, Texas. Pending completion of host specificity testing required for permitting for environmental release, the Punjab strain will be used as a biological control tool to support area-wide ACP management in Texas and other states where ACP is established. Host specificity testing against native psyllids in California is necessary before release permits for that state will be granted. The CPHST Mission Lab submitted samples of ACP adults and host-plant material to the Texas Citrus Center in Weslaco to test for Huanglongbing disease. Testing and negative results were required in order to ship ACP to the quarantine facility in Riverside, California, to support host range testing there. (Contact Ken Bloem or Phil Berger)

Green Treatments for Rangeland Grasshoppers and Mormon Crickets. The CPHST Phoenix Lab

continues to partner with the ARS Northern Plains Agricultural Research Laboratory, Utah State University and the APHIS-PPQ Western Region to discover and develop candidate fungal pathogens for use against rangeland grasshoppers and Mormon crickets. The Western Region provides soil samples taken during routine field surveys. Utah State University processes the samples and screens them for new isolates of *Beauveria bassiana, Metarhizium anisopliae* and *Metarhizium acridum*. Both Utah State University and ARS scientists evaluate the strains in the laboratory for potential activity. The group then selects the most promising isolates for CPHST scientists working together with ARS and USU in the field to evaluate their efficacy under more natural conditions. (Contact Ken Bloem)

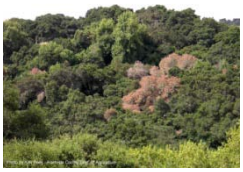
Cactus Mealybug Biological Control. The cactus mealybug (*Hypogeococcus pungens*) is a pest that is devastating endangered cactus species in Puerto Rico and could threaten similar species in the Western U.S. PPQ has been working with the University of Puerto Rico to develop a quarantine facility to test biological control agents. They are currently testing a new species of parasitic wasp that was found attacking the mealybug in Barbados. The mealybug has been known to occur throughout Florida since 1984, but it has a very limited host range and appears not to be a significant pest. University of Florida Tropical Research Education Center and CPHST scientists discovered multiple biological control agents attacking the cactus mealybug in Florida. Several predatory beetles and a primary parasitoid, *Gyranusoidea pseudococci*, were found widely distributed across Florida and are likely proving good biological control of the pest. The Florida and Barbados natural enemies may work as classical biological control agents against the cactus mealybug in Puerto Rico. (Contact Ken Bloem)

Plant Diseases

Citrus Health Response Program. The Citrus Health Response Program (CHRP) began in response to establishment of citrus canker and huanglongbing (HLB or citrus greening) in Florida, and the potential for other pests and pathogens to enter US citrus production areas. The program focuses on citrus disease management using harmonized production standards across all citrus producing states. A technical working group (TWG) reviews, defines, and identifies conditions under which nursery stock may be shipped to non-citrus producing states with no (or very low) risk of spread of citrus canker, HLB, or Asian citrus psyllid, the vector of HLB. (Contact Russ Bulluck or Charla Hollingsworth)

Potato Cyst Nematode. A technical working group (TWG) for potato cyst nematode (PCN), *Globodera pallida*, was convened to make management recommendations based on current scientific knowledge and expertise in response to the detection of PCN in a localized outbreak in Idaho potato fields. The PCN TWG provided scientific support to the regulatory program based on timely information as the response and resulting infrastructure developed. The TWG also supported issues related to survey and detection of PCN in a national survey for this pest. After the discovery of potato cyst nematode in Idaho, the area was quarantined and fumigated. Since the nematode can remain dormant for long periods, methods were developed to eradicate the nematode by planting oil radish as a biofumigant. A national survey and trace-back investigations began in 2007 and continues indefinitely. Currently, there are no other detections. (Contact Russ Bulluck)

***Phytophthora ramorum*.** CPHST provides on-going scientific support, including participating in science panel meetings and recommending modifications to eradication protocols made necessary as new scientific information becomes available. Rapid incorporation of new scientific developments continues to be a major driver of our response and recovery efforts. (Contact Russ Bulluck or Charla Hollingsworth)



Gladiolus Rust. A technical working group meeting was held to review information on the biology of the gladiolus rust (GR) pathogen, evaluate the control recommendations already in practice for this disease, and evaluate progress towards eradication. New measures were incorporated and recent surveys have been negative for the pathogen. An additional TWG meeting is expected to reevaluate the feasibility of eradication, develop management options if eradication is deemed infeasible, and determine ongoing research needs to support regulatory decision-making. (Contact Russ Bulluck or Charla Hollingsworth)

National Ornamentals Research Site at Dominican University of California. The NORS-DUC is a biosecure research site designed to simulate the nursery environment. This will allow scientists and managers to observe the epidemiology and behavior of pests and diseases in a "real world" settting. Research at the site will provide (1) valuable data that will aid in reducing the long range spread of *Phytophthora ramorum* (and other plant pests and pathogens) through infested nursery stock shipments, and (2) validation of established and development of new Best Management Practices (BMPs) for nursery stock production. (Contact Russ Bulluck)

Select Agents. As defined by the Agricultural Bioterrorism Protection Act of 2002, select agents are pathogens that have the potential to pose a severe threat to plant health or plant products by a potential bioterrorist. CPHST is the point of contact on issues regarding agricultural bioterrorism and supports the Select Agent program by collecting scientific literature and development of reports in order to provide rapid and up-to-date information on world scientific expertise, diagnostics, risk analysis, mitigation, and other biological information on the select agents. (Contact Pat Shiel)

Plum Pox Virus Eradication Program. CPHST has hosted a series of Science Panels to review the biology, distribution, control, and survey methodology for plum pox virus (PPV). The purpose of these meetings is to help formulate appropriate responses to PPV eradication efforts, especially in Michigan and New York. The Science Panel consists of government and university scientists; key personnel from state, federal, and Canadian regulatory agencies; and grower representatives. Five meetings have already been conducted in which recommendations were made on matters related to survey, detection, control, and identification of PPV. Additional meetings will convene as this year's survey continues. (Contact Pat Shiel)

Black Stem Rust/Barberry. CPHST provides technical and scientific support for the Black Stem Rust (BSR)/Barberry regulatory program by updating program leadership on new developments concerning the disease and threats posed by the recent emergence of dangerous strains of the pathogen, including Ug99. CPHST and the BSR/Barberry program recently coordinated an update and review of the scientific components of the program, including: new molecular-based identification tools for the pathogen and host varieties, the current status of European barberry in the U.S., the relationship between the disease and its host (Japanese barberry), aerial epidemiology of wind-borne spores, new fungicidal and cultural control treatments, and identification of potential pathways for new pathogen strains like Ug99 into the U.S. CPHST is also engaging scientists for applied research into these scientific components of the program through Farm Bill funding and cooperative agreements. (Contact Pat Shiel)

Chrysanthemum White Rust. CPHST provides technical and scientific support for the Chrysanthemum White Rust (CWR) regulatory program by updating program leadership on new developments concerning the disease and engaging scientists to conduct basic and applied methods development. We are currently evaluating the potential of *Puccinia horiana* to survive winter environmental conditions on ornamental plants in our Laboratory in Otis, MA. (Contact Charla Hollingsworth)

Noxious and Invasive Plants

Herbicide and Cultural Control of Invasive Plants. The CPHST lab in Fort Collins has an active invasive weed control program. The primary goal of the program is to improve weed control for federal noxious weeds and other target species selected by the State Plant Health Directors. The field and lab studies include the testing the use of selective herbicides, commercial adjuvants, and alternative spraying systems.

Herbicide treatments are matched to the local climate and weed species conditions. Replicated field studies have been conducted on benghal dayflower (FL), cogongrass (FL, AL), common tansy (SD), leafy spurge (CO), onionweed (AZ), and yellow toadflax (SD). New field studies will test herbicide treatments for sweet resinbush and fountain grass (AZ) and giant hogweed (ME). In addition, a prototype magnetic sprayer is being tested for spray drift reduction and improved weed control. (Contact Charla Hollingsworth)

Restoration of Invasive Plant Infestations. Restoration of treated invasive weed infestations is an important component of a comprehensive weed control program. Broad spectrum herbicides used for invasive weed control may create barren patches when spraying large weed infestations. The CPHST Fort Collins lab has conducted an onionweed study that included spot spraying to encourage existing native vegetation to re-establish and fill in the barren areas. Other restoration methods used by our lab include the use of selective herbicides, such as the sulfonylureas, which control broadleaf weed species but do not

harm grass species. We have had very good success in re-establishing grasses in our herbicide studies with common tansy and yellow toadflax by using selective herbicides. A third restoration method used by this lab is re-seeding treated areas with grasses or cover crops to establish a rapid growing ground cover or beneficial legume. We have had good success in establishing legume and sudangrass cover crops after controlling cogongrass and benghal dayflower in FL and AL, where there is abundant rainfall. (Contact Charla Hollingsworth)

Ecology of Invasive Plants. Long term monitoring of individual patch expansion rates of perennial species would provide insight into the spatial and temporal dynamics of invasive weed communities. Many invasive

plant species are perennials that spread vegetatively (through rhizomes, stolons, etc.) and form distinct patches. Patch expansion rates are a primary indicator of the invasiveness of a species. Field data on patch expansion has been collected for approximately 10 – 12 invasive weed species in seven states in the past two years. Patch expansion rates vary from 0.4 to 13.3 ft^2/day, with most species averaging about 2- 6 ft^2/day over a summer growing season. This data may be used for spatial analysis or for justifying weed control programs (Contact Charla Hollingsworth)

Weed Risk Assessment. Invasive weeds cause serious damage to our natural resources and agriculture.

Existing invasive weeds are often introduced as plants intended for propagation or unintentionally introduced as contaminants. To prevent introduction of new invasive weeds CPHST risk analysts evaluate the potential of foreign plant species to become damaging invasive weeds, often resulting in regulations that prohibit entry. (Contact Ron Sequeira)

Insect Biological Control of Perennial Weeds. Exotic perennial weeds are significant pests in a variety of

agricultural and natural communities throughout the US. Among these weeds are Russian knapweed (*Acroptilon repens*), an invader of western US rangelands, and yellow toadflax (*Linaria vulgaris*), which occurs in crops, grasslands, and riparian areas thorough the northern US. Both weeds have been selected by PPQ as high-priority targets for implementation of biological control. CPHST Fort Collins has worked with international, Federal, state, and university partners to develop and deliver biocontrol agents for both weeds. In 2009, the Russian knapweed gall midge, *Jaapiella ivannikovi*, was released at sites in Wyoming, Montana, and Colorado; a laboratory colony of the midge was established at CPHST Fort Collins in early 2010. A yellow toadflax-adapted strain of the Dalmatian toadflax stem weevil, *Mecinus janthinus*, was recently discovered in Montana. Field releases of the weevil have been made in Colorado, and a laboratory rearing effort was established at Colorado State University. (Contact Ken Bloem or Charla Hollingsworth)

Biological Control of Perennial Weeds Using Pathogens. Exotic perennial weeds are significant pests in a variety of settings throughout the Unites States. Among these weeds are Canada thistle (*Cirsium arvense)* and perennial pepperweed (*Lepidium arvense*), which are particularly invasive throughout much of the western US and reduce the grazing capacity and biodiversity of rangelands and natural areas. CPHST Fort Collins is working with international, federal, state, and university partners to survey for and develop biocontrol pathogens for these weeds. CABI Bioscience is conducting PPQ-funded surveys for potential biocontrol pathogens in Canada thistle's native range in China. An unreported race of *Albugo candida*, a white rust pathogen, was identified through perennial pepperweed surveys in Colorado and California. Host specificity studies with the rust from both states are being conducted to determine their host range and efficacy. (Contact Ken Bloem or Charla Hollingsworth)

Other

CPHST Quality Management/ISO Registration. CPHST Quality Management provides leadership in the creation of an internationally recognized quality management system that supports CPHST's scientific solutions and PPQ's commitment to science-based decisions. Our goal is to develop and implement a quality management system at all CPHST laboratories that assures stakeholders, shareholders, and management through ongoing internal and third-party certification and accreditation audits that CPHST's processes are managed, maintained, and improved to support decisions based on scientific principles. Currently, four CPHST laboratories (PERAL, Gulfport, Mission and TQAU) are operating within the bounds of an ISO 9001:2008 certified quality management system with one additional laboratory actively working to develop and implement an ISO 17025:2005 accredited system. (Contact Bill Dickerson)