THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

Record of the Year

2015-2016

CAES

The Connecticut Agricultural Experiment Station

Putting Science to Work for Society since 1875

The Connecticut Agricultural Experiment Station, founded in 1875, was the first state agricultural experiment station in the United States. The Station has laboratories, offices, and greenhouses at 123 Huntington Street, New Haven 06511, Lockwood Farm for experiments on Evergreen Avenue in Hamden 06518, the Valley Laboratory and farm on Cook Hill Road, Windsor 06095, and a research center in Griswold and Voluntown. Station Research is conducted by members of the following departments: Analytical Chemistry, Entomology, Environmental Sciences, Forestry and Horticulture, Plant Pathology and Ecology, and the Valley Laboratory. The Station is chartered by the Connecticut General Statutes to experiment with plants and their pests, insects, soil and water and to perform analyses.

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BOARD OF CONTROL

The management of The Station is vested in a Board of Control as specified in section 22-79 of the General Statutes of Connecticut.

The members of the Board of Control as of June 30, 2016 were:

Governor Dannel P. Malloy, President
Terry Jones, Vice President
Paul C. Larson, Secretary
Ms. Patti J. Maroney
Ms. Joan Nichols
Commissioner Steven K. Reviczky
Dr. Dana Royer
Dr. Theodore G. Andreadis, Director

The Board of Control met on August 5, 2015, October 21, 2015, January 20, 2016, and April 13, 2016.

STATION STAFF

The Experiment Station exists to advance scientific knowledge, and that advance depends completely upon the quality and dedication of its staff. The following was the staff of The Connecticut Agricultural Experiment Station as of June 30, 2016.

ADMINISTRATION
Dr. Theodore G. Andreadis, Director
Michael P. Last, Chief of Services
Dianne F. Albertini
Vickie Bomba-Lewandoski
Sandra E. Carney
Lisa L. Kaczenski
Kathryn K. Soleski
Jennifer L. Stevens

ANALYTICAL CHEMISTRY
Dr. Jason C. White, Vice Director, Department Head
Terri Arsenault
Michael J. Cavadini
Dr. Roberto De La Torre Roche
Dr. Brian D. Eitzer
Dr. Lester Hankin, Emeritus
Joseph R. Hawthorne
Dr. Walter J. Krol
Dr. MaryJane Incorvia Mattina, Emeritus
Dr. Sanghamitra Majumdar
Craig L. Musante
Kitty Prapayotin-Riveros
John F. Ranciato
Dr. Christina S. Robb

ENTOMOLOGY
Dr. Kirby C. Stafford III, Department Head
Dr. John F. Anderson, Emeritus
Tia Blevins
Mark H. Creighton
Dr. Douglas W. Dingman
Katherine Dugas
Jeffrey M. Fengler
Megan A. Linske
Morgan F. Lowry
Dr. Chris T. Maier
Dr. Gale E. Ridge
Dr. Claire E. Rutledge
Dr. Victoria L. Smith
Dr. Kimberly A. Stoner
Heidi R. Stuber
Tracy A. Zarrillo

ENVIRONMENTAL SCIENCES
Dr. Joseph J. Pignatello, Department Head
Dr. Philip M. Armstrong
Dr. Douglas E. Brackney
Angela B. Bransfield
Gregory J. Bugbee
Dr. Maria A. Correa
Jennifer M. Fanzutti
Dr. Hsin-se Hsieh
Michael J. Misencik
Dr. Goudarz Molaei
Dr. Brij L. Sawhney, Emeritus
John J. Shepard
Dr. John S. Soghigian
Dr. Blaire T. Steven
Michael Thomas
Michael Vasil
Dr. Charles R. Vossbrinck

FORESTRY AND HORTICULTURE
Dr. Jeffrey S. Ward, Department Head
Dr. Adriana L. Arango-Velez
Joseph P. Barsky
Joan L. Bravo
Dr. Martin P. N. Gent, Emeritus
Dr. David E. Hill, Emeritus
Dr. Abigail A. Maynard
Michael R. Short
Dr. Paul E. Waggoner, Emeritus
Dr. Scott C. Williams

GRISWOLD RESEARCH CENTER
Robert J. Durgy, Research Farm Manager

LOCKWOOD FARM
Richard M. Cecarelli, Research Farm Manager
Rollin J. Hannan
Michael M. McHill

MAINTENANCE
Bancroft C. Nicholson, Lead Maintainer
Isaac Buabeng
Eric J. Flores
Brian Hart
Miguel Roman
Ronald A. LaFrazier
Michael A. Scott

PLANT PATHOLOGY AND ECOLOGY
Dr. Wade H. Elmer, Department Head
Michael A. Ammirata

Dr. Sandra L. Anagnostakis, Emeritus
Dr. Donald E. Aylor, Emeritus
Dr. Sharon M. Douglas, Emeritus
Dr. Francis J. Ferrandino
Regan B. Huntley
Dr. Yonghao Li
Dr. Robert E. Marra
Dr. Neil A. McHale, Emeritus
Lindsay A. Patrick
Dr. Richard B. Peterson, Emeritus
Dr. Neil P. Schultes
Dr. Teja S. Shidore
Pamela Sletten
Peter W. Thiel
Dr. Lindsay R. Triplett
Dr. Israel Zelitch, Emeritus
Dr. Quan Zeng

VALLEY LABORATORY
Dr. James A. LaMondia, Department Head
Dr. Jatinder S. Aulakh
Jane Canepa-Morrison
Dr. Carole A. Cheah
Nathaniel R. Child
Dr. Richard S. Cowles
Jeffrey M. Fengler
Rose T. Hiskes
Dr. DeWei Li
Dr. Katja Maurer
James J. Preste, Research Farm Manager
Thomas M. Rathier, Emeritus
Diane Riddle
Michelle R. Salvas

NEW SCIENTIFIC STAFF

Dr. Jatinder Aulakh

Dr. Jatinder Aulakh is a weed scientist who joined the Valley Laboratory in Windsor in August 2015 as an Assistant Scientist II. He holds a BS degree in agriculture and MS degree in agronomy from Punjab Agricultural University in India and a PhD degree in weed science from Auburn University in Alabama. He additionally completed postdoctoral research at the University of Nebraska. Dr. Aulakh plans to focus his research on management of weeds in ornamental nursery crops species using biological, chemical, and non-chemical practices.

RETIREMENTS

Dr. Sharon Douglas

Dr. Sharon Douglas joined the staff of The Connecticut Agricultural Experiment Station in 1982 as an Assistant Scientist in the Department of Plant Pathology and Ecology. She rose through the ranks of Associate Scientist, Full Scientist, and in 2007 was appointed Head of the Department of Plant Pathology and Ecology. She came to the Station with expertise in the physiological and genetic bases of host-pathogen interactions and the biology and epidemiology of phytoplasma-associated diseases, particularly X-disease of stone fruits. She continued to develop detection and diagnostic skills in the Plant Disease Information Office (PDIO) where she painstakingly transformed the office into a leading full-service diagnostic office that identifies plant health problems for the many different stakeholders of our state. She also ushered in the use of molecular diagnostics and co-directed the Molecular Plant Diagnostics Laboratory designed to develop rapid, accurate methods to detect new or re-emerging plant pathogens. As a direct result of her efforts, the PDIO has become the flagship for the Department of Plant Pathology and Ecology and for The Connecticut Agricultural Experiment Station. As the Head of the Department of Plant Pathology and Ecology, Dr. Douglas fostered a department devoted to cutting edge research and outreach programs. Although her administrative duties were extensive, she still found time to author fact sheets and give presentations for growers, arborists, horticultural clubs, special interest groups, and students. She maintained close cooperation with state regulatory personnel and USDA-APHIS-PPQ for monitoring of select pathogens of national concern and oversaw and authored the Seed Testing reports. Dr. Douglas provided exemplary leadership in overseeing department needs during the move out of and back into the newly renovated Jenkins-Waggoner Laboratory. Her meticulous attention to detail and insistence that all members of the department participate in laboratory design resulted in a smooth transition. For thirty-three years, Dr.

Douglas energetically and ably served the citizens and the green industries of Connecticut. She was awarded honors by The Connecticut Pomological Society, Connecticut Tree Protective Association, The Connecticut Nursery and Landscape Association, and The Connecticut Urban Forest Council. Her leadership and passion for diagnostics garnered her trust and praise of countless citizens, industry personnel, along with every staff member in the Department. It would be hard to find another that The Connecticut Agricultural Experiment Station's motto of "Putting Science to Work for Society" did not more apply to. We honor Dr. Douglas and her contributions on the occasion of her retirement.

Ms. Joan Ives-Parisi

Ms. Joan Ives-Parisi joined the staff the Business Office at the Connecticut Agricultural Experiment Station in 1987 as a Payroll Clerk and worked her way up the ranks to Associate Fiscal Administrative Officer. During the course of her 28 years, she loyally served under three different Business Managers with high levels of professionalism and dedication to the Experiment Station. A superb financial officer, she supervised the day to day operations of the business office including accounts payable, purchasing and inventory. She prepared financial reports for federal and industry grants and coordinated the agency's purchasing card program. She played an important role in the Experiment Station's transition to automation and technology. She assisted with the implementation of the CORE-CT statewide accounting system which completely automated the states accounting and personnel system. Always available and dependable, she quickly adapted to changes in business practices and the demands of the job continually offering good ideas for improvements. Her work was always neat, accurate and error-free as she strived for quality, always caring to do a good job. Ms. Ives-Parisi was polite and courteous with co-workers and state residents who called upon the Station for assistance or information. Her work ethic, competence and cheerful outlook were special qualities that will surely be missed. A true ambassador for the Experiment Station and the State of Connecticut, we honor Ms. Joan Ives-Parisi for her contributions on the occasion of her retirement.

Mr. Stephen Sandrey

Mr. Stephen J. Sandrey joined the staff of The Connecticut Agricultural Experiment Station in January 1981 as an Aide II and was promoted to Aide III in 1985. In recognition of his work conducting plant inspections, gypsy moth surveys, and honey bee mite surveys, Mr. Sandrey was promoted to Technician I in 1987 and Technician II in 2003. He was a Connecticut Accredited Nursery Professional. As a nursery inspector in the Office of the State Entomologist, Mr. Sandrey inspected nurseries and issued phytosanitary certificates for shipment of agricultural commodities out-of-state and outside the country. As a federally certified Authorized Certifying Official, he worked closely with federal regulatory personnel. Mr. Sandrey participated in state surveys for insects and plant diseases and oversaw the Japanese Beetle Harmonization plan for nursery shipments and beekeeper registrations. Mr. Sandrey also served as the historian for the eastern chapter of the Horticultural Inspection Society. Mr. Sandrey's education and outreach activities, including, but were not limited to the CT Nursery and Landscape Association meetings, the CT Flower & Garden Show, and Agricultural Fairs enhanced our citizen's and green industry's knowledge of invasive forest insects and

other pests and diseases. Mr. Sandrey's contributions to the certification and registration of nurseries in Connecticut to conduct intra- and interstate commerce, his countless nursery inspections facilitated trade outside Connecticut and the United States, registration and assistance to beekeepers, and educational outreach helped assure the quality of plants for our growers, maintain the health of forests, and enhance the viability of Connecticut's beekeepers and green industry. For over thirty-five years, Stephen Sandrey ably served the citizens and green industries of Connecticut, ensuring quality plants for our growers and enhancing the reputation of the agricultural industry. His service truly exemplifies the motto of the Experiment Station: "Putting Science to Work for Society". We honor Mr. Sandrey and his contributions on the occasion of his retirement.

Mr. Peter Trenchard

Mr. Peter Trenchard joined the staff of The Connecticut Agricultural Experiment Station in August 1974 as an Aide II in the Department of Entomology to conduct surveys and nursery inspections for insects and plant diseases. In recognition of his work, he was promoted to Technician I in 1986 and Technician II in 2003. Mr. Trenchard completed the Connecticut Nurseryman's Educational Program in 1986 and was a Connecticut Accredited Nursery Professional. As the senior nursery inspector in the Office of the State Entomologist, Mr. Trenchard's primary responsibilities included conducting inspections for nursery growers, issuing phytosanitary certificates for commodities shipped out of state or out of the country, and registering nurseries. As a federally certified Authorized Certifying Official, he worked closely with federal regulatory personnel. He participated in numerous surveys for established and exotic pests and was the state aerial survey coordinator for long-term forest health surveys. He also served as editor and a major author of the newsletter for the eastern chapter of the Horticultural Inspection Society, and was a contributor to the annual report to the Eastern Plant Board. Mr. Trenchard's education and outreach activities, including the CT Nursery and Landscape Association meetings, the CT Flower & Garden Show, the Forest Health Monitoring Workshop, and Agricultural Fairs enhanced our citizen's and green industry's knowledge of invasive forest insects and other pests and diseases. Mr. Trenchard's contributions to the certification and registration of nurseries in Connecticut to conduct intra- and interstate commerce, his countless nursery inspections facilitated trade outside Connecticut and the United States, and educational outreach helped assure the quality of plants for our growers, maintain the health of forests, and enhance the viability of Connecticut's green industry. For over forty-two years, Peter Trenchard ably served the citizens and green industries of Connecticut, enhancing the reputation of the agricultural industry. His service truly exemplifies the Experiment Station motto: "Putting Science to Work for Society". We honor Mr. Trenchard and his contributions on the occasion of his retirement.

The Connecticut Agricultural Experiment Station

105th Plant Science Day

Lockwood Farm, Hamden, CT

August 5, 2015

PLANT SCIENCE DAY

2015

A total of 1,062 guests visited Lockwood Farm, making it one of the more heavily attended Open Houses at the Farm that we have had in recent years.

Director Theodore G. Andreadis welcomed attendees under the Main Tent and gave opening remarks. Dr. Sharon M. Douglas moderated the Short Talks and introduced the speakers.

All the short talks were very well attended:

SHORT TALKS:

Dr. Robert E. Marra	Internal Decay in Trees and its Role in the Forest Carbon Cycle
Dr. Blaire T. Steven	From the Very Large to the Extremely Small: Including Microbiology in Climate Models
Dr. Goudarz Molaei	Tracking Ticks and Tick-associated Diseases in Connecticut

The Demonstration Tent was full for all the demonstrations of the day:

DEMONSTRATION TENT:

Mr. Gregory J. Bugbee	Invasive Aquatic Plants That Threaten Lakes and Ponds
Mr. Mark H. Creighton	Beekeeping Basics

Attendees took advantage of several tours around the farm:

PESTICIDE CREDIT TOUR – **Dr. Robert E. Marra**, Guide

Stops on the tour:

Dr. Joseph J. Pignatello and Dr. Feng Xiao	How Does Biochar Added to Soil Reduce Emissions of the Potent Greenhouse Gas, Nitrous Oxide?
Dr. Quan Zeng	Environmentally-friendly Control of Fire Blight on Apples
Dr. Scott C. Williams	An Experimental Deer Repellent Trial for the Homeowner's Backyard Vegetable Garden

TOUR OF NATIVE WOODY SHRUBS – **Dr. Jeffrey S. Ward**, Guide

A ½-hour guided tour of our native shrub plantings. Participants learned about using native shrubs for naturalistic landscapes without the use of pesticides and fertilizers.

BUS TOURS – **Dr. Neil P. Schultes and Mr. Michael Cavadini**, Guides

Visitors wanting to cool off and also take a narrated tour of Lockwood Farm rode an air-conditioned bus for a 30-minute ride. They were able to get off the bus at any plots that interested them and then rejoin the tour when the next bus came around. It was a very popular feature.

BARN EXHIBITS:
A steady flow of visitors went through the barn throughout the day to view the exhibits and listen to scientists explain their research.

Nanotechnology – Applications and Implications. Investigators: **Dr. Roberto De La Torre Roche, Dr. Alia Servin, Dr. Arnab Mukherjee, Dr. Sanghamitra Majumdar, Dr. Luca Pagano, Mr. Craig Musante, Mr. Joseph Hawthorne,** and **Dr. Jason C. White**

Forest Pest Outreach: What Bugs Our Woodlands. Investigators: **Dr. Victoria Lynn Smith** and **Ms. Katherine Dugas.** Assisted by **Mr. Zachary Brown**

Understanding the Mosquito Microbiome for Practical Applications. Investigators: **Dr. Douglas Brackney** and **Dr. Blaire Steven.** Assisted by **Ariana Trease**

Adaptation Strategies of Trees Under Abiotic and Biotic Stresses. Investigators: **Dr. Adriana L. Arango, Dr. Claire Rutledge** and **Dr. Blaire Steven.** Assisted by **Mr. Joseph P. Barsky, Mr. Richard Cecarelli, Mr. Craig Musante, Ms. Jamie Cantoni, Ms. Amanda Massa,** and **Mr. Joe DeLucia**

Research in Bacteria on Plants. Investigators: **Dr. Lindsay Triplett** and **Dr. Quan Zeng.** Assisted by **Ms. Regan Huntley** and **Ms. Michelle Hoang**

Impacts of Variable Winters on Invasive Hemlock Woolly Adelgid Populations in Connecticut Forests. Investigator: **Dr. Carole Cheah**

QUESTION AND ANSWER TENT:

Throughout the day, hundreds of questions were answered by the staff under the Question and Answer Tent. The tent was manned by **Dr. Yonghao Li, Ms. Rose Hiskes, Dr. Gale E. Ridge, Mr. Robert Durgy**, **Ms. Diane Riddle,** and **Ms. Lindsay Patrick.**

Visitors were able to visit the following 87 Field Plots:

CHINESE CHESTNUT TREES	Dr. Sandra L. Anagnostakis, assisted by Pamela Sletten
SWEET POTATO TRIALS	Dr. Abigail Maynard and Dr. David Hill, assisted by Collin McCarthy
SHEET COMPOSTING WITH OAK AND MAPLE LEAVES	Dr. Abigail Maynard and Dr. David Hill, assisted by Collin McCarthy
CURIOSITY GARDEN	Dr. Abigail Maynard and Dr. David Hill, assisted by Collin McCarthy
NUT ORCHARD	Dr. Sandra L. Anagnostakis, assisted by Pamela Sletten
SWEET CORN TRIALS	Dr. Abigail Maynard and Dr. David Hill, assisted by Collin McCarthy

OKRA TRIALS	Dr. Abigail Maynard and Dr. David Hill, assisted by Collin McCarthy
KABOCHA SQUASH TRIALS	Dr. Abigail Maynard and Dr. David Hill, assisted by Collin McCarthy
GREENHOUSE PRODUCTION OF FIGS IN SELF-WATERING PLANTERS	Dr. Charles R. Vossbrinck, assisted by Richard Cecarelli and Mario DiNatale
USE OF EARTHWORMS AND BIOCHAR TO SUPPRESS FUSARIUM CROWN ROT OF ASPARAGUS	Dr. Wade Elmer, assisted by Peter Thiel
COMMERCIAL CHESTNUT CULTIVARS	Dr. Sandra L. Anagnostakis, assisted by Pamela Sletten
REMOTE ACCESS WEATHER STATION	Dr. Francis J. Ferrandino, assisted by Joan Bravo
TECHNICAL DEMONSTRATION TENT	
ENVIRONMENTALLY-FRIENDLY CONTROL OF POWDERY MILDEW ON LANDSCAPE PLANTS	Dr. Francis J. Ferrandino, assisted by Joan Bravo
COMMERCIAL CHESTNUT SEEDLINGS	Dr. Sandra L. Anagnostakis, assisted by Pamela Sletten
CONTROL OF BLIGHT ON AMERICAN CHESTNUTS	Dr. Sandra L. Anagnostakis, assisted by Pamela Sletten
NEW HYBRID CHESTNUT ORCHARD	Dr. Sandra L. Anagnostakis, assisted by Pamela Sletten
USE OF NANOPARTICLES OF METAL OXIDES TO SUPPRESS SOIL BORNE DISEASES OF EGGPLANTS AND WATERMELONS	Dr. Wade Elmer and Dr. Jason White, assisted by Peter Thiel
COMPARISON OF GRAFT UNION HEIGHT ON CHARDONNAY GRAPEVINES	Dr. Francis J. Ferrandino, assisted by Joan Bravo and Robert Snow
QUESTION AND ANSWER TENT	Dr. Yonghao Li, Ms. Rose Hiskes, Dr. Gale E. Ridge, Mr. Robert Durgy, Ms. Diane Riddle, and Ms. Lindsay Patrick
POWDERY MILDEW ON CHARDONNAY WINE GRAPES	Dr. Francis J. Ferrandino, assisted by Joan Bravo
GROWTH AND CONTROL OF NON-NATIVE BAMBOOS (*Phyllostachys* spp.)	Dr. Jeffrey S. Ward, assisted by Joseph P. Barsky

FIGS IN SELF-WATERING PLANTERS	Dr. Charles R. Vossbrinck, assisted by Richard Cecarelli and Mario DiNatale
TABLE GRAPE DEMONSTRATION PLOT	Dr. Francis J. Ferrandino, assisted by Joan Bravo and Ross Levin
SEEDLINGS OF OLD SURVIVING AMERICAN CHESTNUTS	Dr. Sandra L. Anagnostakis, assisted by Pamela Sletten
WILD CHESTNUTS FROM TURKEY	Dr. Sandra L. Anagnostakis, assisted by Pamela Sletten
INVASIVE INSECTS IN THE NORTHEAST	Dr. Chris T. Maier, assisted by Tracy Zarrillo and Morgan Lowry
EMERALD ASH BORER RESEARCH UPDATE	Dr. Claire Rutledge, assisted by Mioara Scott and Alexandra Kahn
ASSESSING NEONICOTINOID LEVELS IN NURSERY PLANTS	Dr. Richard S. Cowles, Dr. Kimberly Stoner, and Dr. Brian Eitzer, assisted by Isaac K. Mensah
PREDOMINANT MOLDS ON WATER-DAMAGED DRYWALL	Dr. DeWei Li
COMPOSTING LEAVES USING THE STATIC PILE METHOD	Dr. Abigail Maynard and Dr. David Hill, assisted by Collin McCarthy
HAMDEN POLICE DEPARTMENT	
VERIZON WIRELESS	
THE FARMER'S COW	Kathy Smith of Farmer's Cow
KIDS' KORNER	Kathryn Soleski, Lisa Kaczenski Corsaro, and Tracy Zarrillo
SELF-GUIDED ACTIVITY FOR ALL CHILDREN, INCLUDING GIRL SCOUTS	Terri Arsenault
HANDS-ON CHEMISTRY	Dr. Christina Robb, Ms. Kitty Prapayotin-Riveros, Dr. Walter Krol, Ms. Terri Arsenault, Mr. Michael Cavadini, and Dr. Jason C. White
ISOLATED BACTERIAL ENDOPHYTES ENHANCE PLANT GROWTH AND PROMOTE DDE DEGRADATION	Dr. Jason C. White and Ms. Nele Eevers (Hasselt University, Hasselt, Belgium), assisted by Joseph Hawthorne
CAES AND THE FDA FOOD EMERGENCY RESPONSE NETWORK (FERN)	Dr. Brian Eitzer, Dr. Walter Krol, Dr. Christina Robb, Dr. Arnab Mukherjee, Dr. Sanghamitra Majumdar, Ms. Terri Arsenault, Mr. Joseph

	Hawthorne, Mr. Craig Musante, Mr. Michael Cavadini, and Dr. Jason C. White
NANOMATERIALS IN AGRICULTURE: TROPHIC TRANSFER AND POTENTIAL FOOD CHAIN CONTAMINATION	Dr. Roberto De la Torre-Roche, Mr. Joseph Hawthorne, Dr. Alia Servin, Dr. Luca Pagano (University of Parma, Italy), Mr. Craig Musante, and Dr. Jason C. White
INVASIVE AQUATIC PLANT PROGRAM	Mr. Gregory Bugbee and Ms. Jennifer Fanzutti, assisted by Summer Stebbins and Jesse Schock
EXPERIMENT STATION ASSOCIATES	Mr. Will Rowlands, President of Experiment Station Associates
FIDDLEHEAD TRIALS	Dr. Abigail Maynard and Dr. David Hill, assisted by Collin McCarthy
THE PUBLIC HEALTH AND ENTOMOLOGY TENT:	
MOSQUITO SURVEILLANCE FOR WEST NILE AND EASTERN EQUINE ENCEPHALITIS VIRUSES	Dr. Philip M. Armstrong and Dr. Theodore G. Andreadis, assisted by Michael Misencik, John Shepard, Michael Thomas, Stephanie Canales, Molly Clark, Daniel Cole, Alexander Diaz, Ryan Gregory, Joseph Medwid, Katherine Nazario, Michael Olson, Tanya Petruff, and Angie Marie Rivera
THE "DEER" TICK *IXODES SCAPULARIS*	Dr. Kirby C. Stafford III, assisted by Heidi Stuber
INTEGRATED TICK MANAGEMENT	Dr. Kirby C. Stafford III, Dr. Scott C. Williams, and Dr. Goudarz Molaei, assisted by Michael Short, Heidi Stuber, Sarah McQuade, Adam Misiorski, Megan Floyd, Kelsey Schwenk, and Pronoma Srivastava
TICK TESTING PROGRAM FOR LYME AND ALLIED DISEASES	Dr. Goudarz Molaei, assisted by Saryn Kunajukr, Shannon Savisky, and Pronoma Srivastava
SUDDEN VEGETATION DIEBACK OF CONNECTICUT SALT MARSHES	Dr. Wade Elmer, assisted by Peter Thiel
INTEGRATING FOREST AND ROADSIDE MANAGEMENT OBJECTIVES TO CREATE STORM RESILIENT FORESTS	Dr. Jeffrey S. Ward, assisted by Joseph P. Barsky and Amanda Massa
AN EXPERIMENTAL DEER REPELLENT TRIAL FOR THE HOMEOWNER'S BACKYARD VEGETABLE GARDEN	Dr. Scott C. Williams, assisted by Michael R. Short and Megan A. Floyd

NATIVE WOODY SHRUBS	Dr. Jeffrey S. Ward, assisted by Joseph P. Barsky and Jamie Cantoni
BIRD AND BUTTERFLY GARDEN	Ms. Jane Canepa-Morrison and Mr. Jeffrey Fengler
ENVIRONMENTALLY-FRIENDLY CONTROL OF POWDERY MILDEW ON VEGETABLE PLANTS	Dr. Francis J. Ferrandino, assisted by Joan Bravo
HOW DOES BIOCHAR ADDED TO SOIL REDUCE EMISSIONS OF THE POTENT GREENHOUSE GAS, NITROUS OXIDE?	Dr. Joseph J. Pignatello and Dr. Feng Xiao
POLLINATION OF SQUASH AND PUMPKINS	Dr. Kimberly A. Stoner, assisted by Tracy Zarrillo, Morgan Lowry, Benjamin Gluck, Annalise Kieley, Kelly Niland, and Annaleise Peterson
CHESTNUT SPECIES AND HYBRIDS	Dr. Sandra L. Anagnostakis, assisted by Pamela Sletten
HEALTHY PLANTS—HEALTHY BUSINESS: SUPPORT OF THE GREEN INDUSTRY BY INSPECTION	Dr. Victoria Lynn Smith, assisted by Tia Blevins, Mark Creighton, Stephen Sandrey, and Peter Trenchard
MANAGEMENT OF BOXWOOD BLIGHT, A NEW DISEASE OF BOXWOOD AND PACHYSANDRA	Dr. James A. LaMondia and Dr. Katja Maurer, assisted by Michelle Salvas and Nathaniel Child
ENVIRONMENTALLY-FRIENDLY CONTROL OF FIRE BLIGHT ON APPLES	Dr. Quan Zeng, assisted by Michelle Hoang
HOPS TRIALS	Dr. Abigail Maynard and Dr. David Hill, assisted by Collin McCarthy
HOPS IN NEW ENGLAND	Dr. Katja Maurer, Dr. James A. LaMondia, and Dr. Abigail Maynard, assisted by Michelle Salvas and Nathaniel Child
HYBRID AND VINIFERA WINEGRAPE CULTIVAR TRIAL	Dr. Francis J. Ferrandino, assisted by Joan Bravo
PINOT GRIS CULTURAL TRIALS	Dr. Francis J. Ferrandino, assisted by Joan Bravo
THE ROCK	
ASIAN CHESTNUT GALL WASP ON CHESTNUT	Dr. Sandra L. Anagnostakis, assisted by Pamela Sletten

BEACH PLUM TRIALS	Dr. Abigail Maynard and Dr. David Hill, assisted by Collin McCarthy
PAWPAW TRIALS	Dr. Abigail Maynard and Dr. David Hill, assisted by Collin McCarthy
JAPANESE PLUM VARIETY TRIALS	Dr. Abigail Maynard and Dr. David Hill, assisted by Collin McCarthy
HYBRID ELM TREES	Dr. Sandra L. Anagnostakis, assisted by Pamela Sletten
THE CONNECTICUT BOTANICAL SOCIETY	Truda Steinnagel of CT Botanical Society
CONNECTICUT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION DIVISION OF FORESTRY (CT DEEP DIVISION OF FORESTRY)	Chris Donnelly, Larry Rousseau, Dick Raymond, Jen Hockla, and Hannah Reichle
THE CONNECTICUT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION WILDLIFE DIVISION (CT DEEP DIVISION OF WILDLIFE)	Laura Rogers-Castro, Kelly Cannon, and Brendan Zielenski (of DEEP, Wildlife Division)
CONNECTICUT DEPARTMENT OF LABOR CONN-OSHA (CONN OSHA)	Catherine Zinsser of CONN-OSHA
CONNECTICUT ENVIRONMENTAL COUNCIL (CTEC)	Erica Fearn of the CT Environmental Council
CONNECTICUT FARM BUREAU ASSOCIATION (CFBA)	Ashley McCullough and Joan Nichols
CONNECTICUT GREENHOUSE GROWERS ASSOCIATION (CGGA)	Susan Pronovost
CONNECTICUT INVASIVE PLANT WORKING GROUP (CIPWG)	Donna Ellis and Nicole Gabelman
CONNECTICUT NORTHEAST ORGANIC FARMING ASSOCIATION (CT NOFA)	Deb Legge
CONNECTICUT TREE PROTECTIVE ASSOCIATION (CTPA)	Cathy Dvorsky
FEDERATED GARDEN CLUBS OF CONNECTICUT, INC.	Arlene Field
HAMDEN LAND CONSERVATION TRUST	Gail Cameron

LYMAN HALL HIGH SCHOOL AGRICULTURAL SCIENCE AND TECHNOLOGY PROGRAM	Emily Picard
UNIVERSITY OF CONNECTICUT EXTENSION MASTER GARDENER PROGRAM (UCONN EXTENSION MASTER GARDENERS PROGRAM)	Jude Hsiang
UNITED STATES DEPARTMENT OF LABOR/ OSHA (US OSHA)	Leona May and Tandy Mazo
UNITED STATES DEPARTMENT OF AGRICULTURE ANIMAL AND PLANT HEALTH INSPECTION SERVICE PLANT PROTECTION AND QUARANTINE (USDA APHIS/PPQ)	Eric Chamberlain
UNITED STATES DEPARTMENT OF AGRICULTURE, FARM SERVICE AGENCY (USDA FSA)	Debbie Castle and Teresa Peavey
UNITED STATES DEPARTMENT OF AGRICULTURE NATIONAL AGRICULTURAL STATISTICS SERVICE, NEW ENGLAND (USDA NASS)	Gary Keough
UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE (USDA NRCS)	Lisa Krall and Analia Bertucci
WORKING LANDS ALLIANCE	Lisa Bassani

PAVILION AT LOCKWOOD FARM

Lockwood Farm made a beautiful appearance due to the hard work of the farm crew, Richard M. Cecarelli, Farm Manager, Rollin J. Hannan, Jr., and Michael M. McHill, who worked on the plots, grass, trimming and set up. The barns, buildings, and grounds were cleaned by the Maintenance crew – Bancroft Nicholson, Supervisor, Eric Flores, Brian Hart, Ronald A. LaFrazier, Miguel Roman, and Michael A. Scott. They also delivered all items needed for the day to the farm. Tent set-ups were done by Vickie Bomba-Lewandoski, Tia M. Blevins, Steven J. Sandrey, and Peter W. Trenchard. Students from the Sound School, under the supervision of teacher Chaz Mavrelion, helped set up the main tent by washing tables and chairs and putting them in place.

At 11:00 AM, Director Theodore G. Andreadis introduced Mr. Eric Hammerling, Executive Director, Connecticut Forest & Park Association, as the Samuel W. Johnson Memorial Lecturer. He gave a talk on Protecting Forests in Connecticut for the Future – How are we doing? What will it take?

Following Mr. Hammerling's talk, Dr. Andreadis and former Director, Dr. John Anderson presented the Century Farm Award to Anderson Farms of Wethersfield, Connecticut.

Anderson Farms, located in Wethersfield, was founded in 1854 by James R. Anderson who emigrated from Scotland to Connecticut. Red onions, tobacco and dairy were the principal commodities first produced on the farm. As the farm grew and prospered, James built a large Victorian style home that still graces the Broad Street Green in Old Wethersfield. In 1908, James Welles Anderson took over the farm from his father. A tuberculosis outbreak in 1931 brought an end to the dairy business and a fire that destroyed the tobacco shed ended tobacco production on the farm. James W. concentrated on market gardening, supplying the wholesale produce market and the Connecticut State Prison cannery in Wethersfield. In 1960, James Welles Anderson Sr. turned management of the farm over to his son David Clark Anderson, who became owner after his father's death and continues to operate the farm to the present. David's brother Jim assisted on the farm until his passing in 2009 and Jim's sons Craig and Christopher continue to work on the farm.

Currently, Anderson Farms sells a wide variety of vegetables and produce wholesale at the Hartford Regional Market, in direct sales to other farm stands and through retail sales at the farm. The farm has grown to over 140 acres producing various traditional New England vegetables. Most notable is the fresh spinach and sweet corn. Strawberries have been added as well as a greenhouse expansion for production of bedding plants and early tomatoes. A new building was constructed for washing, preparation and packaging produce for market and a walk-in cooler was also added. Anderson Farms was one of the first to use Integrated Pest Management, and works with the Great Meadows Conservation Trust and the Wethersfield Fish & Game Club. David maintains active memberships in the Hartford County and Connecticut Farm Bureaus, the Greater Hartford Farmers Market, Inc., and the Connecticut Vegetable Growers Association. David is also a member of the Board of Governors and a 50+ year member of Company #1, Wethersfield's Volunteer Fire Department, the oldest fire company in continuous existence in New England, founded in 1803.

After the Century Farm Award was presented, Will Rowlands, President of the Experiment Station Associates, gave a few remarks and invited all in the audience to join the Associates.

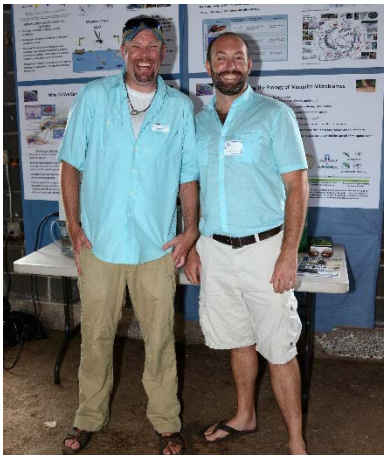
Plant Science Day 2015 was a very big success that was enjoyed by a record number of visitors – due to the hard work of the entire Station staff.










EVENTS HELD AT THE STATION

Conference on Successfully Establishing Plants for Pollinators

A conference titled "Successfully Establishing Plants for Pollinators" was held in Jones Auditorium February 25 and 26, 2016. This was planned as a one-day conference, but demand was so strong that the speakers were asked to give their presentations twice and the conference was held for two days with 59 and 64 in attendance on day one and two, respectively. The conference was organized by Dr. Kimberly Stoner of CAES and Dr. Aaron Hoshide of the University of Maine and was funded by the USDA-NIFA project, "Pollination Security for the Northeast." Tracy Zarrillo and Morgan Lowry assisted with the conference. The speakers were:

- Larry Weaner, Principal of Larry Weaner Associates, "Native Wildflower Meadows: Let's Get Real"
- Dr. Cathy Neal, University of New Hampshire, "Planting Pollinator Habitat in New England: Species Selection, Site Preparation and Maintenance"
- Virginia Keith of Blueberry Hill Organic Farm, "Establishing Pollinator Habitat Organically"
- Don Dzen of Dzen Farms, "Planting Pollinator Habitat"
- Jarrod Fowler, Xerces Society for Invertebrate Conservation, "Plants for Pollinator Diversity"
- Gary Casabona of the US Department of Agriculture, Natural Resources Conservation Service, "NRCS Support for Establishment and Maintenance of Pollinator Habitat"
- Dr. Aaron K. Hoshide, University of Maine, "Budgeting for Establishment and Maintenance of Pollinator Pasture"

Detailed information from most of these speakers has been posted, with their permission, on the CAES website, under the portal "Pollinator Information" listed on the left side of the CAES home page.

Forest Health Workshop

The annual Forest Health Workshop was held on March 1, 2016 in Jones Auditorium at the Experiment Station. This annual workshop included cooperators from DEEP, UConn, UConn Extension, and USDA, and is a conversation among those of us concerned with the health of the forests. Station presenters included Philip Armstrong, Carole Cheah, Katherine Dugas, Yonghao Li, Chris Maier, Claire Rutledge, Kirby Stafford, Peter Trenchard, Jeff Ward, and Scott Williams. Victoria Smith organized the event. There were 60 people in attendance.

CAES

The Connecticut Agricultural Experiment Station

Putting Science to Work for Society since 1875

You are cordially invited to attend the

RIBBON-CUTTING CEREMONY

For
The Pavilion at Lockwood Farm

Thursday, May 19, 2016, 6:00 p.m.

Lockwood Farm

The Connecticut Agricultural Experiment Station,

890 Evergreen Avenue, Hamden, CT 06518

Held in conjunction with the Connecticut Forest and Parks Association Annual Meeting to Follow the Ribbon Cutting Ceremony.

The pavilion at Lockwood Farm was commissioned by the Experiment Station's Board of Control with funds provided by the William R. Lockwood Trust. All wood products used in construction of the pavilion are Connecticut grown. The posts, beams and walls are eastern white pine, grown and harvested from Babcock Pond Wildlife Management Area in Westchester, CT. The pegs and splines are white oak, harvested from the Strong 50-acre farm in East Hampton, CT. The pavilion is constructed using traditional timber framing post and beam techniques with large heart sawn timbers. The pavilion design features a large cupola with window and louver units that were constructed from the edges of the timbers. It functions to allow natural light and ventilation which provide an open feel in the interior of the building.

Ms. Joan Nichols (Member, CAES Board of Control), Mr. Terry Jones (Vice President, CAES Board of Control), Mr. Steven Strong (Builder), Dr. Theodore Andreadis (CAES Director), Mr. Stephen Reviczky (Member, CAES Board of Control and Commissioner of Agriculture), Dr. John Anderson (CAES Former Director), Ms. Susan Whalen (Deputy Commissioner, Department of Energy and Environmental Protection).









Connecticut FFA Forestry Career Development Event

On November 13, 2015, the Department of Forestry & Horticulture marked its 4th year hosting the Connecticut-FFA Forestry Career Development Event at Lockwood Farm. The Forestry Career Development event evaluates students' knowledge of forest management practices, tree and wood products identification, forest mensuration, map reading skills, and industry safety standards. Thirty-two students from 8 State FFA chapters participated in the event. The students took a 50 question exam, testing their general knowledge of forestry and the forest. They then had to identify 25 pieces of forestry related tools and equipment, followed by a 20 specimen tree identification exam. The students were then allowed to participate in two team events – Compass Use and Timber Volume Cruising exercises. The winning team will represent Connecticut in regional and national competition. Dr. Scott Williams, Michael Short, J. P. Barsky, and Megan Linske in the Department of Forestry & Horticulture organized and oversaw the event. Former Station staff members Emily Picard, Geoffrey Picard, and Vikki Christian were on hand as teachers. Nick Zito, former Station staff member and current Regional Water Authority Forester, assisted with tree measurements. Richard Cecarelli, Lockwood Farm Manager, was gracious in preparing the barns and cottage for the event.

EVENTS HELD AT THE VALLEY LABORATORY

Hops Research Meeting in 2015

Forty-three people attended the Connecticut Agricultural Experiment Station's first hops research meeting held at the Valley Laboratory on August 20, 2015. Drs. Jim LaMondia and Katja Maurer welcomed growers and spoke about current hop research, toured field plots, and presented production data and management strategies. Dr. Victor Triolo spoke about low trellis hops and greenhouse hops. HopsHarvester of Honeoye Falls, NY conducted a demonstration of a PTOdriven hops combine. Brewers, growers, and interested participants ended the meeting with a roundtable discussion of the future of the hops industry in Connecticut.

US Forest Service Durham Field Office Forest Health Cooperators Annual Meeting

The annual meeting of the US Forest Service Durham Field Office Forest Health Cooperators was held October 22-23, 2015 at the Valley Lab in Windsor. Station participants included Adriana Arango-Velez, Richard Cowles, Claire Rutledge, and Victoria Smith. Other presenters included personnel from the US Forest Service and the Massachusetts Dept. of Natural Resources. In total, 25 participants from CT, Massachusetts, Maine, Vermont, New Hampshire, Rhode Island, and New York attended.

Annual Tobacco Research Meeting

One hundred and ten people attended the Connecticut Agricultural Experiment Station's annual Tobacco Research Meeting held at the East Windsor Scout Hall on February 23, 2016. Dr. James LaMondia welcomed growers and spoke about research topics and recent developments at the Station. The meeting addressed a wide variety of issues of concern to growers. James LaMondia spoke about the CORESTA pesticide residue program and strategies to reduce pesticide residues in wrapper leaves and research on management of tobacco pathogens including poty viruses, black shank, target spot and blue mold fungicide resistance. Thomas Rathier spoke about environmental changes, soils, microbial activity and tobacco. Katja Maurer spoke about hops as a new crop for Connecticut. Bill Leahey spoke about CT tobacco labeling and marketing and incorporation of the Connecticut-Massachusetts Tobacco Growers Association. Peter Kisselburgh discussed tobacco insurance program changes and Ross Eddy and Heather Baylis of the Farm Services Administration provided updates on FSA services to growers. Jane Canepa-Morrison, Michelle Salvas, Nathaniel Child and James Preste assisted with much of the behind the scenes work for the meeting. The meeting qualified for pesticide applicator re-certification credit in Connecticut and Massachusetts and 64 persons received credit.

Hops Research Meeting in 2016

Sixty-five people attended the Connecticut Hop Growers Association first grower meeting held at the CT Agricultural Experiment Station Valley Laboratory on June 23, 2016. CHGA President Alex DeFrancesco welcomed growers and spoke about current status of hops and malting barley. Dr. Jim LaMondia and Dr. Katja Maurer spoke about hop culture and pest management research, Steve Schmidt of New York spoke about hop yard construction and Jaime Smith of the CT Department of Agriculture spoke about farm grants for new and current farmers. Dr. Jim LaMondia and Dr. Katja Maurer toured hop and barley field plots and presented production data and management strategies. HopsHarvester of Honeoye Falls, NY conducted a demonstration of a PTO-driven hops combine.

THE STATION IN THE COMMUNITY

Two Bedding Plant Meetings Held

The UConn-CAES Spring Bedding Plant Meetings were co-organized and co-sponsored by Dr. Yonghao Li from CAES, Dr. Rosa Raudales, and Ms. Leanne Pundt from UConn and were held on February 2, 2016 at the UConn campus in Torrington and on February 4, 2016 in Vernon. In spite of the weather, there was good attendance at both meetings (35 attendees in Torrington and 37 attendees in Vernon). Topics included Feeding Greenhouse Crops and Monitoring Water Quality. Dr. Li spoke on diseases of spring crops. Ms. Pundt spoke on biological controls. On November 3, Dr. Wade Elmer co-hosted a meeting with 43 attendees on "Marketing Greenhouse Products" with Dr. Raudales and Ms. Pundt of UConn in Jones Auditorium.

New Haven Public Schools Science Fair at Yale University

From May 16-17, 2016, at the Yale University Commons, a team from the Experiment Station served as special awards judges for the New Haven Public Schools Science Fair, choosing winners for the CAES award. Ms. Lindsay Patrick and Drs. Douglas Dingman, Robert Marra, and Teja Shidore served as judges. The *Connecticut Agricultural Experiment Station Award* ($50) for the "Best project related to food, plants, insects, or the environment" went to Elena Brennan from Ms. Ashley Brennan's 8th grade class at Celentano Health and Biotech School for her project titled "Is Nanosilver Toxic to Freshwater Organisms?" Dr. Marra presented the CAES award and certificate to the student at the Awards Ceremony on the evening of May 18, which was held in Yale University's Sheffield-Sterling-Strathcona Hall.

Dr. Robert Marra presenting the CAES Special Award at the Greater New Haven Science Fair for the best project related to food, plants, insects, or the environment to Elena Brenna, an 8th grade student at Celentano School, for a project titled "Is Nanosilver Toxic to Freshwater Organisms."

DONATIONS MADE TO THE COMMUNITY

Lockwood Farm

A total of 33,928 pounds of fresh produce, including apples, broccoli, cabbage, cucumbers, eggplants, grapes, lettuce, okra, peppers, pumpkins, summer and winter squash, tomatoes, and watermelon grown at Lockwood Farm were donated to the Connecticut Food Bank in East Haven and Wallingford, Brooksvale Park in Hamden, the Hamden/North Haven YMCA, the Albert J. Solnit Children's Center in Middletown, Cub Scouts Pack 472 in North Guilford, Gianelli's Early Learning Center in Middletown, and Waverly House in New Haven. Farm Manager Richard Cecarelli arranged for the distribution of the produce.

Valley Laboratory

A total of 10,700 pounds of fresh produce including butternut squash, acorn squash, muskmelons, summer squash, tomatoes, and pumpkins grown at the Valley Laboratory were donated to Foodshare of Hartford. Mr. Preste, Drs. Abigail Maynard, David Hill, and James LaMondia generated the fresh produce, and Jim Preste and Dr. LaMondia organized the distribution effort. The Valley Laboratory also donated two bins of pumpkins to Northwest Park in Windsor and loaned irrigation equipment to the Connecticut Epilepsy Foundation in support of their Mud Volleyball Tournament Fundraiser. Mr. Preste coordinated the distribution of the irrigation equipment.

FOODSHARE
"When hunger stops, so will we."
www.foodshare.org

CERTIFICATE OF APPRECIATION

THIS CERTIFICATE IS AWARDED TO

CT Agricultural Experiment

in recognition of your efforts as a partner
in the fight against hunger, donating food that generated

8,593 meals

in 2015

12/31/2015

James Arena-DeRosa, President and CEO

Paula Siebers/Gaye Sgamboti/Lauren Kowtko/Stephen Slipchinsky- Food Sourcing Department

AWARDS AND RECOGNITION RECEIVED BY STATION STAFF

On July 31, 2015, Dr. Quan Zeng was elected to Vice Chair of the Bacteriology Committee of the American Phytopathological Society.

On September 4, 2015, Dr. Neil Schultes was elected vice president of the Sigma Xi Quinnipiac Chapter.

On October 28, 2015, Dr. Jeffrey S. Ward was awarded the Fred Borman Outstanding Urban Forestry Professional Award at the 2015 Connecticut Urban Forest Council annual conference in Plantsville.

On January 6, 2016, Dr. Robert E. Marra was elected Secretary-Treasurer for the Northeastern Division of the American Phytopathological Society.

On February 25, 2016, the EPA renewed Dr. Gale Ridge's membership for three years as a member of their FIFRA scientific advisory panel.

On March 10, 2016, Ms. Lindsay Patrick won the Rotten Tuber Award at the National Plant Diagnostic Network National Conference in Washington, DC.

On April 6, 2016, Stephen Sandrey received the Distinguished Service Award from the Horticultural Inspection Society (HIS) at the annual meeting of the Eastern Plant Board/Horticultural Inspection Society/Cooperative Agricultural Pest Survey.

On June 8, 2016, Tracy Zarrillo was elected to serve on the board of the Hamden Land Conservation Trust.

On June 15, 2016, Dr. Jeffrey S. Ward was appointed Vice-Chair of the New England Society of American Foresters in Concord, NH.

On June 22, 2016, Mark Creighton was presented a Life Saving Medal by the Lieutenant Governor on behalf of the Department of Public Safety for a medical event that he was involved with in 2015.

In June 2016, Dr. Joseph J. Pignatello's paper titled "Activation of Hydrogen Peroxide and Solid Peroxide Reagents by Phosphate Ion in Alkaline Solution" in *Environmental Engineering Science* 33(3):193-199 (2016), was chosen as "Editor's Spotlight."

In June 2016, Dr. Blaire Steven was acknowledged for authorship of one of the most highly cited articles in 2015 in the journal *FEMS Microbiology Ecology*: "Dryland soil microbial communities display spatial biogeographic patterns associated with soil depth and soil parent material" published in 2013.

THE PUBLIC SPEAKS

On July 15, 2015, Elizabeth Lewis Roberts from the Biology Department at Southern Connecticut State University wrote the following to Dr. Robert Marra. "I wanted to send you a huge thank you for the tour on Monday. Your work is fascinating and it was fun to get to hear about it and visit your lab. And I especially thank you for fitting us in as you did. My students learned a lot and I know some are excited to go to plant science day."

On October 6, 2015, Kelly Lenz from Cheshire Public Schools wrote the following to Joseph Barsky. "Please accept my sincere thanks for participating in Sophomore Career Day. Your presence here this morning was truly meaningful for our students. You showed them that there are caring adults who want to help kids acquire the tools needed for success in this world. You provided them the opportunity to explore different careers, helped them make connections between school and work, and gave them the chance to see that it is possible to channel their personal strengths, work ethic, passion, and drive into a rewarding career. I understand how busy you are and the effort it took for you to be here this morning, so thank you again for making time for our kids!"

On October 9, 2015, Brian Toal from the Department of Public Health wrote the following to Dr. Jason White. "That is good news. We will call the well owner and tell him his water is safe to drink. I know he appreciates your efforts. I want to thank you and your staff for going above and beyond on this request!"

On October 13, 2015, Marilynn Klepfer, National Garden Clubs Gardening Study School 2015 CT State Co-Chair, wrote the following to Dr. Neil Schultes. "On behalf of National Garden Clubs, The Federated Garden Clubs of CT and the 2015 Gardening Study School Committee and participants, I would like to thank you for your presentation at this year's School on the topic of "How New Plants are Developed and Evaluated." We appreciate the time and effort you put into creating a comprehensive and informative program that will benefit the gardening skills of our participants. I personally appreciated your promptness and professionalism in responding to the requests for submission of paperwork. We hope that we can look forward to having you contribute to future Gardening Study Schools."

On October 21, 2015, Marilynn Klepfer, Co-Chair of The Federated Garden Clubs of CT's Gardening Study School Committee, wrote the following to Dr. Theodore Andreadis. "On behalf of the Federated Garden Clubs of CT's Gardening Study School Committee I would like to thank you for taking the time to address our participants at the Opening of this year's program. I know that our attendees appreciated learning about the vital contributions of the CAES staff to the agricultural interests in CT and the many services provided directly to CT residents. I heard numerous accolades about your impressive PowerPoint presentation."

On October 21, 2015, Bradley Rein from USDA NIFA wrote the following to Dr. Joseph Pignatello. "On behalf of the National Institute of Food and Agriculture, I wish to express my sincere appreciation for your service on the virtual panel for the Agriculture Systems and Technology: Nanotechnology for Agricultural and Food Systems program, held October 5-9, 2015. Your expertise was invaluable in the thorough review of the proposals submitted to this program. Your participation on the review panel helped us ensure that each proposal received a fair and unbiased evaluation, that the highest standards for scientific excellence were met, and that available funds were invested in projects with the greatest potential for making a positive impact on food and agricultural systems. We are grateful for your assistance and hope that you will be willing to participate in the peer review process in the future."

On November 7, 2015, Kay Linquist from The Institute for Learning in Retirement, Inc. at Albertus Magnus College wrote the following to Dr. Neil Schultes. "Thank you so much for your presentations on

"Genetically Modified Plants and Agriculture" and for the tour and look into your work. We appreciate your ability to present at a lay person's level and to make it all so interesting."

On November 13, 2015, Mary Peet from USDA NIFA wrote the following to Dr. Lindsay Triplett. "On behalf of the National Institute of Food and Agriculture, I wish to express my sincere appreciation for your service on the panel for the Citrus Disease and Research Extension program, held October 20-21, 2015. Your expertise was invaluable in the thorough review of the proposals submitted to this program. Your participation on the review panel helped us ensure that each proposal received a fair and unbiased evaluation, that the highest standards for scientific excellence were met, and that available funds were invested in projects with the greatest potential for making a positive impact on agriculture in the United States and around the world. We are grateful for your assistance and hope that you will be willing to participate in the peer review process in the future."

On December 8, 2015, Sue Sibilio wrote the following to Dr. Goudarz Molaei. "I want to thank you for your quick response. So rare these days. I must say that in my many years of dealing with individuals and companies, you are without a doubt, one of the most professional and caring groups I have ever worked with. What a pleasure. Wishing you and the staff a very happy holiday season. Thank you again."

In April 2016, Mariano Ortiz from the CT Women's, Infants, and Children (WIC) Program wrote the following to Vickie Bomba-Lewandoski. "Thank you for offering the CT WIC Program the use of your Conference Center for our most recent vendor trainings. The combination of your Conference Center's design, set-up and amenities incorporated with the geographic location of your company, enabled us to conduct the perfect training sessions for WIC vendors in greater New Haven. Please know that due to your assistance to the Program, WIC vendors, participants, and state residents alike will benefit from the new, eWIC (credit card-style) system that is presently being implemented statewide. Thanks again! Your hospitality was greatly appreciated!

On April 13, 2016, Robert Wick from the University of Massachusetts Stockbridge School of Agriculture wrote the following to Dr. Wade Elmer. "On behalf of the Plant Disease Diagnosticians of New England, graduate students at UMass, Li-Jun Ma and myself, I thank you whole heartedly for taking the time to give us an excellent workshop on the identification of Fusarium. The PowerPoint presentation was very informative and clearly you put a lot of time in for preparation of cultures. Everyone was very pleased with what they got out of the program and certainly will put their new skills to work back in the lab."

SCIENTIFIC OFFICERSHIPS AND MEMBERSHIPS ON STATE, NATIONAL, OR REGIONAL COMMITTEES

ADMINISTRATION

THEODORE G. ANDREADIS

- Adjunct Professor, Department of Pathobiology, University of Connecticut
- Clinical Professor, Epidemiology of Microbial Disease Division, Yale University School of Public Health
- Administrative Advisor, Multi-State Research Project NE-1043: Biology, Ecology & Management of Emerging Disease Vectors
- Administrative Advisor, Multi-State Research Project NE-1306: Management of the Marmorated Stink Bug
- Subject Editor, *Journal of Medical Entomology*
- Council Member for Agriculture, Connecticut Academy of Science and Engineering
- Member, Connecticut Invasive Plant Council
- Member, Peabody Fellows Biodiversity and Human Health Program, Yale University
- Member, State of Connecticut Mosquito Management Program
- Member, Selection Committee, Connecticut Century Farm Award
- Dissertation Committee Member, Biology Department, Clark University

DEPARTMENT OF ANALYTICAL CHEMISTRY

JASON C. WHITE

- Immediate Past President, International Phytotechnology Society
- Managing Editor, *International Journal of Phytoremediation*
- Editorial Board, *Environmental Pollution*
- Editorial Board, *NanoImpact*
- Editorial Advisory Board, *Environmental Science & Technology*
- Editorial Advisory Board, *Environmental Science & Technology Letters*
- Science Advisory Board, Annual International Conference on Soils, Sediments, Water, and Energy
- Advisor, Nanotechnology Advisory Group, Society of Environmental Toxicology and Chemistry
- Member, CT DEEP Lobster Pesticide Study 2014 Steering Committee
- Member, Sustainable Nanotechnology Organization
- Chair, *Environmental Science and Technology* "Best Papers of the Year" Committee, 2015

BRIAN D. EITZER

- Member, Conservation Commission for the Town of Bethany
- Judge, Connecticut Science Fair held at Quinnipiac University
- Member, Organizing Committee for the North American Chemical Residue Workshop (Conference Co-chair for the 2016 meeting)
- Member, Quinnipiac Chapter of Sigma Xi

WALTER J. KROL

- Member, CT DEEP Lobster Pesticide Study 2014 Steering Committee

SANGHAMITRA MAJUMDAR
- Member, Sustainable Nanotechnology Organization
- Phytoscholar, International Phytotechnology Society (IPS)

CHRISTINA S. ROBB
- Board Member, Eastern Analytical Symposium

DEPARTMENT OF ENTOMOLOGY

KIRBY C. STAFFORD III
- Member, Board, Connecticut Coalition Against Bed Bugs
- Member, Tick IPM Working Group

JOHN F. ANDERSON
- Selection Committee to select the Connecticut Century Farm Award
- Nominating Committee, Connecticut Academy of Science and Engineering
- Clinical Professor, Yale University School of Public Health

TIA M. BLEVINS
- Treasurer, Horticultural Inspection Society, Eastern Chapter

DOUGLAS W. DINGMAN
- Member, Quinnipiac Chapter of Sigma Xi
- Member, Connecticut Beekeepers Association
- Chairman, Institutional Biosafety Committee (CAES)

CHRIS T. MAIER
- Curatorial Affiliate in Entomology, Peabody Museum of Natural History, Yale University.
- Member, Advisory Committee, Cooperative Agricultural Pest Survey, USDA.
- Member, Connecticut Endangered Species Committee, Invertebrate Subcommittee.
- Research Associate, Division of Plant Industry, Florida Department of Agriculture and Consumer Services.
- Research Associate, Mohonk Preserve, New Paltz, New York.

GALE E. RIDGE
- Chair, Connecticut Coalition Against Bed Bugs
- Member, EPA FIFRA Scientific Advisory Board
- Member, State Health Improvement Plan (SHIP)

CLAIRE E. RUTLEDGE
- Director, The Connecticut Tree Protection Association, Chair Education Committee

VICTORIA L. SMITH
- Past President, Eastern Plant Board
- Member, Horticultural Inspection Society
- Member, National Plant Board Systems Approach to Nursery Certification Committee
- Member, New England Wildflower Society, Connecticut Task Force
- Member, Yale Biosafety and Recombinant DNA Committee

- Member, Farm Bill Review Team 6: Enhanced Mitigation Capabilities
- New Pest Advisory Group, Eastern Plant Board Liaison
- Member, Northeast Area Association of State Foresters Firewood Working Group
- Member, USDA-APHIS-PPQ Early Detection-Rapid Response Committee
- Member, National Clean Plant Network Fruit Tree committee

KIMBERLY A. STONER
- Member, Multi-State Research Project NC1173 – Sustainable Solutions to Problems Affecting Bee Health
- Member, Multi-State Research Project NE2261 – Harnessing Chemical Ecology to Address Agricultural Pest and Pollinator Priorities
- Member, Steering Committee, New England Vegetable and Fruit Conference
- Member, City Farm and Garden Working Group, New Haven Food Policy Council

DEPARTMENT OF ENVIRONMENTAL SCIENCES

JOSEPH J. PIGNATELLO
- Professor Adjunct of Chemical and Environmental Engineering, Yale University
- Associate Editor, *Journal of Environmental Quality*
- Editorial Board, *Environmental Engineering Science*
- Member, Biochar Advisory Committee, International Biochar Initiative
- Member Connecticut Academy of Science and Engineering and reviewer for the IN BRIEF Environmental section of the quarterly Bulletin.

PHILIP M. ARMSTRONG
- Clinical Associate Professor, Department of Epidemiology of Microbial Diseases, Yale School of Public Health
- Member, Multi-State Research Project NE-1443: Biology, Ecology, and Management of Emerging Disease Vectors
- Councilor, Executive Council of the American Committee on Medical Entomology
- Guest Editor, *PLOS Neglected Tropical Diseases*
- Dissertation Committee Member, Department of Ecology and Evolutionary Biology, Yale University

DOUGLAS E. BRACKNEY
- Assistant Adjunct Professor, Section of Infectious Diseases, Yale School of Medicine
- Assistant Adjunct Clinical Professor, Microbial Diseases Division, Yale School of Public Health

GREGORY J. BUGBEE
- Member, PA 12-155 Nonpoint Source Phosphorus Workgroup
- Editor, Northeast Aquatic Plant Management Society Newsletter
- Director, Clear Lake Improvement Association

GOUDARZ MOLAEI
- Clinical Associate Professor, Department of Epidemiology of Microbial Diseases, Yale School of Public Health
- Member, Multi-State Research Project NE-1443: Biology, Ecology, and Management of Emerging Disease Vectors

JOHN J. SHEPARD
- Treasurer, Northeastern Mosquito Control Association

MICHAEL C. THOMAS
- Committee Member, CT Taxonomic Advisory Committee for Rare and Endangered Insects
- Committee Member, CT Comprehensive Wildlife Conservation Action Plan
- Curatorial Affiliate, Yale Peabody Museum, Yale University

CHARLES R. VOSSBRINCK
- Visiting Professor, Department of Microbiology, State Key Lab of Silkworm Genome Biology, Southwest University, Chongqing, China
- Member, Editorial Board, Springer Plus

DEPARTMENT OF FORESTRY AND HORTICULTURE

JEFFREY S. WARD
- Chair-Elect, New England Society of American Foresters
- Secretary, Connecticut Tree Protection Examination Board
- Executive Board Member, Connecticut Urban Forest Council
- Program Chair, New England Society of American Foresters
- Member, Audubon Connecticut Science Committee
- Ex-Officio Member, Goodwin Scholarship Committee

ADRIANA L. ARANGO-VELEZ
- Executive Board Member, Connecticut Urban Forest Council

JOSEPH P. BARSKY
- Member, State Consulting Committee for Agricultural Science and Technology Education
- Member, Consulting Committee, Vernon E. Cleaves Agricultural Science and Technology Program
- Member, Connecticut Environmental Review Team
- Editor, NESAF News Quarterly

MARTIN P. N. GENT
- Official Representative, NE1335 Regional Research Committee
- Associate Editor, *Journal of Plant Nutrition*

ABIGAIL A. MAYNARD
- Member, Editorial Board, *Compost Science & Utilization*
- Ex-Officio Member, Connecticut Council on Soil and Water Conservation
- Member, State Technical Committee

SCOTT C. WILLIAMS
- Adjunct Professor, Department of Natural Resources and the Environment, University of Connecticut, Storrs
- Executive Treasurer, Connecticut Urban Forest Council
- Executive Treasurer, The Wildlife Society, Northeast Section
- Certified Wildlife Biologist, The Wildlife Society
- Scientific Advisor, Fairfield County Municipal Deer Management Alliance

- Wildlife Management Advisor, Northeast Organic Farming Association
- Chair, Town of Guilford Inland Wetlands Commission
- Commissioner, Town of Guilford Land Acquisition Commission
- Graduate Advisor, Ph.D. student Megan Floyd, University of Connecticut, Storrs
- Graduate Advisor, Ph.D. student Acima Cherian, University of Connecticut, Storrs

DEPARTMENT OF PLANT PATHOLOGY AND ECOLOGY

WADE H. ELMER
- Associate Editor, *Crop Protection*
- Member, Widely Prevalent Fungi List Committee, American Phytopathological Society
- Member, Northeast Research, Extension and Academic Programs Committee for IPM
- Member, Program Committee, Connecticut Greenhouse Growers Association
- Member, Thesis Advisory Committee, University of Connecticut

SHARON M. DOUGLAS
- Member, USDA-APHIS-PPQ Cooperative Agricultural Pest Survey Committee (CAPS) for Connecticut
- Member, Board of Directors, Connecticut Tree Protective Association
- Chair, Education Committee, Connecticut Tree Protective Association

FRANCIS J. FERRANDINO
- President, Past President, Northeastern Division of the American Phytopathological Society
- Member, Connecticut Wine Council
- Member, Science/Education Committee, Connecticut Wine Council

YONGHAO LI
- Chair of Extension Committee, Northeastern Division of the American Phytopathological Society

ROBERT E. MARRA
- Book Review Editor, Mycological Society of America
- Member, Phytopathology Committee, Mycological Society of America
- Founding Member, Connecticut Conference on Natural Resources Steering Committee
- Founding Member, West Haven Tree Coalition
- Secretary/Treasurer, Executive Committee, Northeastern Division of the American Phytopathological Society

NEIL P. SCHULTES
- Vice President & Executive Board member, Sigma Xi Quinnipiac Chapter
- Junior Radiation Safety Officer, CAES
- Fellow, Linnaean Society of London
- Member, Thesis Advisory Committees, University of Indiana – Purdue at Ft. Wayne, IN

LINDSAY R. TRIPLETT
- Associate Editor, *Phytopathology*
- Associate Editor, *Phytobiomes*
- Faculty Affiliate, Colorado State University

QUAN ZENG

- Vice Chair, Bacteriology Committee, American Phytopathological Society
- Panel member, 2015 USDA-AFRI Foundational Program "Understanding Plant-Associated Microbes and Plant-Microbe Interactions" Grant Review Panel

VALLEY LABORATORY

JAMES A. LAMONDIA

- Chair, Northeast Regional Project NE-1040, "Plant-parasitic Nematode Management as a Component of Sustainable Soil Health Programs in Horticultural and Field Crop Production Systems"
- Senior Editor, Journal of Nematology
- Society of Nematologists Extension Committee
- Connecticut Agricultural Information Council
- Member, Century Farm Award Selection Committee
- Ex-Officio Member, Connecticut Tree Protection Examining Board
- Worker Protection Standards Trainer for the Valley Laboratory
- CT Vegetable & Small Fruit Growers' Conference Steering Committee

CAROLE CHEAH

- Fellow, Cambridge Philosophical Society, UK

DEWEI LI

- President, Pan-American Aerobiology Association
- Associate Editor, *Aerobiologia*
- Member, Editorial Board, *Fungal Biology and Biotechnology*

THOMAS M. RATHIER

- Past President and Member of the program, tree improvement and merit award committees, Connecticut Christmas Tree Growers Association
- Member of Steering Committee, Connecticut Invasive Plant Working Group
- Member, Cooperative Agricultural Pest Survey
- Member, Water Use and Conservation Committee, Connecticut Nursery and Landscape Association

LECTURES, SEMINARS AND INTERVIEWS

During the year, staff members present formal lectures and seminars to organized groups outside The Station. They also describe their research to organized groups visiting The Station. Occasionally they report their research to elected officials. At still other times newspaper, radio and TV reporters interview our staff. These occasions are listed below.

ANAGNOSTAKIS, SANDRA L.

- Attended the Board meeting and presented her recent work on the nutrients in chestnuts at the Annual Meeting of the Northern Nut Growers Association held in La Crosse, WI (200 attendees) *July 25-29, 2015*
- Reported on Station chestnut research at the annual meeting of the Chestnut Federal Regional Project held at Hungry Mother State Park in Marion, VA *September 10-13*
- Gave a talk on "Chestnuts for Connecticut" to the Hartland Land Trust in East Hartland (25 adult attendees) *September 28*
- Gave a talk on "The Chestnuts on Chestnut Lane" to the Spring Glen Garden Club in the Cottage at Lockwood Farm in Hamden (14 adults attended) *October 16*
- Served as a judge for over 500 Nut entries from many species of tree nuts at the Nut Exhibit at the Pennsylvania Farm Show in Harrisburg, PA *January 8-10, 2016*. The Best of Show was from a seedling heartnut (*Juglans ailantifolia* var. *cordiformis*) grown by Tucker Hiller from Etters, PA.

ANDREADIS, THEODORE G.

- Presented an overview of the history and current operation of the Experiment Station and led a tour of the grounds to a group from the New Haven Preservation Trust (20 attendees) *July 16, 2015*
- Hosted Max Goldman, Outreach Assistant for U.S. Senator Chris Murphy, and presented an overview of current research, surveillance, statutory, and outreach activities of the Station along with a tour of selected laboratories *July 22*
- Was interviewed about Plant Science Day 2015 by Ray Andrewsen, WQUN AM 1220, in Hamden *July 23*
- Participated in a Council Meeting of the Connecticut Academy of Science and Engineering held in Wethersfield *July 29*
- Presided over a quarterly meeting of the Station's Board of Control held at Lockwood Farm *August 5*
- Was interviewed about the detection of West Nile virus in six Connecticut towns by Nicholas Rondinone, Hartford Courant *August 6*
- Was interviewed about West Nile virus activity in Connecticut and the US this summer by Tony Turzi, Fox News *August 18*
- Participated in a Health Policy Round Table Discussion on Lyme Disease in Connecticut, hosted by Congressman Joe Courtney, held at the Old Lyme Memorial Town Hall *August 21*
- Participated in a committee meeting of John Soghigian, PhD candidate at Clark University, Worcester, MA *August 25*
- Presented an overview of the history and current operation of the Experiment Station and led a tour of the grounds to a group from the New Haven Preservation Trust (20 attendees) *August 26*
- Presented an overview of scientific staff and research activities at the Center for Vector Biology & Zoonotic Diseases at CAES at an orientation session for incoming MPH students within the Department of Epidemiology of Microbial Diseases at the Yale School of Public Health *August 31*
- Met with State Representative Melissa Ziobron to discuss algal research on Lake Pocotopaug in East Haddam *September 17*
- Presented opening remarks and an update on CAES activities at the Federated Garden Clubs of Connecticut President's Day/Board Meeting held at the Station *September 24*

- Presented opening remarks and an update on CAES activities at the Federated Garden Clubs of Connecticut's Garden Study School held at the Station *October 13*
- Participated in a meeting of Connecticut's Invasive Plant Council held in Hartford *October 13*
- Presided over a quarterly meeting of the Station's Board of Control held at the Valley Lab in Windsor *October 21*
- Presented an invited symposium talk entitled "Ecology and Vector Biology of Mosquito-Borne Bunyaviruses in the Northeastern US" at the Annual Meeting of the American Society of Tropical Medicine and Hygiene held in Philadelphia, PA *October 27*
- Was interviewed about the public health significance of mosquito breeding in used tires in Connecticut by Gregory Hladky, Hartford Courant *October 31*
- Attended the annual meeting of Connecticut's Working Lands Alliance held in Hartford *November 17*
- Attended a board meeting of the Experiment Station Associates held at the Station *November 18*
- Presented an invited seminar entitled "West Nile Virus: The Emergence and Spread of an Exotic Mosquito-Borne Disease in the Western Hemisphere" at the Yale University School of Public Health *November 19*
- Attended the annual meeting of the Connecticut Farm Bureau in Wallingford *November 20*
- Presented an overview of the Experiment Station and its various research, regulatory, and public service programs at a meeting of the Connecticut State Consulting Committee for Agricultural Science and Technology Education held at the Station *December 2*
- Presented a talk entitled "Spatial-Temporal Patterns of Mosquito-Borne Bunyaviruses in Connecticut" at the 61st Annual Meeting of the Northeastern Mosquito Control Association held in Cambridge, MA (200 attendees) *December 8*
- Presided over a quarterly meeting of the Station's Board of Control held in Hartford *January 20, 2016*
- Presented an update on Experiment Station activities at a meeting of the Experiment Station Associates Board of Directors in Jones Auditorium *January 20*
- Presented an overview of the Experiment Station and its various research, regulatory, and public service programs at the Annual Meeting of the Connecticut Tree Protective Association held in Plantsville (700 attendees) *January 21*
- Met with Senator Ted Kennedy Jr., Representative James Albis, and other members of the Environment Committee to discuss the impact of pesticides on pollinator health in Connecticut, with Dr. Kimberly Stoner and Dr. Richard Cowles *January 26*
- Attended a Council Meeting of the Connecticut Academy of Science and Engineering held in Wethersfield *January 27*
- With Dr. Jason White, attended a meeting with Dr. Cameron Faustman and Dr. Michael O'Neill of the University of Connecticut's College of Agriculture and Natural Resources to discuss the 2015 Accomplishment Report and 2016 Plan of Work for the Experiment Station *January 29*
- Was interviewed about the Zika virus outbreak in Latin America by Andrew Pollack, New York Times *February 1*
- Was interviewed about the risk of Zika virus to Connecticut by Mary Ellen Godin, Record Journal *February 4*
- Was interviewed about the risk of Zika virus to Connecticut by Judy Benson, The Day *February 8*
- Testified before the Appropriations Committee of the General Assembly on the impact of Governor Malloy's proposed FY 2017 budget on the Experiment Station *February 10*
- Participated in a press conference with Governor Malloy and Department of Public Health Commissioner Raul Pino to announce Connecticut's "Response and Surveillance Plan for Zika Virus" *February 11*
- With Dr. Jeffery Ward and Dr. Blaire Steven, met with Dr. Peter Crane, Dean of the Yale School of Forestry, to discuss formal collaborations and adjunct faculty appointments for CAES scientists *February 16*

- Was interviewed about the impact of the proposed budget reductions on the State Beekeeper position by Laraine Weschler, Waterbury Republican-American *February 17*
- Hosted State Senator Martin Looney and Ms. Lisa Bassani, Project Director, Working Lands Alliance, and gave a tour of the Station *February 25*
- Was interviewed about the risk of Zika virus to Connecticut by Sam Gingerella, WTIC Radio *March 2*
- Participated in a meeting of the Connecticut Invasive Plant Council held in Hartford *March 8*
- Was interviewed about the impact of the proposed budget reductions on the State Beekeeper positon by Bob Miller, Connecticut Post *March 9*
- Was interviewed about the risk of Zika virus to Connecticut by Rebecca Stewart, *Health Care Matters* show, WTIC Radio *March 12*
- Participated in the spring meeting of the Northeastern Regional Association of State Agricultural Experiment Station Directors held in Baltimore, MD *March 15-16*
- Participated in the final thesis defense of PhD candidate, John Soghigian held at Clark University, Worcester, MA *March 18*
- Presented welcoming remarks and an overview of the Experiment Station and its various research, regulatory, and public service programs to the Landscape Design School held at the Station *March 22*
- Participated as Administrative Advisor in the annual meeting of Multi-State Project, NE-1443, *Biology, Ecology & Management of Emerging Disease* held in St. Augustine, FL *March 31*
- Was interviewed about Zika virus and the risk of mosquito transmission in Connecticut by Jaclyn Diaz, Norwich Bulletin *April 6*
- Presided over a quarterly meeting of the Station's Board of Control held at the Station *April 13*
- Presented welcoming remarks and an overview of the Experiment Station and its various research, regulatory and public service programs at the Annual Meeting of the Experiment Station Associates held at the Station *April 21*
- Was interviewed about Zika virus and the risk of mosquito transmission in Connecticut by Courtney Zieller, WFSB Channel 3, Hartford *April 28*
- Was interview about the results of the Station's testing of lobsters from Long Island Sound for pesticides by Dave Collins, Associated Press *April 29*
- Welcomed and gave opening remarks at a ceremony honoring 5th grade student winners of the CTPA Arbor Day Poster Contest with a tree planting at the Station (30 attendees) *April 29*
- Presented an invited talk entitled *Mosquitoes and Zika Virus in the Americas: Biology, Ecology and Control*, at a "Zika Global Health Symposium" held at the University of Massachusetts Boston (100 attendees) *May 2-3*
- Participated in a press conference with Congresswoman Rosa DeLauro to express support for federal funding of Zika virus research and mosquito control held at the Station *May 5*
- Was interviewed about Zika virus and the risk of mosquito transmission in Connecticut by Fran Schneidau, WCBS Radio, NY *May 6*
- Presented opening welcoming remarks to participants attending the "7th Annual Northeastern Eastern Equine Encephalitis Conference" held at the Station *May 6*
- Participated in a press conference with Governor Dannel P. Malloy and Department of Public Health Commissioner Raul Pino to present an update on Connecticut's "Response and Surveillance Plan for Zika Virus" held at the Hartford Hispanic Community *May 6*
- Presented welcoming remarks and an overview of the Experiment Station and its various research, regulatory, and public service programs to attendees of the Federated Garden Clubs of Connecticut Flower Show School (50 attendees) *May 11*
- Provided opening remarks for the "Lockwood Pavilion Ribbon-Cutting Ceremony," held in conjunction with the Annual Meeting of the Connecticut Forest & Park Association (100 attendees) *May 19*

- Presented opening remarks and a talk entitled, *Mosquitoes and Zika Virus in the Americas: Biology, Ecology, and Control* in a "Symposium on Vector-Borne Diseases in Connecticut" (75 attendees) *May 20*
- Was interviewed about federal and state funding for research and surveillance for Zika virus by Kyle Arnold, Republican-American *June 14*
- Presented an update on Experiment Station activities at a meeting of the Experiment Station Associates Board of Directors held at Lockwood Farm *June 22*
- Presented welcoming remarks and an overview of the Experiment Station and its various research, regulatory, and public service programs to a group of students from Central Connecticut State University (15 attendees) *June 23*

ARANGO-VELEZ, ADRIANA L.

- Spoke on "Southern Pine Beetle, It's Here and It's Moving into the Northeastern U.S." at the Connecticut Tree Protective Association summer meeting in Farmington (300 attendees) *July 16, 2015*
- Administered practical and oral examinations to arborist candidates for the Connecticut Tree Protection Examining Board *September 9*
- Met with Kevin Broderick and Andrew J. Bosse at Pequot Fish and Game Preserve in Newtown to examine Norway spruce attacked by southern pine beetle *September 21*
- Spoke on "Southern Pine Beetle, Moving Northeastern…Will it Stay?" at the Forest Health Cooperators Workshop held at the Valley Lab in Windsor (20 attendees) *October 23*
- Moderated the session "Bringing Back Native Trees – Elms and Chestnuts" at the 27th Connecticut Urban Forest Council annual conference in Plantsville (100 attendees) *October 28*
- Spoke on forest physiology to students from Co-Op High School, New Haven (7 students and 2 teachers attended) *October 30*
- Met with Leslie Kane (Audubon Connecticut) to discuss southern pine beetle on the Bent-of-the-River Sanctuary in Southbury *November 2*
- Met with Kevin Broderick (Pequot Fish and Game Preserve) to examine Norway Spruce attacked by southern pine beetle in Newtown *November 2*
- Met with Eric Hansen (Ferrucci & Walicki, LLC) and Bill VanDerBeek and Vic Donahey (Hammonasset Fishing Association) to examine trees infested with southern pine beetle in Madison *November 5*
- Met with Lou Bacchiocchi (Haskins Preserve) to examine Norway and white spruce infested with southern pine beetle *November 6*
- Attended the Partners in Community Forestry Conference held in Denver, CO *November 18-19*
- Was interviewed about the expansion range of insects, such as the southern pine beetle, due to changes in climate by Nate Lynch of The Day *December 24*
- Gave a presentation titled "Uses of Biochar for Urban Tree Health" at the Mass. Tree Wardens & Foresters Association 103rd Annual Conference in Sturbridge, MA (300 attendees) *January 12, 2016*
- Spoke on "Plant Defenses Against Biotic and Abiotic Stresses" and "Defensas de Árboles a Estreses Bióticos y Abióticos" at the Connecticut Nursery & Landscape Association Winter Symposium & Expo held in Plantsville (60 attendees) *January 15*
- Visited Dr. Chakraborty at Central Connecticut State University to discuss research collaboration *January 25*
- Spoke on "Environmental Challenges and Trees…Who Wins the Battle?" at the Forest Health Monitoring Workshop held in Jones Auditorium (40 attendees) *March 1*
- Presented a CAES seminar titled "Environmental Challenges and Trees…Who Wins the Battle?" in Jones Auditorium (45 attendees) *March 9*

- Gave a workshop about "Introduction to tree care: best practices" at the Experiment Station Associates (ESA) (18 attendees) *March 17*
- Spoke on "How do Trees Cope with Stress" at the Station's Arbor Day celebration (8 students, 7 adults) *April 29*
- Met with Leslie Kane (Audubon Connecticut) to discuss white pine decline at the Bent-of-the-River Sanctuary in Southbury *June 13*
- Began collaborating on a USDA multistate project to examine white pine health and responses to environmental and climate changes *June 16*

ARMSTRONG, PHILIP M.

- Gave the talk "Impact of Climate Change on Mosquito-Borne Diseases" to science teachers at Yale University as part of the Yale-Peabody Fellows SEPA NIH educational program on mosquito biology (25 attendees) *July 8, 2015*
- Was interviewed by Rich Cohen of the New York Magazine for an article about Powassan virus *July 14*
- Was interviewed about the detection of West Nile virus in mosquitoes by Fox CT News *July 31*
- Was interviewed about West Nile virus activity in Connecticut by NBC Connecticut Channel 30 *August 5*
- Was interviewed about West Nile virus activity by Mark Simms of CT Radio Network *August 6*
- Was interviewed about West Nile virus activity by Frank MacEachern of the Greenwich Daily Voice *August 11*
- Was interviewed about West Nile virus activity by Leslie Lake of the Hour *August 25*
- Was interviewed about West Nile virus activity by the Record Journal *September 2*
- Gave a brief overview of his research program to students at the Yale School of Public Health *September 3*
- Was interviewed about West Nile virus activity by the CT Radio Network *September 8*
- Gave a lecture on the statewide mosquito trapping and testing program to a group of students from Long River Middle School in Prospect as part of the Yale-Peabody Fellows SEPA NIH program on mosquito biology (27 students and 3 adults attended) *November 5*
- Gave a lecture on the statewide mosquito trapping and testing program to a group of students from High Horizons Magnet School in Bridgeport as part of the Yale-Peabody Fellows SEPA NIH program on mosquito biology (24 students and 3 adults attended) *November 17*
- Gave the talk "Phylogeography of Mosquito-Borne Bunyaviruses in the Northeastern U.S." at the Northeastern Mosquito Control Association in Newport, RI (180 attendees) *December 7*
- Gave a lecture titled "An Overview and Survey of Arboviral Diseases" for the course, Biology of Disease Vectors in the Yale School of Public Health *January 28, 2016*
- Was a guest lecturer speaking on "Dengue and Other Arboviral Diseases" for the course Principles of Infectious Diseases at the Yale School of Public Health (20 students) *February 9*
- Spoke to local health department directors about the risks of, and surveillance for, Zika virus transmission in Connecticut with the Department of Public Health and the Department of Energy & Environmental Protection (40 attendees) *February 22*
- Was interviewed by News Channel 8 about the risks of mosquito-borne transmission of Zika virus in Connecticut *February 29*
- Gave the lecture "Mosquito-Borne Disease Threats in the Northeastern US" as a part of the Forest Health Monitoring Workshop at CAES (50 attendees) *March 1*
- Gave the talk "Phylogeography of Mosquito-Borne Bunyaviruses in the Northeastern US" at the New Jersey Mosquito Control Association Meeting in Atlantic City, NJ (200 attendees) *March 3*
- Was interviewed by the Toronto Star about Cache Valley virus *March 14*

- Met with Yale PhD students in Epidemiology of Microbial Diseases to discuss his career path as a part of the Wine on Whitney Series, New Haven (8 students) *March 29*
- Presented his research findings at the Annual Northeastern Multistate Project Meeting- Biology, Ecology and Management of Emerging Disease Vectors (40 attendees) *March 31*
- Met with Milford town officials and reporters at the Annual Mosquito Kickoff (20 attendees) *April 5*
- Was interviewed by WFSB Channel 3 News about the Asian Tiger mosquito in Connecticut *April 25*
- Was interviewed by Crossroads Magazine about the threat of Zika virus transmission in Connecticut *April 27*
- Was interviewed for a profile in New Haven Living Magazine on insect awareness *April 29*
- Gave a talk "Molecular Evolution of EEE Virus in Connecticut" at the 7th Annual Northeastern EEE virus Conference held at CAES (50 attendees) *May 6*
- Gave a talk "Mosquito and Arbovirus Surveillance in Connecticut" at the Symposium on Vector-Borne Diseases in Connecticut held at CAES (100 attendees) *May 20*
- Was interviewed by CBS Evening News about the risk of Zika virus transmission in the US *May 2*
- Was interviewed by WTIC news and Fox News 61 about the statewide mosquito monitoring program *May 31*
- Was interviewed by CT Radio Network about mosquito-borne diseases in Connecticut *June 1*
- Was interviewed by News Channel 8 and Channel 3 about the start of the mosquito trapping program and threats posed by Zika virus *June 1*
- Was interviewed by the Republican-American about the mosquito monitoring program *June 2*
- Was interviewed by the New Haven Register about the mosquito monitoring program *June 7*
- Was interviewed by WTIC about mosquitoes and their diseases in Connecticut *June 8*

AULAKH, JATINDER S.

- Assisted Dr. Carole Cheah with a mile-a-minute biocontrol weevil release in Glastonbury *August 18, 2015*
- Assisted Dr. Carole Cheah with a mile-a-minute biocontrol weevil release in New Milford *August 20*
- Participated in the Connecticut Christmas Tree Growers twilight meeting held in Andover to introduce himself and his research interests to growers and board members *August 26*
- Visited with Pete Picone, Wildlife Biologist with CT DEEP, about potential collaborative research projects *September 2*
- Mapped "Kudzu" infested sites in Connecticut with Nicole Gabelman from UConn *September 15*
- Attended a meeting with Dr. Steve Young, Director of the Northeastern IPM Center, at UCONN and apprised other IPM coordinators of his research interests *September 16*
- Attended the Connecticut Invasive Plant Working Group meeting at UConn in Storrs, introduced himself to the CIPWG members, and explored opportunities for research and outreach collaborations *October 6*
- Prepared a factsheet and trifold and gave a talk titled "Distinguishing Between the Native and Non-native Phragmites" at Fulton Park in Waterbury *October 17*
- Attended the Connecticut Invasive Plant Working Group meeting at the Valley Lab in Windsor *November 12*
- Conducted a weed management survey at Planter's Choice Nursery in Newtown *November 17*
- Met with Edith Lurvey and Marlee Ross, IR-4 NE regional research coordinators, to discuss potential ornamental plant research grant opportunities *November 19*
- Met with Peter Picone, wildlife biologist with CT DEEP, to discuss invasive plant management studies *November 24*
- Discussed mugwort research trials at selected sites with Erin O'Hare, an Environment and Natural Resources Planner, in Wallingford *December 8*

- Presented a research poster and interacted with weed scientists in the Northeast for research collaborations at the Northeastern Plant, Pest, and Soils Conference in Philadelphia, PA (60 attendees) *January 4-7, 2016*
- Discussed ornamental plant safety trials for 2016 at the IR-4 meeting in Philadelphia, PA *January 5*
- Presented a talk on "Research Perspectives on Management of Invasive Plants and Weeds in Ornamental Nurseries and Christmas Trees" at the CNLA Winter Symposium & Expo held at Aqua Turf in Plantsville *January 14*
- Attended the Connecticut Invasive Plant Working Group meeting at the Valley Lab in Windsor *January 19*
- Reviewed a Master's research thesis from the University of Nebraska-Lincoln *March 17*
- Participated in the Connecticut Invasive Plant Work Group Symposium Planning Committee meeting at the Valley Lab in Windsor *March 21*
- Attended the Connecticut Invasive Plant Working Group symposium planning committee meeting held at the Valley Laboratory in Windsor *April 26*
- Participated in a Christmas tree growers twilight meeting and talked about how to improve efficacy of pre-emergence herbicides for weed control and discussed emerging weed issues in Christmas tree plantations *June 21*
- Attended the CIPWG symposium planning committee meeting in Windsor *June 23*

BARSKY, JOSEPH P.

- Participated in a meeting of the Connecticut State Consulting Committee for Agricultural Science and Technology Education in Vernon *July 14, 2015*
- Attended the Connecticut Tree Protective Association summer meeting in Farmington *July 16*
- Participated in a meeting of the Connecticut State Consulting Committee for Agricultural Science and Technology Education in Washington *July 22*
- Participated in the quarterly meeting of the New England Society of American Foresters Executive Committee in East Concord, NH *September 9*
- With Ms. Amanda Massa, staffed a CAES booth featuring tree physiological research projects at the Brooksvale Fall Festival in Hamden (50 visitors to the booth) *September 26*
- Gave a presentation on "Careers in Agricultural Science" to sophomore students at a career day event at Cheshire High School (80 students attended) *October 6*
- Participated in the quarterly meeting of the Connecticut State Consulting Committee for Agricultural Science and Technology Education at Southington High School *October 7*
- Gave a presentation on "Invasive Species in Connecticut" to upper class students from Co-Op High School at East Rock Park in New Haven (7 students, 2 teachers) *October 30*
- Administered forestry examinations at the Connecticut Future Farmers of America (FFA) Association's Forestry Career Development Event held at Lockwood Farm in Hamden (32 students and 8 teachers attended) *November 13*
- Hosted the quarterly meeting of the Connecticut State Consulting Committee for Agricultural Science and Technology Education at the Station (6 attendees) *December 2*
- Participated in the New England Society of American Foresters quarterly meeting teleconference *December 9*
- Participated in the quarterly executive committee meeting of the New England Society of American Foresters in Sturbridge, MA *January 14, 2016*
- Attended the Annual Meeting of the Connecticut Tree Protective Association in Plantsville *January 21*
- Participated in a triennial review of the Agriscience and Biotechnology program at Trumbull High School with the State Consulting Committee *February 11*

- Participated in a triennial review of the Agriscience and Biotechnology program at Trumbull High School with the State Consulting Committee *February 24*
- Participated in the New England Society of American Foresters Executive Committee Meeting in Sturbridge, MA *March 9*
- Organized and moderated a technical workshop at the 96th Winter Meeting of the New England Society of American Foresters, Sturbridge, MA *March 11*
- Co-organized the 2016 State FFA Agriscience Fair and led walking tours of CAES Departments (35 students, 5 teachers) May 5
- Represented CAES at the 2016 Connecticut Agricultural Education Summit at Suffield High School *May 11*
- Spoke to high school students about careers in forestry and natural resources at North Branford High School *May 20*
- Led a tree identification walking tour and with Dr. Robert Marra, Ms. Katherine Dugas, and Ms. Lindsay Patrick, staffed the CAES booth at the Connecticut Tree Festival held at Cranbury Park in Norwalk *May 21*

BRACKNEY, DOUGLAS E.

- Was appointed Clinical Assistant Professor in the Department of Epidemiology of Microbial Diseases, Yale School of Public Health *July 1, 2015*
- Introduced his scientific research interests to the incoming class of Master's students within the Department of Epidemiology of Microbial Diseases, Yale School of Public Health (50 attendees) *September 3*
- Was discussion leader for the Yale of School Public Health EMD563 Laboratory and Field Studies in Infectious Diseases course on the topic of molecular mechanisms of mosquito host-seeking behaviors (3 student participants) *March 17, 2016*
- Presented the invited talk "Innate Immune Modulation of West Nile Virus Populations" at the New Jersey Mosquito Control Association Annual Meeting (approx. 100 participants) *March 4*
- Presented the invited talk "Catch Me If You Can: A Tale of Flavivirus Evolution and Innate Immunity" in the Yale School of Public Health Epidemiology of Microbial Diseases Seminar Series (approx. 60 attendees) *March 11*
- Presented a CAES seminar titled "Genetic Bottlenecks, RNAi-mediated Diversification, and Selective Constraints Collectively Influencing Powassan Virus Evolution" in Jones Auditorium (50 attendees) *April 27*
- Presented a poster "Genetic bottlenecks, RNA interference and selective constraints collectively influence Powassan virus evolution" at the Keystone Symposia: Positive Strand RNA Viruses, in Austin, TX *May 1-5*

BRANSFIELD, ANGELA B.

- Participated in the 2015 Federal Select Agent Program Webcast *November 19, 2015*
- Participated in the Federal Select Agent Program Webinar: Changes to FD-961 Bioterrorism Risk Assessment Form *April 19, 2016*
- Participated in the Association of Public Health Laboratories (APHL) Webinar, "Shipping Select Agents, Toxins and Other Infectious Materials" *June 1*
- Participated in the Sandia National Laboratories forum "Biological Select Agents and Toxins: Risk Assessment and the Regulated Community" *June 13*
- Attended the CT Biosafety Alliance Group meeting at Wesleyan University in Middletown *June 17*

BRAVO, JOAN L.

- Met with John Lavorgna, GioProduction in Hamden to discuss pruning methods and pruning to balance production (March 30); and met with Jerry Savino and staff of Savino Vineyards Woodbridge, to train on Hudson River Umbrella, vine renovation, and proper pruning practices (5 attendees) *March 31, 2016*

BUGBEE, GREGORY J.

- Was interviewed about water chestnut found in Filley Park Pond in Bloomfield by Steve Goode of the Hartford Courant *July 13, 2015*
- Spoke on "Invasive Aquatic Plants" at the West Haven Eco Camp (50 attendees) *July 15*
- Spoke on "Invasive Aquatic Plant Control Options for Moodus Reservoir" at a town meeting at the East Haddam Grange Hall (75 attendees) *July 16*
- Spoke on "The Condition of Bashan Lake and Invasive Aquatic Plant Control Needs," with reference to the drawdown for dam repairs, at the East Haddam Grange Hall (50 attendees) *July 27*
- Spoke on "Container Gardening Indoors and Out" to the Orchard Valley Garden Club in Southington (50 attendees) *July 28*
- Was interviewed about invasive aquatic plant problems in Connecticut by Danielle Faipler of the Willimantic Chronicle *August 11*
- Participated in a meeting of local and state officials, including Senator Ted Kennedy Jr., Representative Shaun Scanlon, and Guilford First Selectman Joe Mazza, in Guilford to discuss invasive aquatic plant problems in Lake Quonnipaug *September 11*
- Spoke on the CAES invasive aquatic plant survey of Coventry Lake at a town meeting in Coventry (80 attendees) *September 15*
- Was interviewed about invasive aquatic plant problems in Connecticut by Virginia Fisher of FOXCT *September 29*
- With Ms. Jennifer Fanzutti, gave a lecture on "Connecticut Soils and Soil Testing" to an environmental science class at the Co-op High School in New Haven (approx. 35 students attended) *November 30*
- With Ms. Jennifer Fanzutti, gave a talk titled "Connecticut's Invasive Aquatic Plant Program – Who We Are and What We Do" at the North American Lake Management Society Conference in Saratoga Springs, NY (approx. 80 attendees) *November 18*
- With Ms. Jennifer Fanzutti, spoke on "CAES Invasive Aquatic Plant Program Surveys of Gardner Lake – Changes from 2006-2015" to the Gardner Lake Association at the Salem Free Public Library in Salem (approx. 25 attendees) *November 12*
- Spoke on "CAES Invasive Aquatic Plant Program Aquatic Plant Surveys of Lake Quonnipaug – A Decade of Changes" to the Lake Quonnipaug Association at the North Guilford Firehouse (approx. 50 attendees) *November 7*
- Gave a lecture titled "Connecticut's Invasive Aquatic Plant Problem – Searching for Solutions" to an Environmental Studies class at the University of Hartford (approx. 50 students attended) *November 5*
- Participated as a member of the 2016 CT DEEP aquatic invasive species grants review team at CT DEEP Headquarters in Hartford *December 3*
- With Ms. Jennifer Fanzutti, gave two workshops on invasive aquatic plants for the Connecticut Envirothon at Goodwin College in East Hartford (approx. 85 attendees) *January 16, 2016*
- Was interviewed by Corey Sipe of the Willimantic Chronicle on the hydrilla problem in Coventry Lake *February 17*
- Gave the seminar "Soil and Fertilizers" as part of the arborists training program at the Bartlett Arboretum in Stamford (approx. 12 attendees) *February 18*
- Was interviewed by Linda Comeau on the hydrilla problem in Coventry Lake for the Town of Coventry Newsletter *February 25*

- With Jennifer Fanzutti, presented an invasive aquatic plant workshop at The Connecticut Conference on Natural Resources at UCONN (approx. 25 attendees) *March 14*
- With Jennifer Fanzutti, presented an invasive aquatic plant seminar at Three Rivers Community College in Norwich (approx. 35 attendees) *March 16*
- With Michael Cavadini, proctored the Invasive Species event at The 2016 Science Olympiad held at the Robbin's Middle School in Farmington (approx. 35 attendees) *March 19*
- With Jennifer Fanzutti, presented the results of the CAES IAPP 2015 invasive aquatic surveys of Lakes Candlewood, Lillinonah, and Zoar and Squantz Pond to the FirstLight Power Resources Technical Committee (approx. 14 attendees) *March 22*
- Gave the talk "Improving Soil in Urban Vegetable Gardens" to inner city gardeners, sponsored by the United Way, at the Ansonia Community Center (approx. 25 attendees) *March 30*
- Spoke to the Branford Garden Club on "Container Gardening Indoors and Out" at the Branford Community Center (approx. 75 attendees) *April 4*
- Spoke to a fifth-grade class at St. Thomas Day School in New Haven on "Soil Testing" (approx. 20 students) *April 28*
- Was interviewed by Zoe Roos of the Guilford Courier on control of invasive plants in Lake Quonnipaug *May 23*
- Was interviewed by Will Rowlands of The Connecticut Gardener on endophytes in tall fescue *May 24*
- Spoke at a meeting of the Friends of Lake Quonnipaug on CAES IAPP surveys and control options for invasive aquatic plant problems at the North Guilford Firehouse (approx. 30 attendees) *June 2*
- With Jennifer Fanzutti, spoke at a meeting of the Friends of Lake Lillinonah on CAES IAPP surveys and control options for invasive aquatic plant problems at the Bridgewater Town Office Building (approx. 30 attendees) *June 17*
- Spoke to a class from Central Connecticut State University on "Soil Testing and Invasive Aquatic Plants" (approx. 25 attendees) *June 23*

CAVADINI, MICHAEL J.

- With Mr. Gregory Bugbee, proctored three invasive species exams for the CT Science Olympiad in Farmington (30 middle school participants) *March 19, 2016*
- Presented information about analytical chemistry and QuEChERS extractions at the North Branford High School Environmental Science Fair (approx. 30 students and 5 adults attended) *May 20*

CHEAH, CAROLE A.

- With Donna Ellis from UConn, was interviewed for a segment on NBC 30 for a mile-a-minute weevil release in Glastonbury, presented by Doug Greene, NBC News CT *July 16, 2015*
- With Donna Ellis from UConn and Emmett Varricchio, a summer research assistant at the Valley Laboratory, was interviewed and photographed by Brad Horrigan of the Hartford Courant and by Jim Shannon of the Waterbury Republican-American during the weevil release in Glastonbury *July 16*
- Was interviewed about the Glastonbury weevil release by Shawn Dagle of the Glastonbury Citizen *July 16*
- Attended the general meeting of Connecticut Invasive Plant Working Group at the University of Connecticut *October 6*
- Gave an update on the effects of severe winters on elongate hemlock scale and hemlock woolly adelgid in Connecticut at the NY/NE 2015 Forest Health Cooperators Meeting held at the Valley Lab in Windsor *October 23*
- Was interviewed by Kendra Bobowick of the Newtown Bee for a biological control weevil update on mile-a-minute weed control in Newtown *October 30*
- Was interviewed about warm temperatures and the effects on hemlock woolly adelgid by Nate Lynch of The Day *December 24*

- Was interviewed by Tim Palmer, renowned photographer and author, about hemlock woolly adelgid and biological control for an upcoming book *January 29, 2016*
- Gave a presentation on predicting hemlock woolly adelgid winter mortality in Connecticut at the annual Forest Health Monitoring Workshop in Jones Auditorium *March 1*
- Was interviewed by Robert Miller for the News-Times on the effect of the February 2016 cold snap on HWA winter mortality *April 12*
- Gave a presentation on predicting hemlock woolly adelgid winter mortality in Connecticut at the 2016 Northeast Natural History Conference at Springfield, MA (50 attendees) *April 23*
- Gave members of the Carolina Land Conservancy, NC and Tree-Savers, PA, a tour of the Kenneth White Insectary, Valley Laboratory and farm *April 23*
- With Donna Ellis (UConn) and Emmett Varricchio (CAES summer assistant), released mile-a-minute herbivorous weevils, *Rhinoncomimus latipes*, in Groton as part of the 2016 biological control program for invasive mile-a-minute weed, funded by USDA APHIS *June 29*
- With Donna Ellis (UConn) and Emmett Varricchio (CAES summer assistant), released mile-a-minute herbivorous weevils, *Rhinoncomimus latipes*, in Milford as part of the 2016 biological control program for invasive mile-a-minute weed, funded by USDA APHIS *June 30*

COWLES, RICHARD S.

- Spoke on "Christmas Tree Pest Management" at a twilight meeting of the CT Christmas Tree Growers Association held at the Valley Lab in Windsor (30 attendees) *July 14, 2015*
- Discussed "How to Properly Handle and Apply Nematodes for Grub Control" at the School and Municipal Turf/Ground Workshop, sponsored by UConn, in Hamden (60 attendees) *July 29*
- Lectured on "Strategizing for Bee Health" to the Massachusetts Association of Lawn Care Professionals in Boylston, MA (50 attendees) *July 30*
- Presented the field exhibit "Assessing Neonicotinoid Levels in Nursery Plants" at Plant Science Day in Hamden *August 5*
- Spoke about "Challenges in Using Boric Acid to Manage Spotted Wing Drosophila" as an invited speaker to the American Chemical Society in Boston, MA (30 attendees) *August 17*
- Discussed "Christmas Tree Insect Update" and provided a field demonstration on using a backpack mist blower sprayer at the CT Christmas Tree Growers meeting in Andover (40 attendees) *August 26*
- Presented "Management Options for EAB" at the CT Tree Protective Association EAB Workshop in Durham (75 participants) *September 3*
- Spoke about "Christmas Tree Insect Update" at the CT Christmas Tree Growers meeting in Plainfield (40 attendees) *September 19*
- Presented "Spotted Wing Drosophila Management" for the Northeast Regional IPM webinar (20 participants) *October 20*
- Discussed "Is There Life after Neonics?" to greenhouse and nursery growers (40 participants) and "Managing Annual Bluegrass Weevils" for golf course superintendents (25 participants) at the Helena Chemical Company educational program in Providence, RI *October 21*
- Spoke about "The Neonicotinoid Controversy" and "Managing the Emerald Ash Borer" at the New England regional meeting for the International Society for Arboriculture in North Conway, NH (150 attendees for each talk) *October 26-27*
- Was interviewed by David Kuack for an article on his research supported by the Horticulture Research Institute *October 27*
- Participated in a meeting with the Connecticut Environmental Council to discuss drafting model legislation to permit low toxicity pesticides to be used on school grounds while safeguarding students from pesticide exposure (12 participants) *October 30*
- Presented "The Role of the Green Industry in Enhancing Bee Health" to the Connecticut Environment Council in Plantsville (150 attendees) *November 24*

- Presented “Control Measures for Bed Bugs” to facilities managers for Yale University, New Haven (25 attendees) *December 9*
- Presented “Making the Right Choices,” about insecticide physical characteristics and how that influences their suitability to be used to target particular groups of pests, to the New York Turf and Landscape Association in Yonkers, NY (109 attendees) *January 13, 2016*
- Had a phone conference with researchers and extension specialists in North Carolina regarding soil acidification to protect Christmas trees from root rot infection (5 participants) *January 21*
- Presented “The Annual Bluegrass Weevil Paradox” to golf course superintendents for the Hart Seed Co. educational seminar in Taunton, MA (100 participants) *January 26*
- With Dr. Theodore Andreadis and Dr. Kimberly Stoner, met with the Environment Committee of the state legislature about pollinator health and what action might be taken to protect and support pollinators *January 26*
- Presented “The Annual Bluegrass Weevil Paradox” to golf course superintendents for the Hart Seed Co. educational seminars in Cromwell (70 participants) *January 27*
- Provided a two-hour presentation on “Neonic Update and Nursery IPM Principles” to staff at Pride’s Corner Nursery (50 attendees) *January 28*
- Presented “The Dos and Don’ts of Neonicotinoids” to SavATree managers in Florham Park, NJ (150 attendees) *February 2*
- Gave a talk titled “Cyclical, Emerging, and Disappearing Pests” at the CT Grounds Keepers Association Turf & Landscape Conference in Cromwell (320 attendees) *February 17*
- Discussed “Behavioral Control of Pests: Are We There Yet?” at the Crop Production Services’ educational seminar in Windsor Locks (85 participants) *February 29*
- Presented “The Dos and Don’ts of Neonicotinoids” to SavATree in Danbury (100 attendees) *March 1*
- Conducted a webinar hosted by University of Massachusetts titled “Neonicotinoids, Bees and Urban Trees: The Controversy Defined,” archived at https://vimeo.com/157623443, observed during the presentation by 450 people *March 3*
- With Dr. Kimberly Stoner, represented CAES in testimony for the Environment Committee of the CT State Legislature regarding draft pollinator protection legislation *March 4*
- Spoke on “Neonicotinoids and Bees” to The New Hampshire Arborists Association in Concord, NH (100 attendees) *March 15*
- Spoke on “Against the Wind: Challenges in Using Behavioral Manipulation for Managing Spotted Wing Drosophila,” as part of the CAES Seminar Series, in Jones Auditorium (40 attendees) *March 30*
- Presented “Bed bugs!” to Connecticut Community Care home health care providers in Wethersfield (28 attendees) *April 13*
- Gave a talk titled “Strategizing for bee health” to Vegetation Control Service in Orange, MA (150 attendees) *April 13*
- Was a special guest speaker for the northeast small fruit growers’ call-in discussion, discussing “Spotted wing drosophila and cyclamen mites” (20 attendees) *May 10*
- Presented “Neonics, ornamental crops, and bees” to a twilight meeting of the Rhode Island Nursery Growers’ Association in South Kingston, RI (80 attendees) *May 18*
- Met with leaders of the Connecticut Environment Council to discuss neonicotinoid legislation in Connecticut, in Windsor (4 attendees) *June 15*
- Shared observations on “Insect and mite management” at a summer Christmas tree growers’ twilight meeting in Woodstock (40 attendees) *June 21*
- Was a special guest speaker for the New Hampshire/Vermont Christmas Tree Growers’ association meeting in Cuttingsville, VT (45 attendees) *June 25*

CREIGHTON, MARK H.

- Was notified by the Connecticut Department of Agriculture that he was awarded a $40,000 grant from the USDA titled the Minority Youth Beekeeper Initiative (MYBI) *October 5, 2015*
- Attended the Connecticut Beekeepers Association meeting in New Haven and spoke on the value of hive registration and IPM for mite control; also collected several honey bee registration forms and made several inspection appointments (28 attendees) *October 24*
- Spoke at the Connecticut Beekeepers Association Bee School at CAES to new beekeepers about bee diseases and the honey bee registration program (120 attendees) *February 6, 2016*
- Officially received USDA Specialty Crop Block Grant paperwork to begin the Minority Youth Beekeeping project *February 10*
- Attended the Connecticut Beekeepers spring meeting at CAES and spoke on honey bee registration and oxalic acid (90 attendees) *February 13*
- Manned the CAES booth at the CT Flower Show in Hartford and spoke with several hundred visitors on forest health and honey bee-related topics *February 19-21*
- Attended a lecture on thermoregulation of the hive at the Backyard Beekeepers Association meeting in Weston and spoke about honey bee registration and the use of oxalic acid for Varroa mite control (80 attendees) *February 23*
- Attended a Pollinator Habitat meeting at CAES *February 26*
- Gave a talk on basic beekeeping at the Benedicts Home and Garden Center in Monroe (100 attendees) *February 27*
- Attended the Eastern Connecticut Beekeepers Bee school in Hamden, and spoke with the 45 attendees on bee health issues and the honey bee registration program *March 1*
- Attended a lecture on queen bee health at the Worchester Beekeepers Association meeting, and met with the Chief Apiary Inspector of MA and the Worchester County Bee Inspector to discuss bee health issues *March 5*
- Spoke on beginning beekeeper topics at Shagbark Lumber and Supply in East Haddam (89 attendees) *March 12*
- Spoke to 2-3rd grade students from the region on honey bees and the role they play in pollination at Eastcon in Hampton (170 students) *March 15*
- Completed a course on Export Certification by the USDA-APHIS PPQ in Wallingford and became an Authorized Certification Official (ACO); this course provided information on legal authorities related to export certification, along with current Plant Protection and Quarantine (PPQ) policies *March 16-17*
- Spoke with students about honey bee biology and inspected their apiary at the Montessori School in New Hartford *April 5*
- Attended the Connecticut Beekeepers Association meeting and spoke to the attendees about bee health issues and honey bee registration at the Experiment Station in New Haven *April 16*
- Spoke with students about the Station and the role pollinators play in agriculture at the Arbor Day celebration at the UCONN campus in Storrs *April 19*
- With Dr. Kimberly Stoner, participated in a Pollinator Health display sponsored by Congresswoman Elizabeth Etsy at the New Britain Bee Base Ball park in New Britain *April 22*
- Spoke to visiting students from St. Thomas Day School about the role honey bees play in agriculture *April 28*
- Spoke at the Connecticut Farm Bureau, Youth Farmers Club, on honey bees and their role in pollination at the Valley Lab in Windsor *May 3*
- Was interviewed on the status of honey bee health in CT by Gregory Hladky of the Hartford Courant *May 11*
- Was interviewed by WSUV-NYC public radio on the status of honey bee health in CT *May 12*

- Was interviewed by Evan White of WFSB 3 in Hartford on the status of honey bee health in CT *May 12*
- Spoke on honey bees at the Experiment Station to the 1st Grade Class of St Thomas Academy *May 18*
- Set up a Bee Health table and collected honey bee registration forms at the Connecticut Beekeepers Association's 125 year celebration held at Lockwood Farm (over 300 attendees) *June 4*
- Spoke on honey bee health topics at the Stonington Land Trust annual meeting held at Stonington Vineyards (60 attendees) *June 13*
- Was presented a Life Saving Medal by the Lieutenant Governor on behalf of the Department of Public Safety for a medical event that he was involved with in 2015 *June 22*

DINGMAN, DOUGLAS W.

- Convened a planning meeting with Mark Cooper (Director of Health, Westport Weston Health District), Pete Fraboni (Head, Earthplace, Inc.), Sarah Crosby (Staff scientist, Earthplace, Inc.), and David Knauf (Director of Health, Town of Darien) regarding logistics and initiation of the Microbial Source Tracking Project at CAES *August 7, 2015*
- Submitted and released twenty six 16S rDNA sequences through the NIH NCBI GenBank database determined for bacterial species *Paenibacillus larvae* subsp. *larvae*, *Paenibacillus larvae* subsp. *pulvifaciens*, and *Brevibacillus laterosporus August 19*
- Met with Mark Cooper (Director of Health, Westport Weston Health District) to confirm start and logistics of waterway sampling/DNA extraction in October for the Microbial Source Tracking Project *September 2*
- Attended the Institutional Biosafety Committee (IBC) training workshop held at State College, PA with instruction by representatives of NIH-OBA *November 17-19*
- Presented a lecture on *E. coli* and microbial contamination to the students of Dr. Kristen Martin (St. Joseph University, West Hartford) *March 1, 2016*
- Presented a seminar on honey bee basics and biology to the Cherry Brook Garden Club in Canton *March 8*
- Was an invited speaker for the Department of Microbiology and Molecular Biology, BYU, Provo, Utah and presented a seminar entitled "*Paenibacillus larvae* subsp. *larvae* and *pulvifaciens*: Honey Bee Pathogens with Differences" *April 6-8*
- Conducted a training workshop on sequential sampling of honey bees for Nosema prevalence in Bethlehem *April 29*
- Served as a judge for the Connecticut FFA Science Fair in Jones Auditorium *May 5*
- Conducted an all-day workshop on "Nosema monitoring" for the Backyard Beekeepers Association in Jones Auditorium *May 14*
- Served as a judge for the New Haven Science Fair in New Haven *May 16 and 17*

DOUGLAS, SHARON M.

- Organized and participated in the CAES booth by answering questions about tree health and examining samples from arborists at the CTPA Summer Meeting in Farmington (720 adult attendees) *July 16, 2015*

DUGAS, KATHERINE

- Attended a USDA Cerymbicid and Buprestid identification workshop in Amherst, MA *August 12, 2015*
- Gave an insect talk for the youth program at the Danbury Library (12 adults and children attended) *August 18*
- With Dr. Claire Rutledge, attended the Connecticut Tree Protective Association (CTPA) EAB tour in Durham *September 3*

- With Mr. Stephen Sandrey and Mr. Zachary Brown, set up and staffed a Forest Pest display booth at the Woodstock Fair (1,266 attendees) *September 3-7*
- With Mr. Mark Creighton and Mr. Zachary Brown, set up and staffed a joint Forest Pest/Honey Bee display booth at the Hebron Harvest Fair (361 attendees) *September 9-13*
- With Ms. Rose Hiskes, attended the Vernon Greenways Beetlemania Event and CAES staff and Vernon Greenways members identified and surveyed 401 ALB/EAB host trees along the Rail Trail, and distributed ALB/EAB identification cards to people using the trail *September 12*
- With Mr. Mark Creighton, Ms. Rose Hiskes, and Mr. Zachary Brown, staffed a joint Forest Pest/Honey Bee booth in the CT building at the Big E (1,321 attendees) *September 22*
- With Mr. Mark Creighton, staffed the USDA's Forest Pest booth at the Durham Fair *September 24*
- Staffed a Forest Pest booth at the Celebrating Agriculture event in Woodstock (80 children made buttons with the CAES button machine) *September 26*
- With Dr. Gale E. Ridge, hosted students and teachers from the Foote School in the Insect Information Office where the students learned about insect identification and forest pests in Connecticut (15 first-graders and 2 teachers attended) *September 30*
- With Drs. Victoria Smith, Kirby Stafford, and Gale Ridge, attended an EAB Strategy Meeting at CT Forest & Park Association Headquarters in Rockfall *November 4*
- Assisted Dr. Gale Ridge with a workshop for the CT Reuse and Recycling Industries regarding bed bugs and mattress recycling issues (30 attendees) *November 12*
- Spoke with three 1st grade classes at the CREC Academy of Aerospace & Engineering Elementary School about ALB, EAB, and forest pests (60 student attendees) *November 13*
- Staffed a forest pest table at the Connecticut Association of Conservation and Inland-Wetland Commissions (CACIWC) meeting at Villa Capri in Wallingford. She spoke with members of conservation commissions and tree wardens from throughout the state regarding EAB management *November 14*
- With Drs. Kirby Stafford and Victoria Smith, attended and ran the State CAPS Committee meeting at the Lockwood Farm Cottage in Hamden *November 18*
- Staffed a CAES/forest pest booth at the CT Farm Bureau meeting at Villa Capri in Wallingford *November 20*
- Staffed a CAPS and Forest Pest booth at the CNLA Winter Symposium & Expo held at Aqua Turf in Plantsville *January 14-15, 2016*
- Staffed a CAPS and Forest Pest booth at the Annual Meeting of the CT Tree Protective Association held at Aqua Turf in Plantsville *January 21*
- Participated in an EAB Outreach meeting at the CTPA office in Wallingford *January 19*
- Staffed a Forest Pest/Don't Move Firewood Table at the Northeast RV and Camping Show in Hartford *January 22 & 24*
- Attended the Forest Health Monitoring Workshop in Jones Auditorium *March 1*
- Staffed a CAES/Forest Pest table at the CT Master Gardener's Symposium held at Connecticut College in New London (300 attendees) *March 19*
- Gave a talk about Asian longhorned beetle and winter moth for 8 students as part of a series for the Institute for Learning in Retirement (8 attendees) *May 11*
- With Mr. Joseph P. Barsky, Ms. Lindsay Patrick, and Dr. Robert Marra, had a Station booth at the Connecticut Tree Festival in Norwalk. The CAES tables contained plant pathology and forest pest information *May 21*
- Organized and ran the Statewide Cooperative Agricultural Pest Survey (CAPS) committee meeting in Jones Auditorium (12 attendees) *May 31*

DURGY, ROBERT J.

- Attended as a member of the steering committee and ran the audio-visuals at the Connecticut

Vegetable & Small Fruit Growers Conference in Windsor (266 attendees) *January 11, 2016*

- Taught a University of Connecticut Master Gardener Program class on vegetables in Stamford (24 attendees) *February 22*
- Taught a University of Connecticut Master Gardener Program class on vegetables in Vernon (30 attendees) *March 4*
- Taught a University of Connecticut Master Gardener Program class on vegetables in Torrington (22 attendees) *February 3*
- Taught a University of Connecticut Master Gardener Program class on vegetables in Norwich (33 attendees) *February 16*
- Taught a University of Connecticut Master Gardener Program class on vegetables in New Haven (30 attendees) *February 25*
- Taught Math Calculations and Calibration for Pesticide Applicator's Training in East Haven (26 attendees) *February 18*
- Taught Math Calculations and Calibration for Pesticide Applicator's Training in West Hartford (15 attendees) *March 1*

EITZER, BRIAN D.

- Presented a poster on the use of Liquid Chromatography High Resolution Mass Spectrometry and was selected as the co-chair of the program for next year's meeting at the 52nd Annual North American Chemical Residue Workshop in St. Petersburg Beach, FL (350 attendees) *July 19-23, 2015*
- Was a participant in the FERN cCAP Technical meeting in Silver Springs, MD (30 attendees) *August 12*
- Attended the FDA FVM Science and Research Conference in Silver Springs, MD (250 attendees) *August 13-14*
- Met with Robert Koethe of the U.S. Environmental Protection Agency EPA-New England, Region 1 Office to discuss pesticide analysis and pesticides and pollinator protection research at CAES *August 17*
- With Ms. Terri Arsenault and Dr. Sanghamitra Majumdar, attended a workshop on the use of Tracefinder Software at the Thermo Instruments facility in Cambridge, MA *September 14*
- Participated in the North American Chemical Residue Workshop (NACRW) organizing committee phone call *September 17*
- Was a participant in organizing committee phone calls for the North American Chemical Residue Workshop *November 6 and 8*
- Attended the monthly Laboratory Preparedness Advisory Committee meeting at the Department of Public Health Laboratory in Rocky Hill *November 9*
- Was a leader of the North American Chemical Residue Workshop's organizing committee teleconference call and presented a talk titled "The Analysis of Pesticide Residues in Foods Using Liquid Chromatography and High Resolution Mass Spectrometry" (25 attendees) *November 12*
- With Dr. Christina Robb, co-chaired a session on the analysis of contaminants in foods at the Eastern Analytical Symposium in Somerset, NJ *November 16-18*
- Participated in a North American Chemical Residue Workshop teleconference call *December 11*
- Attended the American Bee Research Conference and was a participant in the PI meeting of the Multistate Hatch project titled "Sustainable Solutions to Problems Affecting Bee Health" in Ponte Vedra, FL *January 8-9, 2016*
- With Mr. Joseph Hawthorne and Dr. Sanghamitra Majumdar, attended a seminar on the use of mass spectrometry in forensics at the State of Connecticut Department of Emergency Services & Public Protection Laboratory in Meriden *January 20*
- Was a participant in the conference call of the Organizing Committee of the North American Chemical Residue Workshop *February 11*

- Was a participant in the North American Chemical Residue Workshop Organizing Committee conference call *March 10*
- Served as a judge at the Connecticut State Science Fair at Quinnipiac University in Hamden *March 16-17*
- Presented method validation results during the FDA FERN cCAP annual technical meeting in New Orleans, LA (60 participants) *March 28-31*
- Was a participant in the NACRW organizing committee conference call *May 12*
- Was a participant in the PI meeting for the SCRI grant entitled "Pollination Security for Fruit and Vegetable Crops in the Northeast" at the University of Massachusetts (20 participants) *May 13*
- Attended the monthly CT Preparedness meeting at the Department of Public Health Laboratory in Rocky Hill *June 6*
- Was a participant in the North American Chemical Residue Workshops organizing committee conference call *June 9*

ELMER, WADE H.

- Gave a talk titled "Use of Mineral Nutrition to Suppress Diseases of Ornamentals" at the Connecticut Nursery & Landscape Association summer meeting in Stamford (23 attendees) *July 15, 2015*
- Served as Ms. Magali Bazzano's thesis advisor and participated in her defense for her Master's degree at the University of New Haven *August 19*
- Joined volunteers from the Hiking Alliance Meet-up Group and harvested 51 boxes of apples and 39 boxes of eggplants at Lockwood Farm for the Connecticut Food Bank *August 30*
- Presented the invited lecture "Using Mineral Nutrition to Suppress Plant Disease" to the faculty at the Agricultural University of Iceland in Reykjavik, Iceland (22 adult attendees) *September 22*
- Visited with Dr. Shivendra Sahi from Western Kentucky University about nanoparticles in plants *October 29*
- With Dr. Rosa Raudales (UConn) and Ms. Leanne Pundt (UConn Cooperative Extension Service), co-hosted a meeting on "Marketing Greenhouse Products" held in Jones Auditorium (43 attendees) *November 3*
- Presented the poster "Si Nutrition in Relation to the Health of *Spartina alterniflora* in Dieback Sites" at the Coastal Estuarine Research Foundation Biennial Meeting in Portland, OR *November 8-11*
- Gave a presentation titled "Nanoparticles of Copper Oxides Improve Growth of Eggplant in Disease Infested Soils" at the Sustainable Nanoparticle Organization meeting in Portland, OR (23 attendees) *November 9*
- Met with members of the Connecticut State Consulting Committee for Agricultural Sciences and Technology and presented information on his research program, at the Station (5 adult attendees) *December 2*
- Presented a talk titled "Effect of CuO Nanoparticles on Fusarium Wilt of Watermelon" at the Annual Meeting of the Northeastern Division of the American Phytopathological Society in Philadelphia, PA (32 adults) *January 4-7, 2016*
- Attended the Special Crop Research Initiative planning meeting for "Biocontrol Products in the Greenhouse" at Ohio State University, Columbus, OH and co-presented "Biocontrol Products for Disease Management" (44 attendees) *January 12-15*
- With Dr. Rosa Raudales (UConn) and Ms. Leanne Pundt (UConn Extension Service), co-hosted the "Hands-on Plant Nutrition Workshop" held in Jones Auditorium (25 attendees) *February 11*
- With Ms. Lindsay Patrick and Dr. Lindsay Triplett, hosted a tour of the Jenkins-Waggoner Laboratory for State Senator Martin Looney *February 25*
- Attended the Connecticut Greenhouse Grower's "Evening at the Greenhouse" at Vaiuso Farms in Branford *April 5*

- Conducted a workshop for the identification of *Fusarium* species at University of Massachusetts in Amherst, MA (14 attendees) *April 12*
- Gave a presentation on "Nanoparticles in Agriculture" to a Plant Physiology Class from Southern CT State University (16 attendees) *April 14*
- Gave a presentation titled "Plant Parts and Their Diseases" to a Girl Scouts troop in Wallingford (7 youths and 4 adults attended) *April 20*
- Accepted an Award of Appreciation on behalf of the Station from the Garden Club of New Haven in Jones Auditorium (80 attendees) *May 1*
- Participated in the Compliance review of the Sound School in New Haven (17 attendees) *May 3*
- Presented a talk on "Salt Marsh Dieback" to St. Thomas first grade class (18 children and 4 adults attended) *May 18*
- Attended the CT State BioBlitz event in East Hartford *June 3*
- Was interviewed about the role of nanoparticles in agriculture by Ms. Jan Ellen Spiegel of The CT Mirror *June 9*

FANZUTTI, JENNIFER

- Was interviewed about invasive aquatic plant mapping of Squantz Pond in New Fairfield by Katrina Koerting for the News-Times *August 6, 2015*
- With Mr. Gregory Bugbee, gave a lecture on "Connecticut Soils and Soil Testing" to an environmental science class at the Co-op High School in New Haven (approx. 35 students attended) *November 30*
- With Mr. Gregory Bugbee, co-authored a talk titled "Connecticut's Invasive Aquatic Plant Program – Who We Are and What We Do" at the North American Lake Management Society Conference in Saratoga Springs, NY (approx. 80 attendees) *November 18*
- With Mr. Gregory Bugbee, spoke on "CAES Invasive Aquatic Plant Program Surveys of Gardner Lake – Changes from 2006-2015" to the Gardner Lake Association at the Salem Free Public Library in Salem (approx. 25 attendees) *November 12*
- With Mr. Gregory Bugbee, gave two workshops on invasive aquatic plants for the Connecticut Envirothon at Goodwin College in East Hartford (approx. 85 attendees) *January 16, 2016*
- With Mr. Gregory Bugbee, presented an invasive aquatic plant workshop at The Connecticut Conference on Natural Resources at UCONN (approx. 25 attendees) *March 14*
- With Mr. Gregory Bugbee, presented an invasive aquatic plant seminar at Three Rivers Community College in Norwich (approx. 35 attendees) *March 16*
- With Mr. Gregory Bugbee, presented the results of the CAES IAPP 2015 invasive aquatic surveys of Lakes Candlewood, Lillinonah, and Zoar and Squantz Pond to the FirstLight Power Resources Technical Committee (approx. 14 attendees) *March 22*
- Spoke to a fifth-grade class at St. Thomas Day School in New Haven on "Invasive Aquatic Plants" (approx. 20 students) *April 28*
- Spoke to St. Thomas's Day School 1st grade class on a tour of CAES on "Invasive Aquatic Plants" (19 students and 4 teachers attended) *May 18*
- With Mr. Gregory Bugbee, spoke at a meeting of the Friends of Lake Lillinonah on CAES IAPP surveys and control options for invasive aquatic plant problems at the Bridgewater Town Office Building (approx. 30 attendees) *June 17*

FERRANDINO, FRANCIS J.

- Was interviewed about cold resistance in grapes by John Bell of FOX CT *October 20, 2015*
- Delivered a talk titled "The Effect of Vine Architecture in New England Vineyards" at the New England Fruit and Vegetable Conference in Manchester, NH (72 adult attendees) *December 15-17*

- Presented **"**Spore Transport in a Vineyard" at the Northeastern Division of the American Phytopathological Society meeting in Philadelphia, PA as part of the Northeastern Plant Pest and Soils Conference (NEPPSC) and presided over the business meeting as the Division President *January 3-7, 2016*
- Was interviewed by Chrislyn A. Particka, PhD Extension Support Specialist, Cornell University for a personal profile article in the Northern Grapes News http://northerngrapesproject.org/wp-content/uploads/2016/05/NG-News-Vol5-I2-May-2016.pdf *May 26*

GENT, MARTIN P. N.

- Presented a talk (with Ido Seginer) on "Dynamic Carbohydrate Supply and Demand Model of Vegetative Growth" at the MODEL-IT Symposium on Modelling in Horticulture at Wageningen University, Netherlands, and chaired a session on 3-dimensional models (75 participants) *October 11-14, 2015*
- Attended the NE1335 regional research committee meeting in Riverhead, NY and reported on a trial of Poinsettia infected with Pythium and treated when silicon and/or partial saturation ebb and flow watering *June 22-24, 2016*

HISKES, ROSE T.

- Participated in the Connecticut Invasive Plant Working Group Steering Committee meeting in Storrs *October 6, 2015*
- Gave a talk titled "The Connecticut Agricultural Experiment Station: Who We Are and What We Do" to the Squires Men's Club in West Hartford (32 attendees) *November 6*
- Participated in the Connecticut Invasive Plant Working Group Symposium Planning Committee meeting at the Valley Lab in Windsor *November 12*
- Participated in the Cooperative Agricultural Pest Survey meeting at the Lockwood Farm Cottage in Hamden *November 18*
- Participated in the Pesticide Resistance Management Education Webinars put on by the Northeastern Integrated Pest Management Center *December 3, 7, 10, and 14*
- Participated in the Connecticut Invasive Plant Working Group Symposium Planning Committee meeting in Windsor *December 8*
- Met with the Friends of Bolton Lakes Association board to discuss educational materials for waterfront property owners in Connecticut *December 16*
- Spoke about invasive insects to Envirothon Teams at Goodwin College in East Hartford (143 attendees) *January 16, 2016*
- Participated in the Connecticut Invasive Plant Working Group Symposium Planning Committee meeting in Windsor *January 19*
- Participated in the Connecticut Invasive Plant Working Group Symposium Planning Committee meeting in Windsor *February 23*
- With Ms. Lindsay Patrick, staffed a CAES booth at the Connecticut Grounds Keepers Association annual meeting in Cromwell *February 17*
- Participated in the Connecticut Invasive Plant Working Group Symposium Planning Committee meeting in Windsor *March 21*
- Gave a talk on "Invasive Plants and Insects" to the Simsbury Garden Club in Simsbury (14 attendees) *March 22*
- Gave a talk on "Invasive Plants" to the Vernon Garden Club in Vernon (44 attendees) *May 16*

LAMONDIA, JAMES A.

- Met with John Cranmer and Steve Zimmerman of Valent at the Valley Laboratory to tour plots and discuss research *July 9, 2015*

- Participated in a research conference call to present research progress as a part of the Potato Cyst Nematode Management Project *July 14*
- Was interviewed about hops research by Laraine Weschler of the Waterbury Republican-American *August 5*
- Spoke about current hops research as part of the hops field meeting held at the Valley Lab in Windsor *August 18*
- Was interviewed about hops research by Laraine Weschler of the Waterbury Republican-American *August 18*
- Spoke about "The Use of Cover Crops for Management of Root-knot, Root-lesion and Dagger Nematodes" as part of a day-long workshop "Nematology Short Course for Agribusiness" organized by the Northeast Regional Nematology Project held at Michigan State University *August 20*
- Was interviewed about hops culture, diseases, and research by Erik Ofgang for Connecticut Magazine *August 26*
- Spoke about the history of tobacco in Connecticut and past and current CAES tobacco research at the Luddy Taylor Tobacco Museum in Windsor (6 attendees) *August 27*
- Examined candidates for the Connecticut arborist license and participated in the quarterly meeting of the Connecticut Tree Protection Examining Board in New Haven *September 9*
- Was interviewed about the effects of drought on crops in Connecticut by Mike Krafcik of FoxCT News *September 9*
- Spoke about the latest research on growing hops and malting barley in Connecticut as part of a program sponsored by the Connecticut Farm Bureau in Watertown (15 attendees) *September 23*
- Participated in the Connecticut Vegetable and Small Fruit Conference Steering Committee meeting in Tolland *October 6*
- Taught a class on identification, biology, and management of tree diseases to students in the Connecticut Tree Protective Association's Arboriculture 101 class in Wallingford (30 attendees) *October 14*
- Spoke about research results and chaired the annual meeting of the Northeast Regional Multistate Nematology Technical Committee (NE-1040) held in Orlando, FL *October 20-22*
- Participated in a conference call meeting of the American Phytopathological Society Divisional Forum *November 2*
- Participated in a growers' meeting to initiate a Hops Growers Association, held at the Valley Lab in Windsor (23 attendees) *November 3*
- Discussed Station research programs and IR-4 priorities with Edith Lurvey and MaryLee Ross of the IR-4 program *November 19*
- Examined candidates for the Connecticut arborist license and participated in the quarterly meeting of the Connecticut Tree Protection Examining Board in New Haven *December 16*
- Attended the Northeast Plant Pest and Soils Conference held in Philadelphia, PA and presented "Curative Fungicidal Activity Against *Calonectria pseudonaviculata*, Causal Agent of Boxwood Blight" (60 attendees) *January 4-7, 2016*
- Moderated the afternoon session of the Connecticut Vegetable & Small Fruit Growers' Conference held in South Windsor *January 11*
- Discussed the Connecticut Century Farm Award program with Emily Smith, legislative aide for US Senator Chris Murphy *January 19*
- Participated in a meeting of the Connecticut Agricultural Information Council at the Valley Laboratory in Windsor *January 27*
- Participated in a steering committee meeting held at the Valley Lab to initiate the Connecticut Hop Growers Association *February 11*
- Attended the 2016 University of Vermont Hops Conference in Colchester, VT *February 18 and 19*

- Welcomed growers to the Annual Tobacco Research Meeting and spoke about research topics and recent developments at the Station, research on management of tobacco pathogens including poty viruses, black shank, target spot and blue mold fungicide resistance, and the CORESTA pesticide residue program and strategies to reduce pesticide residues in wrapper leaves (110 attendees) *February 23*
- Taught a class on identification, biology, and management of tree diseases to students in the Connecticut Tree Protective Association's Arboriculture 101 class held in Wallingford (35 attendees) *February 24*
- Participated in a meeting of the Connecticut Agricultural Information Council at the Valley Laboratory to select the Connecticut Outstanding Young Farmer Award winner and prepare for Ag Day at the Capitol *March 2*
- Was interviewed about hops and hops research by Paul Dockter and Lamott for HomeBrew, an iCRV radio show *March 3*
- Participated in Agriculture Day at the Capitol, speaking about the 2015 Century Farm Award and Anderson Farms of Wethersfield (100 attendees) *March 16*
- Was interviewed about tobacco diseases, fungicide use, and resistance management by Julia Ellis of Tobacco Farm Quarterly *March 16*
- Participated in the American Phytopathological Society Division Forum Representatives meeting held in conjunction with the APS Potomac Division meeting in Richmond, VA *March 22-24*
- Spoke about research on management of tobacco pathogens including poty viruses, black shank, target spot, and blue mold fungicide resistance, spoke about tobacco breeding for resistance and spoke about the CORESTA pesticide residue program and strategies to reduce pesticide residues in wrapper leaves in Windsor Locks (80 attendees) *April 5*
- Spoke about the latest research on growing hops and malting barley in Connecticut as part of a program sponsored by the Connecticut Farm Bureau in Lebanon (67 participants) *April 13*
- Was interviewed about winter damage to plants by Eric Stecker of the Journal Inquirer *April 26*
- Was interviewed about tobacco culture and diseases by Linda Rickard for a book on the history of tobacco in Windsor *April 28*
- Participated in a Potato Cyst Nematode Research Conference call to update research progress *May 10*
- Was interviewed about chemical injury to tobacco plants and similar symptoms from disease by Julia Ellis of Tobacco Farm Quarterly *June 15*
- Spoke about hop pest management research as part of the Connecticut Hop Growers Association (CHGA) Workshop and Seminar held at the Valley Laboratory in Windsor (65 attendees) *June 23*

LI, DEWEI

- Participated in the Pan-American Aerobiology Association Meeting and Spore Camp held at Harvard Forest, Petersham, MA *August 23-26, 2015*
- Took his one-month sabbatical leave at Nanjing Forestry University (NJFU) from October 12-November 13 and made two presentations: "Overview of Major Forest Diseases and Insects in the USA" (39 attendees) and "Principles of Research Paper Writing and Publication in English" (92 attendees) at the College of Forestry, NJFU. He also gave a presentation titled "Overview of Major Forest Diseases and Insects in the USA" at Jiangsu Provincial Academy of Forestry in Nanjing (36 attendees) *(October 28)*, made two field trips in Hubei provinces and collected over 200 fungal specimens, and conducted laboratory work on the hyphomycete specimens and collaborative studies on fungi associated with the pine wood nematode.
- Made a presentation on "Indoor Molds and Human Health" to medical students at the Quinnipiac University School of Medicine in North Haven *January 7, 2016*
- Attended the Annual Meeting of the Connecticut Tree Protective Association (CTPA) at Aqua Turf in Plantsville *January 21*

- Spoke about research and services at the Station and Valley Laboratory and summer employment opportunities at the Central Connecticut State University Biology Department Career Fair (55 attendees) *February 29*
- Visited the Instituto of Ecologia (INECOL), Xalapa, Mexico and worked with Dr. Gabriela Heredia, mycologists/research scientist at INECOL to conduct a preliminary study in a cloud forest near INECOL and in the buildings at INECOL *March 13-19.* During his visit, he made a presentation "Aeromycology in the Last 20 Years: Research and Challenges" (60 people in the audience and 40 people at three other institutions watched via web link) *March 16*
- Attended the 2016 Annual Northeastern Regional Conference on Occupational Health Surveillance in Chester *May 16 and 17*
- Invited and hosted Dr. James Scott, Associate Professor, University of Toronto, who gave a Lockwood Lecture entitled 'The Whiskey Fungus: Systematics and Biology" in Jones Auditorium *May 19*
- Invited and hosted Paula Schenck, Director of Indoor Environments and Health Programs, UConn Health, Division of Occupational and Environmental Medicine who gave a seminar titled "Mold Exposure and Health" as part of the CAES Seminar Series in Jones Auditorium *May 25*
- With Dr. Wade Elmer and Ms. Lindsay A. Patrick, participated in the 2016 CT State BioBlitz held at Two Rivers Magnet School in East Hartford collecting plant pathogens and microfungi. Forty nine fungi (8 Ascomycota, 9 Basidiomycota, 30 anamorphic fungi, 2 Prostista) and one bacterium were collected and identified *June 3-4*

LI, YONGHAO

- Gave a talk titled "Disease Management in Christmas Tree Farms" at the CCTGA twilight meeting in Windsor (30 attendees) *July 14, 2015*
- Staffed the CAES booth and answered questions about tree health and examined samples from arborists at the CTPA Summer Meeting in Farmington (720 adult attendees) *July 16*
- Gave a talk titled "Chemical Control of Foliar Diseases of Christmas Trees" at the Connecticut Christmas Tree Growers Association's twilight meeting in Andover (35 adult attendees) *August 26*
- Was interviewed about "Leaf-peeping in Connecticut: What can you expect from this year's fall foliage?" by Matt Scott of FoxCT *September 15*
- Was interviewed about the impact of drought conditions on fall foliage by Sam Kantrow at News 8 (WTNH) *September 17*
- Gave a talk titled "Foliar Diseases of Spruce and Their Control" at the Connecticut Christmas Tree Growers Association annual meeting in Plainfield (40 adult attendees) *September 19*
- Attended the System for True, Accurate, and Reliable Diagnostics (STAR-D) Phase 2 Workshop in Salem, OR *September 21-24*
- Was interviewed about the effects of drought conditions on trees and shrubs by Robert Miller of the News-Times *October 7*
- Presented a lecture titled "Understanding Plant Diseases and Garden Pests" to the Garden Study School in Jones Auditorium (35 adult attendees) *October 13*
- Staffed the "hands-on" table with tree diseases for Arboriculture 101 in Wallingford (25 attendees) *October 21*
- Was interviewed about how frost affects plants by Sam Kantrow of WTNH News 8 *October 8*
- Was interviewed about drought conditions and acorn production by Tony Spinelli of the Litchfield County Times *October 30*
- Visited Dr. Pinshan Wu in the Institute of Plant Quarantine at the Chinese Academy of Inspection and Quarantine in Beijing, China and gave a talk titled "Sudden Oak Death and Boxwood Blight" to scientists (7 adult attendees) *November 2*

- Visited Dr. Jingzhi Wen in the Department of Plant Protection at the Northeast Agricultural University in Harbin, China and gave a talk titled "Emerging Diseases of Conifers" to faculty members and students (60 adult attendees) *November 3*
- Visited Dr. Tingbo Jiang in the State Key Laboratory of Tree Genetics and Breeding at the Northeast Forestry University and worked with graduate students to revise manuscripts for publication in peer-reviewed journals *November 3-6*
- Presented a talk titled "Ornamental Disease Update in Connecticut" at the Northeast Plant, Pest, and Soil Conference – Industry/Extension Session in Philadelphia, PA (26 adult attendees) *January 4, 2016*
- Presented "Effects of Fungicides on Spore Germination and Colony Development of *Erysiphe pulchra*, the Causal Agent of Powdery Mildew of Flowering Dogwood" at the Northeast Plant, Pest, and Soil Conference in Philadelphia, PA (50 adult attendees) *January 6*
- Gave a talk titled "Important and Common Disease Problems in the Industry" at the CNLA Winter Symposium & Expo held at Aqua Turf in Plantsville (100 adult attendees) *January 14*
- Was interviewed about possible impacts of the lack of snow on trees and shrubs by Mr. Sam Kantrow of WTNH News 8 *January 15*
- Staffed the CAES booth at the CT Tree Protective Association Winter Meeting held at Aqua Turf in Plantsville *January 21*
- Gave a talk titled "Backyard Small Fruits 101– Easy and Quick Yielding Delectables" for the Sustainable Backyard Series at the Scoville Memorial Library in Salisbury (16 adult attendees) *January 30*
- Was interviewed about the impact of the mild winter on trees and shrubs by Matt Scott at FoxCT *February 1*
- With Ms. Lindsay Patrick, was visited by members of the Anthropocene Landscapers Guild led by Mr. Gerald Posner to discuss twilight tours *February 2*
- Presented a talk titled "IPM: An Eco-Friendly Approach to Disease Control" in the UConn Bedding Plants Program for Greenhouse Growers in Torrington (44 attendees) *February 23*
- Presented a talk titled "IPM: An Eco-Friendly Approach to Disease Control" in the UConn Bedding Plants Program for Greenhouse Growers in Vernon (30 attendees) *February 25*
- Gave a talk titled "Needle Damages of Eastern White Pine" for the Forest Health Monitoring Workshop in Jones Auditorium (50 Attendees) *March 1*
- Staffed the "hands-on" table with tree diseases for Arboriculture 101 in Wallingford (36 attendees) *March 2*
- Attended the National Plant Diagnostic Network National Conference in Washington, DC *March 7-11* and presented a talk titled "Updates from the Plant Disease Information Office" at the Northeast Regional Meeting in Washington, DC (25 attendees), and with Ms. Lindsay Patrick, presented a poster titled "The role of inquiry data in monitoring economically important diseases – Results from the PDIO Plant Disease Inquiry Database" (200 attendees)
- Gave a talk about "Disease Management in Organic Vegetable Farms and Gardens" at the CT NOFA's 34th Annual Winter Conference in Danbury (60 attendees) *March 12*
- Was interviewed by Ms. Brigitte Ruthman at the Republican-American about effects of warm winter on spring gardening *March 14*
- Gave a lecture "Tree diseases and their management" for the Stamford Arboretum Arboriculture 101 Class in Stamford (11 attendees) *March 15*
- Attended the CT Nurserymen's Foundation (CNF) Scholarship Committee meeting and participated in the review of scholarship applicants *March 21*
- Gave a talk titled "Indoor plant selection and care" for the Towers Ones and East Garden Club in New Haven (15 attendees) *March 22*

- Gave a talk titled “Selection and Care of Houseplants” for the Aging at Home Garden Club in Hamden (12 attendees) *March 31*
- Organized the Spring 2016 Study Group for the Institute for Learning in Retirement and gave a talk titled “Common Diseases of Trees and Shrubs” at Albertus Magnus College in New Haven (7 attendees) *April 27*
- Gave a talk titled “Gardening Tips for Spring and Summer” for The Graduate Clubhouse in New Haven (8 attendees) *April 28*
- Organized a workshop and gave the talk “Disease Diagnostics – How to Identify Common Plant Health Problems” at the Experiment Station Associates Workshop held in Jones Auditorium (17 attendees) *May 19*
- Presented the talk “Spruce Needle Casts and Their Control” at the CCTGA twilight meeting held in Woodstock Valley (32 attendees) *June 21*
- Talked about the Plant Disease Information Office to visiting students from Central CT State University (20 attendees) *June 23*

MAIER, CHRIS T.

- Was interviewed about the biological control of the brown marmorated stink bug and the lily leaf beetle by Gregory Hladky of the Hartford Courant *July 9, 2015*
- Participated in a meeting of the Advisory Committee of the Cooperative Agricultural Pest Survey at Lockwood Farm Cottage in Hamden *November 18*
- Exhibited new entomological literature at a meeting of the Connecticut Entomological Society at the University of Connecticut in Storrs *November 20*
- Discussed the brown marmorated stink bug and the spotted wing drosophila with fruit growers while attending the Annual Meeting of the Connecticut Pomological Society in Glastonbury *December 1*
- Displayed longhorned beetles commonly found in firewood while attending the annual meeting of the Connecticut Tree Protective Association in Plantsville *January 21, 2016*
- Presented a display on the invasive spotted lanternfly at a meeting of the Connecticut Entomological Society at Yale University in New Haven *January 22*
- Gave a talk on “An Introduction to the Longhorned Beetles or Cerambycidae” at the Forest Health Monitoring Workshop in Jones Auditorium *March 1*
- Exhibited fairy shrimp and mosquito larvae from a vernal pool in Guilford at a meeting of the Connecticut Entomological Society at Yale University in New Haven *March 25*
- Exhibited live adult specimens of a cerambycid beetle known to bore into the vines of Virginia creeper at the annual dinner meeting of the Connecticut Entomological Society in Jones Auditorium *April 15*
- Spoke about periodical cicadas and surveys for longhorned beetles during a tour organized by the South Central Connecticut Regional Water Authority at Lake Gaillard in North Branford *May 12*
- Participated in the University of Connecticut BioBlitz in Hartford Co. where a new national record for recorded species was established *June 3-4*
- Spoke about the threat of the spotted lanternfly, an exotic insect, while attending a twilight meeting of the Connecticut Pomological Society at Belltown Hill Orchard in Glastonbury *June 15*

MARRA, ROBERT E.

- Met with Southern Connecticut State University students from Professor Elizabeth Roberts’ mycology class, gave them a tour of the lab, and talked to them about boxwood blight, internal decay, and perennial canker on birch *July 13, 2015*
- Had a conference call with Dr. Kathleen Wolf (University of Washington and US Forest Service) to discuss her Lockwood Lecture for next spring *July 16*
- Attended a webinar on Urban Forestry *July 24*

- Met with members of the Connecticut State Consulting Committee for Agricultural Sciences and Technology and presented information about his research program, at the Station (5 adult attendees) *December 2*
- Presented a talk titled "Assessing Internal Decay in Trees Nondestructively with Tomography" at the Annual Meeting of the Northeastern Division of the American Phytopathological Society, held jointly this year with the Northeastern Plant, Pest and Soils Conference, in Philadelphia, PA and was elected Secretary-Treasurer for the Northeastern Division of the American Phytopathological Society *January 6, 2016*
- Participated in a conference call with the executive committee of the Northeastern Division of the American Phytopathological Society *February 25*
- Gave a presentation on "Research in assessing internal decay in trees and its role in forest carbon cycling" to a Plant Physiology Class from Southern CT State University (16 attendees) *April 14*
- Participated in an executive committee conference call for the Northeastern Division of the American Phytopathological Society to discuss the October annual meeting in Ithaca, NY *May 4*
- Served as special-award judges for the Greater New Haven Science Fair *May 16-18*
- Participated in the Connecticut Tree Festival in Cranbury Park in Norwalk and demonstrated sonic and electrical-resistance tomography on a white oak in the park (40 attendees) *May 21*
- Visited the Hotchkiss School in Salisbury to analyze elm trees using sonic and electrical-resistance tomography *May 23*
- Hosted Dr. Ruth Yanai (SUNY-ESF) to discuss research collaborations on forest nutrient cycles *May 27*
- Participated in an executive committee conference call for the Northeastern Division of the American Phytopathological Society to discuss the October annual meeting in Ithaca, NY *June 1*
- Visited Smith College in Northampton, MA to analyze elm trees using sonic and electrical-resistance tomography *June 2*
- Participated in a Boxwood Blight Working Group conference call *June 21*
- Participated in a webinar on the iTrees modules "Storm" and "Species" *June 23*
- Visited the town of Sharon to analyze elm trees on the town Green, using sonic and electrical-resistance tomography *June 27*

MASSA, AMANDA M.

- Spoke on "Assessing Urban Forest Health for Avian Habitats" at the 96th Winter Meeting of the New England Society of American Foresters held in Sturbridge, MA (70 attendees) *March 10, 2016*

MAURER, KATJA

- Was interviewed about hops culture and diseases by Laraine Weschler of the Waterbury Republican-American *August 5, 2015*
- Spoke about hops diseases and pests as part of the hops field meeting held at the Valley Lab in Windsor *August 18*
- Was interviewed about hops culture and diseases by Laraine Weschler of the Waterbury Republican-American *August 18*
- Presented "Fungicide Sensitivity in the Boxwood Blight Pathogen *Calonectria pseudonaviculata*" at the Northeast Plant Pest and Soils Conference held in Philadelphia, PA (60 attendees) *January 4-7, 2016*
- Was interviewed about the UConn Extension Master gardener class "Growing Hops" by Judy Benson from The Day *February 12*
- Attended the hop conference in Colchester, VT *February 19*
- Attended the CAES Tobacco Research Meeting held in East Windsor and presented "Growing hops in CT" (110 attendees) *February 23*

- Taught a UConn Extension Master Gardener class about growing hops held in Norwich (30 attendees) *March 12*
- Spoke about growing hops in Connecticut as part of the Connecticut Hop Growers Association (CHGA) Workshop and Seminar held at the Valley Laboratory (65 attendees) *June 23*

MAYNARD, ABIGAIL A.

- Talked about the New Crops Program during a visit to Gazy Farm in Oxford *July 15, 2015*
- Talked about the New Crops Program during a visit to Rose's Berry Farm in South Glastonbury *July 17*
- Visited the Offinger Farm in Wilton and discussed the New Crops Program with Hank Offinger *August 15*
- Visited and discussed the New Crops Program at the Gazy Brothers Farm in Oxford *August 22*
- Judged fruits and vegetables at the North Haven Fair *September 10*
- Spoke about the New Crops Program to two teachers from Hamden Hall Country Day School at Lockwood Farm *September* 30
- Spoke about how to grow pumpkins to the 1st and 2nd grades of Hamden Hall Country Day School in Hamden (32 students and 4 teachers attended) *October 2*
- Hosted the pre-Kindergarten and 3rd grade from Hamden Hall Country Day School at Lockwood Farm (37 students, 4 teachers, and 2 adults attended) *October 14*
- Reported on Station activities at a quarterly meeting of the Council on Soil and Water Conservation in Windsor (18 attendees) *October 20*
- Reported on Station activities at a quarterly meeting of the State Technical Committee in Tolland (31 attendees) *October 29*
- Discussed the New Crops Program at Hindinger Farm in Hamden *November 25*
- Spoke about farming and unusual crops to fourth graders at Hamden Hall Country Day School in Hamden (2 teachers and 24 students attended) *November 30*
- Attended the annual meeting of the Connecticut Pomological Society in Glastonbury *December 1*
- Spoke about the New Crops Program to members of the State Consulting Committee for Agricultural Science and Technology Education (10 adults) *December 2*
- Gave a talk titled "Calabaza Squash and Personal-sized Watermelons – Two High Valued Specialty Crops" at the New England Vegetable and Small Fruit Conference in Manchester, NH (180 adults) *December 16*
- Spoke about the New Crops Program and agricultural research to an AP Biology class at Hamden Hall Country Day School in Hamden (1 teacher and 15 students attended) *January 7, 2016*
- Attended the Connecticut Vegetable & Small Fruit Growers' Conference in South Windsor *January 11*
- Visited Hindinger Farm in Hamden and discussed the New Crops Program *January 14*
- Reported on Station activities at a quarterly meeting of the Council on Soil and Water Conservation in Windsor *January 20*
- Represented the Station at a meeting of the State Technical Committee in Tolland *January 27*
- Discussed New Crops research at Borelli Farm in North Haven *February 1*
- Worked with teachers in setting up an experimental garden at Bear Path School in Hamden *February 22*
- Discussed New Crops research at DeFrancesco Farm in Northford *February 23*
- Worked with teachers in setting up a vegetable garden at Hamden Hall Country Day School *February 26*
- Discussed New Crops research at Offinger Farm in Wilton *February 29*
- Assisted in preparing an experimental garden at Hamden Hall Country Day School (3 teachers, 18 children) *March 14*

- Assisted in preparing an experimental garden at Hamden Hall Country Day School (3 teachers, 18 children) *March 21*
- Helped the preschool, pre-kindergarten, and kindergarten classes set up a learning garden at Hamden Hall Country Day School (6 teachers, 34 students) *April 18-28*
- Judged student posters at the Sigma Xi Poster competition at Quinnipiac College *April 20*
- Represented the Station at a quarterly meeting of the State Technical committee in Tolland *April 27*
- Prepared and planted the Learning Garden and discussed gardening techniques at Hamden Hall Country Day School (26 students, 6 teachers) *May 2, 10, 17, and 24*
- Reported on Station activities at a quarterly meeting of the Council on Soil and Water Conservation in Windsor (18 adults) *May 5*
- With Dr. Blaire Steven, met with Stephen Wood and Emily Oldfield of the Yale School of Forestry and Environmental Studies at the sheet composting plot at Lockwood Farm where they took soil samples *May 20*
- Talked about the New Crops Program at DeFrancesco Farm in Northford *June 15*
- Talked about the New Crops Program with Stephanie Page in North Branford *June 15*
- Spoke about the New Crops Program with four farmers at the Hamden Farmers Market *June 24*

MOLAEI, GOUDARZ

- Was interviewed about ticks and tick-associated illnesses in Connecticut by Sujata Jain of WFSB Eyewitness News 3 *July 17, 2015*
- Hosted a group of associates of the "Friends of the East Rock Park Society" at the Tick Testing Laboratory and gave a short talk on tick-associated diseases and preventive measures against tick bites (8 attendees) *July 27*
- Presented a short talk, "Tracking Ticks and Tick-associated Diseases in Connecticut" at Plant Science Day *August 5*
- Was interviewed about ticks and tick-associated diseases by the Connecticut Post *August 6*
- Was interviewed about ticks and Babesiosis by the New Haven Register *August 7*
- Was interviewed on CDC-funded tick control and the tick testing program by PBS *August 18*
- Introduced his research and service activities at the CAES to the students and faculty at the Department of Epidemiology of Microbial Diseases, Yale School of Public Health (50 attendees) *September 3*
- Gave an invited talk on "Olfaction" to the faculty and graduate students at the Ferdowsi University of Mashhad, Iran (25 attendees) *September 13*
- Gave an invited talk on "Biogenic Amines in Insects and the Future of Insect Pest/Vector Control" to the joint meeting of the Tehran University of Medical Sciences, and Entomological Society of Iran (35 attendees) *September 15*
- Visited universities and research institutions to discuss research collaborations and the possibility of hosting faculty in their sabbatical and PhD students as visiting scholars at CAES *September 12-15*
- With Ms. Saryn Kunajukr presented a joint invited talk, "Tracking Ticks and Tick-associated Diseases in Connecticut" and discussed the CAES research initiatives and services on ticks and tick-associated diseases to the Pomperaug Valley Garden Club in Woodbury (approx. 40 attendees) *October 13*
- Hosted Dr. Daniel Green, a clinical microbiology fellow at Yale University, provided him with a tour of the Tick Testing Laboratory, and discussed research and service activities in the areas of tick- and mosquito-borne human diseases at CAES *October 16*
- Hosted the State of Connecticut Consulting Committee for Agricultural Science and Technology Education and discussed CAES research initiatives and services on ticks and tick-associated diseases (8 attendees) *December 2*

- Gave an invited talk, "Ticking for a Quarter of a Century: Spatiotemporal Distribution of Infection in *Ixodes scapularis* Ticks Questing Human Hosts in Connecticut, 1996-2015," at the Annual Meeting of the Northeastern Mosquito Control Association (approx. 8 attendees) *December 8*
- Hosted Dr. Mahmood Iranpour, from the National Microbiology Laboratory, Public Health Agency of Canada, and trained him on mosquito blood meal analyses *January 18-22, 2016*
- Was an invited attendee at a symposium on Bio-Control and organized a workshop, "*Planning and Execution of Research Projects, and Presentation and Publication of the Results"* at the Ferdowsi University of Mashhad, Iran (approx. 60 attendees) *February 3, 6, and 7*
- Met with CAES scientists and Yale faculty to discuss funding opportunities on the newly emerged Zika virus *February 26*
- Presented an invited talk titled "Vector-Host Interactions and Emergence and Expansion of Arboviruses" and discussed research collaborations with individuals in the Department of Biology and Health Sciences, Wilkes University, PA (approx. 50 attendees) *March 23*
- Presented an invited talk titled "Avian Hosts as Super-spreaders of Eastern Equine Encephalitis Virus" to the 7th Northeastern EEE Virus Conference (approx. 40 attendees) *May 6*
- Presented a talk titled "Tick-associated Diseases in Connecticut: A Major Public Health Challenge" at the Connecticut Vector-borne Disease Symposium (approx. 50 attendees) *May 20*
- Hosted students from Central Connecticut State University, Molecular Biology Laboratory and presented a short talk on his research on the role of mosquitoes and ticks in disease transmission, and on the services provided by the CAES Tick Testing Laboratory (approx. 17 attendees) *June 23*

PATRICK, LINDSAY A.

- With Ms. Pamela Sletten, attended The Annual Seed Analyst Workshop of the USDA Seed Regulatory and Testing Division (Federal Seed School) in Gastonia, NC *August 24-26, 2015*
- Staffed the CAES information booth at the Connecticut Grounds Keepers Association 2016 Turf & Landscape Conference in Cromwell *February 17, 2016*
- Was interviewed by two students from a local middle school about the effects of climate change on plants *March 4*
- Attended the National Plant Diagnostic Network National Meeting in Washington D.C., where she won the Rotten Tuber Award, and participated in a workshop on the "Identification of Microfungi" at the University of Maryland *March 8-12*
- Assisted on the Connecticut Nurserymen Foundation Scholarship Committee to interview and select the winner of CT Nurserymen Foundation Scholarships *April 5*
- Presented the lecture, "Selecting Plants for the Landscape: Plants to Consider and Plants to Avoid" for the course *Native Plants for Sustainable Gardening* for The Institute for Learning in Retirement at Albertus Magnus College (8 participants) *April 13*
- Gave a tour of the PDIO and seed testing laboratory to a Plant Physiology class from Southern CT State University (16 attendees) *April 14*
- Participated in the University of Connecticut's Earth Day Spring Fling and manned an informational booth about CAES and bees *April 19*
- Participated in the Guilford Green-Earth Day and manned an informational booth about plant diseases and insects in *April 23*
- With Ms. Pamela Sletten, gave an Arbor Day Tour of the PDIO and seed testing laboratory to the winners of the CTPA contest along with their parents *April 29*
- Served as a judge for the FFA AgriScience Fair in New Haven *May 5*
- Served as a judge for the New Haven Science Fair in New Haven *May 16-17*
- Assisted DR. YONGHAO LI with the Experiment Station Associates workshop on "Disease Diagnostics: How to Identify Common Plant Health Problems**"** in Jones Auditorium (17 attendees) *May 19*

- Staffed a CAES/Plant Disease information table at the Connecticut Tree Festival in Norwalk *May 21*
- Attended the CT State BioBlitz event in East Hartford *June 3*
- Staffed a CAES/Plant Disease Information table during the public portion of this event *June 4*
- With Dr. Yonghao Li, gave a tour of the PDIO to Central Connecticut State University biology students (20 participants) *June 23*

PIGNATELLO, JOSEPH J.

- Met with Prof. Lee Ferguson, Department of Civil and Environmental Engineering, Duke University over breakfast to discuss mutual research interests *September 18, 2015*
- Participated in a U.S. Department of Agriculture NIFA-AFRI grants review panel, Agriculture Systems and Technology: Nanotechnology for Agricultural and Food Systems *October 4-9*
- Gave a talk, co-authored by Dr. Hsin-Se Hsieh, titled "Removal of CH_3Br from Vent Streams by Catalysis or Adsorption-Catalysis" at the Annual Methyl Bromide Alternatives and Outreach Conference in San Diego, CA (approx. 120 attendees) *November 10*
- Gave a talk titled "Steric and Electronic Effects in the Interactions of Triazine Herbicides with Biochars" at the Soil Science Society of America Annual Meeting in Minneapolis, MN *November 15-19*
- With Doug Brackney, Blaire Steven, Philip Armstrong, and Goudarz Molaei presented introductions to their research interests to first year medical students at Quinnipiac University at a special session of the Capstone Mentor Fair (approx. 30 attendees) *January 7, 2016*
- Met with Prof. Baoshan Xing at the University of Massachusetts in Amherst to discuss ongoing collaborative research *January 27*
- Hosted Dr. Lebelle Hicks, Board of Pesticides Control, Maine Department of Agriculture, Conservation and Forestry, for discussions on the bioavailability of pesticides in coastal sediments toward lobsters *February 24*
- Gave a workshop on biochar at the Connecticut Northeast Organic Farmers Association (NOFA) Winter Conference in Darien (approx. 25 attendees) *March 12*
- Met with Prof. Francisco Zaera, University of California, Riverside to discuss mutual research interests *May 11*
- Attended the business meeting and awards ceremony of the Connecticut Academy of Science and Engineering at New Haven University *May 24*
- Gave an invited talk titled "Nanoscale Interactions between Engineered Nanomaterials and Black Carbon (Biochar) in Soil" at the USDA Nanotechnology Grantees Annual Meeting, Penn State University (approx. 150 attendees) *June 6-7*

PRAPAYOTIN-RIVEROS, KITTY

- With Dr. Alia Servin, attended a Live Online Webinar of the FDA/ORA Laboratory Accreditation Program and Overview of Requirements for ISO 17025 Accreditation *October 20, 2015*

RIDGE, GALE E.

- Spoke to staff at the Keystone House in Norwalk about managing bed bugs in disabled communities (38 attendees) *August 6, 2015*
- As an expert invitee, attended a statewide meeting of code agencies and organizations for the purpose of starting to develop the "State Health Improvement Plan (SHIP)" scheduled to be launched in 2020 (70 attendees) *August 17*
- Was interviewed about pesticide resistance in head lice by a staff reporter from the New Haven Register *August 19*
- Visited a crime scene in Bloomfield as part of a murder investigation researching fly species and environmental conditions of the area *September 2*

- Spoke about bed bugs to the Village for Families and Children in West Hartford (60 attendees) *September 3*
- Spoke about bed bugs to staff at the Veterans Affairs Hospital in West Haven (40 attendees) *September 17*
- Presented a talk to the River Valley Services staff that serves the mentally impaired in Middletown about managing bed bugs in their workplace (15 attendees) *October 1*
- Talked to staff at the Park City Green mattress recycling company in Bridgeport about protection against bed bugs while in the workplace (20 attendees) *October 14*
- Was interviewed about bed bugs on the Colin McEnroe live radio show on WNPR in Hartford *October 16*
- Presented a talk to case managers at the Department of Developmental Services in Wallingford about how to deal with bed bugs (38 attendees) *October 28*
- Presented at the Trash Museum in Hartford, and in collaboration with DEEP, trained transfer attendants from Connecticut, Massachusetts, and Rhode Island on how to screen and manage bud bug issues as mattresses enter the recycling stream. The program is part of the 2013 Connecticut mattress recycling law, Public Act No. 13-42, the first of its kind in the United States, which stipulates training for transfer station attendants and recyclers (80 attendees) *October 29*
- Presented a talk to the River Valley Services staff that serves the mentally impaired in Middletown about managing bed bugs in their workplace (15 attendees) *October 1*
- Talked to staff at the Park City Green mattress recycling company in Bridgeport about protection against bed bugs while in the workplace (20 attendees) *October 14*
- Was interviewed about bed bugs on the Colin McEnroe live radio show on WNPR in Hartford *October 16*
- Presented a talk to case managers at the Department of Developmental Services in Wallingford about how to deal with bed bugs (38 attendees) *October 28*
- Presented at the Trash Museum in Hartford, and in collaboration with DEEP, trained transfer attendants from Connecticut, Massachusetts, and Rhode Island on how to screen and manage bed bug issues as mattresses enter the recycling stream (80 attendees) *October 29*. This program is part of the 2013 Connecticut mattress recycling law, Act 13-42, the first of its kind in the United States, which stipulates training for transfer station attendants and recyclers.
- Presented a talk to Connecticut transfer station attendants and sanitarians on how to screen and manage for bed bugs as mattresses enter the recycling stream, held in Jones Auditorium (30 attendees) *November 12*
- Visited the Newreach shelter for battered women and children in New Haven to assist with an ongoing problem with bed bugs *November 23*
- Did a collaborative presentation about bed bug biology, behavior, and management with Dr. Richard Cowles to the environmental health staff of Yale University, New Haven (40 attendees) *December 9*
- Spoke to health directors/staffs and transfer station personnel in western Connecticut (Brookfield Town Hall) about bed bugs in the third of a series of training talks for mattress recyclers in the state *December 10*
- Spoke to the Connecticut transfer station attendant and health department officials on how to screen and manage for bed bugs as mattresses enter the recycling stream in Gales Ferry (40 attendees) *January 6, 2016*
- Was quoted in the New Haven Register in their article, “Bed bug battle a constant in state,” and the online C-hit news outlet in an article titled, “Bed Bugs: Our Creepy, Pervasive and Expensive Problem” *January 11*
- Spoke about bed bugs at the Vocational Rehabilitation Center, River Valley Services in Middletown (60 attendees) *January 14*

- Trained Gilead Community Services staff, based in Middletown, about bed bug management and self-protection via phone conferencing *January 15*
- Was interviewed about bed bugs on the Larry Rifkin live radio show WATR, Waterbury *January 25*
- Was interviewed about bed bugs by Lewis Carta from WIHS Radio, Wallingford *January 27*
- Attended a conference on cross cultural communication sponsored by the Department of Consumer Protection in Hartford *January 28*
- Presented a talk about bed bugs to staff at the Western Connecticut Mental Health Network in Waterbury (45 attendees) *January 29*
- Dr. Ridge's identification of Obscure scale *Pseudococcus viburni* Signoret, obtained from a nursery in Windham, CT, was confirmed by USDA ARS SEL as a new state record *February 3*
- Spoke about bed bugs to the Gilead Community Services Group at Middlesex Community College in Middletown (60 attendees) *February 24*
- As a member of the statewide State Health Improvement Plan 2020 (SHIP) group, reviewed with representatives from code agencies, towns, cities, and State law the international property maintenance code, with the goal of adopting a statewide property maintenance code, which would include clauses for bed bug management *February 29*
- Spoke at Yale University about the history the bed bug, its biology, and how to manage the insect in dormitory settings and taught travelling students and staff on how to protect themselves (15 attendees) *March 9*
- Was interviewed by Kaitlyn McGrath NBC News about the mild winter, early spring, and effects on insects in Connecticut *March 11*
- Was interviewed by the Danbury Times about the emerald ash borer *March 11*
- Was interviewed by Lori Mack (NPR) about bed bugs *March 15*
- Spoke to the Arc of Meriden-Wallingford about bed bugs and charities (30 attendees) *March 16*
- Was interviewed by Jake Dressler of the New Haven Independent about bed bugs *March 22*
- Spoke at Southern Connecticut State University to health care professionals about bed bugs (35 attendees) March 23
- Identified an exotic species of scale submitted to the Station call the Japanese wax scale *Ceroplastes japonicas* on gardenia *March 29*
- Was interviewed by Harold Harlan from the Journal Courier about springtime insects *March 31*
- Was interviewed by the New Haven Register about bed bugs in a New Haven High School and what appropriate protocols should be followed *April 12*
- Was interviewed about bed bugs in Hillhouse High School by Channel 3 *April 13*
- Was interviewed about bed bugs by NBC News *April 13*
- Was interviewed by Yale Daily News about bed bugs in the university dorms *April 18*
- Was interviewed about bed bugs in Connecticut and best practices for management by Michael Melia from the Associated Press *April 19*
- Hosted Bed Bug Forum IX (65 attendees) at the Experiment Station and was interviewed by Justin Schecker NBC News and Tony Terzi Fox 61 News, and cited in the New Haven Register by the associated press in an article titled "Bed Bugs Causing Stir in Elm City" *April 25*
- Was interviewed by Todd Lyon of the New Haven Living Magazine *April 28*
- Was interviewed by CBS News, New York about the Zika virus and native mosquitoes *May 2*
- An Act Concerning the Rights and Responsibilities of Landlords and Tenants Regarding the Treatment of Bed Bug Infestations passed unanimously by the Connecticut General Assemble Senate at 10:52 PM. The House role call was 112 yea to 35 nay and passed on April 27 at 3:13 PM. Much of the language for the act was written by Attorney Judith R. Dicine member of CCABB with assistance from Dr. Ridge *May 3*
- Presented a talk in a national CDC webinar about bed bugs and economics *May 4*

- Spoke about bed bugs to Albertus Magnus College Institute of Learning in Retirement (7 attendees) *May 18*
- Spoke to the New England Tribes EPA sponsored meeting in Augusta, ME about bed bug behavior, economics, and management. This was followed by field workshop training at a school and apartment complex (25 tribal leaders) *May 19*
- Was interviewed about the gypsy moth caterpillar outbreak by the New Haven Register *May 31*
- Was interviewed by Nora Norton from the Stamford Advocate about the a recent breakthrough for treating tick-borne Babesiosis *June 6*
- Identified both virus (*Nuclear polyhedrosis*) and fungus (*Entomophaga maimaiga*) in dead Gypsy moth caterpillars (*Lymantria dispar*) submitted by Bob Standish of Hadlyme *June 13*
- Identified the Brown House Moth, *Hofmannophila psedospretella*, from a home in Plantsville *June 13*
- Was interviewed by Angela Fritz from the Washington Post about the Gypsy moth outbreak in Connecticut *June 28*
- Was interviewed by Anna Costera from the New Haven Register about the Gypsy moth outbreak *June 30*

ROBB, CHRISTINA S.

- Attended the FBI Academic Biosecurity Workshop at the Yale West Campus in Orange *September 16, 2015*
- With Dr. Theodore Andreadis, Dr. Blaire Steven, Dr. Joseph Pignatello, Mr. Gregory Bugbee, and Mr. Michael Last, attended a meeting with State Representative Melissa Ziobron to discuss a potential research project on Lake Pocotopaug *September 17*
- Participated in a board meeting for the Eastern Analytical Symposium in Somerset, NJ *September 18*
- With Ms. Kitty Prapayotin-Riveros and Ms. Terri Arsenault, participated in an ISO Accreditation mentor-mentee phone call with the Ohio Department of Agriculture *October 7*
- With Drs. Brian Eitzer and Sanghamitra Majumdar, attended onsite LC-MS training from Thermo Scientific *October 13-15*
- Attended a board meeting *(November 15)*, a meeting for the Exposition committee *(November 18)*, was co-chair of the session "Analysis of Chemical Contaminants in Foods," and was interviewed by Ms. Laura Bush of LC-GC on the role and future of high-performance liquid chromatography coupled to high-resolution mass spectrometry (HPLC-HRMS) for pesticide analysis at the Eastern Analytical Symposium (EAS) in Somerset, NJ *November 16-18*
- Attended the Eastern Analytical Symposium general board meeting *December 11*
- Attended the Eastern Analytical Symposium program meeting *December 21*
- Presented "Plant Toxins and Select Agents" at the FDA FERN cCap annual technical meeting in New Orleans, LA (60 participants) *March 28-31, 2016*
- Participated in a conference call for the Eastern Analytical Symposium *April 8, 2016*
- Presented her career path as an Analytical Chemist and the work performed in the Department of Analytical Chemistry at the STEM high school career fair, which was organized by the Many Mentors group, at Wilbur Cross High School (50 students) *May 19*
- Participated in an Eastern Analytical Symposium board meeting *June 3*
- Performed some solar experiments with the ready-set-grow preschool classrooms of the Creative Arts Preschool in Woodbury (20 attendees) *June 22*
- Presented an overview of the work of the Department of Analytical Chemistry to students of Central Connecticut State University (CCSU) (25 attendees) *June 23*

RUTLEDGE, CLAIRE E.

- Organized and presented at the 4th annual "Emerald Ash Borer in Connecticut" workshop for the CTPA in Durham (87 attendees) *September 3, 2015*
- Taught "Insects that Attack Trees" for the CTPA's Arboriculture 101 course in Wallingford (35 attendees) *September 30*
- Presented a talk on the emerald ash borer at the Connecticut Audubon Center in Fairfield as part of their Master Naturalist program *October 13*
- Taught "Tree Conditions Laboratory" for the CTPA's Arboriculture 101 course in Wallingford (35 attendees) *October 21*
- Presented the talk "Emerald Ash Borer Update" at the Forest Cooperators Meeting at the Valley Lab in Windsor (15 attendees) *October 23*
- Presented the display "Dr. Rutledge's Insectorium and Petting Zoo" at "Ghouls & Gourds" at the Brooklyn Botanic Garden, New York, NY *October 24*
- Gave a presentation on insects to Mrs. Manende's 3rd grade class at Green Acres Elementary School in North Haven, CT (18 children attended) *October 30*
- With Dr. Adriana Arango-Velez as co-author, presented a poster on "The Southern Pine Beetle Moves North: First Report of *Dendroctonus frontalis* in Southern New England" at the Annual Meeting of the Entomological Society of America in Minneapolis, MN *November 18*
- Met with the Wallingford Conservation Board to discuss emerald ash borer mitigation options in Tyler Mill Conservation Area and the town (10 attendees) *December 10*
- Presented the talk "Emerald Ash Borer in Connecticut" in the IDEP symposium at the Eastern Branch of the Entomological Society's annual meeting in Philadelphia, PA (60 attendees) *January 4, 2016*
- Presented the talk "Emerald Ash Borer in Sprague" to a town meeting in Sprague (14 attendees) *January 12*
- Presented the talk "Emerald Ash Borer in Connecticut" to Joshua's Trust in Mansfield (40 attendees) *January 14*
- Presented the talk "Something Old, Something New: Emerald Ash Borer and Southern Pine Beetle" at the Connecticut Nursery and Landscape Association's annual meeting held at Aqua Turf in Plantsville (30 attendees) *January 15*
- Participated in a meeting of the Emerald Ash Borer Outreach group in Wallingford (15 adults) *January 19*
- Participated at the annual meeting of the Connecticut Tree Protective Association held at Aqua Turf in Plantsville *January 21*
- Participated in the monthly Board meeting of the Connecticut Tree Protective Association in Wallingford *February 9*
- Taught "Insects that Attack Trees" for the Arboriculture 101 class, presented by the Connecticut Tree Protective Association, in Wallingford (45 attendees) *February 17*
- Taught "Insects that Attack Trees" for the Arboriculture class, presented by Bartlett Arboretum, in Stamford (12 attendees) *February 25*
- Presented the talk "Emerald Ash Borer in New England" to the New England 2016 Plant Healthcare Seminar in Taunton, MA (55 attendees) *February 26*
- Presented the talk "Something old, something new; updates on Emerald Ash Borer and Southern Pine Beetle" at the Forest Health Monitoring Workshop held in Jones Auditorium (50 attendees) *March 1*
- Taught "Tree Conditions Laboratory" for Arboriculture 101, Connecticut Tree Protective Association in Wallingford *March 2*
- Moderated the full-day workshop "Arborists and the Law," which she organized for The Connecticut Tree Protective Association, held at Sessions Woods in Burlington (110 attendees) *March 15*
- Talked with Master Gardner students about "Wasp Watching" at the Outreach Opportunity Fair in New Haven (25 attendees) *March 17*

- Presented a guest lecture “Emerald Ash Borer” in the Bio 226 course “Invasive Species Biology and Management” at Wesleyan University in Middletown, at the invitation of Dr. Helen Poulos (35 attendees) *March 24*
- Participated in CT Tree Protective Association Board meeting *April 12*
- Gave a talk “Emerald Ash Borer in Connecticut” to the Friends of Brookvale Park in Hamden (15 adults) *April 13*
- Hosted and co-organized the Connecticut Tree Protective Association’s Arbor Day celebration for winners of their Arbor Day poster competition and their parents. The celebration included an introduction from Dr. Theodore G. Andreadis, presentation of awards to the winners, planting a new tree in the Magnarelli Garden; and visits with 6 Station scientists to learn about their tree-related research (16 adults, 8 youth) *April 29*
- Volunteered as a scorekeeper at the Connecticut Tree Climbing Competition in Hartford (70 adults) *May 7*
- Presented a talk on the emerald ash borer to the Connecticut Audubon Naturalists Program in Fairfield (8 attendees) *May 10*
- Gave the talk “Invasive Pests of Connecticut Forests” to The Institute for Learning in Retirement, Inc. in New Haven (3 attendees) *May 25*
- Participated in the spring meeting of the Cooperative Agricultural Pest Survey (CAPS) in New Haven *May 31*
- Was interviewed by Brigitte Ruthman, Waterbury Republican-American, and met with their photographer at White Memorial Conservation Center in Litchfield, which resulted in the article published on June 6 titled “Wasps Ready to Strike a Blow at the Ash Borer: State Steps up Use of Insect to Combat Devastating Beetle” *June 2*
- Was interviewed by a reporter from WSFB Channel 3 News to explain biological control of emerald ash borer *June 6*
- Was interviewed by WTNH Channel 8 News to explain biological control of emerald ash borer *June 8*
- Helped administer the oral exam portion of the Arborists Licensing Exam *June 9*
- Gave a talk titled “Emerald Ash Borer in Connecticut” to the North End Club in New Haven (50 adults) *June 10*
- Conducted a training for Wasp Watchers, a citizen-scientist group that uses biosurveillance to detect and monitor emerald ash borers, at White Memorial Conservation Center in Litchfield (15 adults) *June 29*

SCHULTES, NEIL P.

- Participated in an executive board meeting for the Quinnipiac Chapter of Sigma Xi *July 14, 2015*
- Participated in an executive board meeting for the Quinnipiac Chapter of Sigma Xi *July 28*
- Visited Dr. Timothy McNellis at the Department of Plant Pathology and Environmental Microbiology at Pennsylvania State University and discussed collaborative research concerning the genetics of metabolism in *Erwinia amylovora August 18-19*
- Participated in an executive board meeting for the Quinnipiac Chapter of Sigma Xi *September 4*
- Visited Dr. George Mourad at the Biology Department at the University of Indiana-Purdue in Ft. Wayne, IN and worked with graduate students to oversee and plan their projects *September 7-12*
- Participated in Geeta Buda’s Master’s Defense for her thesis “Genetic and Biochemical Characterization Reveals the Substrate Specificity of the Three-Member Azaguanine-Like Transporter Family of *Zea mays*” *September 13*
- Participated in an executive board meeting for the Quinnipiac Chapter of Sigma Xi *September 24*
- Presented a lecture on “Plant Biodiversity and Ecology” to the Federated Garden Clubs Master Gardener’s School at the Kellogg Environmental Center in Derby (25 attendees) *October 6*

- Presented a lecture on "How plant varieties are developed and evaluated" to the Federated Garden Clubs Master Gardener's School in Jones Auditorium (33 attendees) *October 13*
- Presented a series of lectures on "Plant Genetics and GMOs" for the Institute for Learning in Retirement at Albertus Magnus College in New Haven (10 attendees) *October 14, 21, and 28*
- Participated in an executive board meeting for the Quinnipiac Chapter of Sigma Xi *October 29*
- Hosted a tour of the Station's molecular laboratories for students in his Plant Genetics course in the Institute for Learning in Retirement (10 attendees) *November 4*
- Presented the CAES seminar titled "Purine and Pyrimidine Transporters in Plants and Microorganisms" in Jones Auditorium (38 attendees) *November 25*
- Participated in an executive board meeting for the Quinnipiac Chapter of Sigma Xi *February 24, 2016*
- Delivered the first of a two-lecture series on "Genetically Modified Plants in Agriculture" in a Yale Course Scie 031 "Current Topics in Science" *March 11*
- Delivered the first two lectures in a series on "Genetically Modified Plants in Agriculture" in a Yale Course Scie031 "Current Topics in Science" (16 undergraduate students) *April 1 & 8*
- Organized and led a tour of the Plant Pathology and Ecology Department for undergraduate students in a Plant Physiology class from Southern Connecticut State University. The group heard from Lindsay Patrick, Dr. Quan Zeng, Dr. Robert Marra, and Dr. Wade Elmer (18 attendees) *April 14*
- Officiated the judging for the Fourth Annual Student Research Conference hosted by the Quinnipiac Sigma Xi Chapter *April 20*
- Participated in an executive board meeting for the Quinnipiac Chapter of Sigma Xi *May 16*
- Hosted Besnik Murtishi, a senior in Biology at Southern Connecticut State University, as an intern *June*
- Participated in an executive board meeting for the Quinnipiac Chapter of Sigma Xi *June 6*

SHEPARD, JOHN J.

- Participated in a conference call meeting of the Board of Directors for the Northeastern Mosquito Control Association (11 attendees) *September 25, 2015*
- Participated in a Board of Directors meeting of the Northeastern Mosquito Control Association in Newport, RI (13 attendees) *November 12*
- With Mr. Michael C. Thomas, conducted a hands-on workshop on mosquito biology to a group of students from Long River Middle School in Prospect as part of the Yale-Peabody Fellows SEPA NIH program on mosquito biology (27 students and 3 adults attended) *November 5*
- With Mr. Michael C. Thomas, conducted a hands-on workshop on mosquito biology to a group of students from High Horizons Magnet School in Bridgeport as part of the Yale-Peabody Fellows SEPA NIH program on mosquito biology (24 students and 3 adults attended) *November 17*
- Gave the talk "Arbovirus Activity in Connecticut, 2015" at the 61st Annual Meeting of the Northeastern Mosquito Control Association in Newport, RI (approx. 180 attendees) *December 7-9*
- Participated in a Board of Directors meeting of the Northeastern Mosquito Control Association held at the Bristol County Mosquito Control Project in Attleboro, MA (8 attendees) *February 18, 2016*
- Was interviewed about range maps for issued by the CDC for *Aedes aegypti* and *Aedes albopictus* mosquitoes in Connecticut by Evan White from WFSB Channel 3 *March 31*
- Was interviewed about range maps for issued by the CDC for *Aedes aegypti* and *Aedes albopictus* mosquitoes in Connecticut by Josh Sheinblum from WTNH Channel 8 *March 31*
- Was interviewed about range maps for issued by the CDC for *Aedes aegypti* and *Aedes albopictus* mosquitoes in Connecticut by John Silva from 1080 WTIC *March 31*
- Presented information on the Connecticut Arbovirus Surveillance Program and West Nile Virus at a Mosquito Control Public Health Workshop held for the City of Bridgeport employees at Bass Pro Shops in Bridgeport (approx. 30 attendees) *April 18*

- Was interviewed about Connecticut mosquitoes and Zika virus by Scott McDonnell of WTNH-TV *May 6*

SHIDORE, TEJA S.
- Presented a poster "Protein Moonlighting in Plant Disease: Characterization of the Dual Function of a Bacterial Type III Secreted Virulence Effector and Chaperone as a Toxin-Antitoxin System" at the Annual Meeting of the Northeastern Division of the American Phytopathological Society, held jointly this year with the Northeastern Plant, Pest and Soils Conference, in Philadelphia, PA *January 6, 2016*
- Served as special-award judges for the Greater New Haven Science Fair, on behalf of the CAES Special Award *May 16-18*

SHORT, MICHAEL R.
- With Mr. Joseph P. Barsky and Ms. Megan Linske, staffed a Station display at the 26th Annual CT Urban Forest Council Conference and CT Forest Forum in Southington (175 attendees) *October 28, 2015*
- Attended the 72nd Annual Northeast Fish & Wildlife Conference in Annapolis, MD where he presented a poster titled "Field-test of Bait Acceptance by *Peromyscus leucopus* Using Rhodamine-B Fluorescent Dye" (500 attendees) *April 3-5, 2016*

SLETTEN, PAMELA
- With Ms. Lindsay Patrick, attended The Annual Seed Analyst Workshop of the USDA Seed Regulatory and Testing Division (Federal Seed School) in Gastonia, NC *August 24-26, 2015*

SMITH, VICTORIA L.
- Participated in discussions on chrysanthemum white rust, emerald ash borer response, medicinal marijuana, and other topics at the 89th annual meeting of the National Plant Board, held at Poco Diablo Resort in Sedona, AZ (150 participants) *August 2-6, 2015*
- Visited with Steve Young, Director of the Northeastern IPM Center, in the W. B. Young Building on the UConn Campus (10 attendees) *September 16*
- Participated in a meeting of the Yale University Biosafety Committee in New Haven (20 attendees) *September 17*
- Participated in a meeting of the Yale University Biosafety Committee in New Haven (20 attendees) *October 15*
- Presided over the annual meeting of the US Forest Service Durham Field Office Forest Health Cooperators, held at the Valley Lab in Windsor (25 participants from CT, Massachusetts, Maine, Vermont, New Hampshire, Rhode Island, and New York attended) *October 22-23*
- Participated in an emerald ash borer strategy meeting, held at Connecticut Forest & Park Association Headquarters in Rockfall (20 participants) *November 4*
- Participated in the fall meeting of the Cooperative Agricultural Pest Survey, held at the Cottage at Lockwood Farm (10 participants) *November 18*
- Participated in a meeting of the Yale Biosafety Committee in New Haven (20 participants) *November 19*
- Presented the CAES seminar titled "Inspection, Registration, and Early Detection: Activities of the Office of the State Entomologist" in Jones (45 attendees) *January 6, 2016*
- Attended the CT Nursery and Landscape Association Winter Symposium, held at Aqua Turf in Plantsville (200 attendees) *January 14*
- Participated in an emerald ash borer municipal strategy meeting, held at CT Tree Protective Association headquarters in Wallingford (10 participants) *January 19*
- Participated in a meeting of the Yale University Biosafety Committee in New Haven (20 participants) *January 21*

- Participated in a meeting of the National Plant Board Systems Approach to Nursery Certification Working Group, as part of the Pilot Nurseries Committee, held at the Holiday Inn Orlando Airport, in Orlando, FL (100 participants) *January 26-28*
- Participated in a meeting of the Yale Biosafety Committee in New Haven (20 participants) *February 18*
- Participated in a tour of the Yale University Zika Mosquito containment facility at the Laboratory of Environmental and Public Health in New Haven (6 participants) *February 23*
- Participated in a meeting of the CT Nursery and Landscape Association Winter Symposium Planning Committee, held at the WB Young Building on the University of Connecticut campus (10 participants) *February 24*
- Organized the annual Forest Health Monitoring Workshop, held in Jones Auditorium at the Experiment Station. This annual workshop included cooperators from DEEP, UConn, UConn Extension, and USDA, and is a conversation among those of us concerned with the health of the forests (60 attendees) *March 1*
- With Tia Blevins, participated in Aerial Survey and Aviation Safety and Management, a course conducted by the US Forest Service, held at the Hampton Inn in Dover, NH (20 participants) *March 14-17*. Completion of the course qualifies the participants as an Aerial Survey-Fixed Wing Flight Manager.
- With Ms. Vickie Bomba-Lewandoski and Mr. Michael Last, met with personnel from the Dept. of Administrative Services-BEST in Hartford to automate and bring on line the licensing functions of the Office of the State Entomologist *March 23*
- Participated in a meeting of the CT Nursery and Landscape Association Winter Symposium planning committee, held in the WB Young Building on the UConn Campus (6 participants) *March 23*
- With Ms. Tia Blevins, Ms. Katherine Dugas, Mr. Jeffrey Fengler, Mr. Stephen Sandrey, and Mr. Peter Trenchard, participated in the annual meeting of the Eastern Plant Board/Horticultural Inspection Society/Cooperative Agricultural Pest Survey, held at HarbourTowne Resort in Saint Michaels, MD where Steve Sandrey received the Distinguished Service Award from the HIS (80 participants) *April 4-7*
- Participated in a meeting of the CT Nursery and Landscape Association Winter Symposium Planning Committee, held at UConn (10 participants) *April 20*
- Participated in a meeting of the Yale Biosafety committee in New Haven (22 participants) *April 21*
- Three cooperative agreements under the Farm Bill were executed in April: Honey Bee Disease Survey ($12,120), Mixed Berry Commodity Survey ($16,908); and *Phytophthora ramorum* Nursery & Environs Survey ($18,791).
- Was interviewed by Frank Barnett of WNPR radio about beekeeping and bears *May 10*
- Was interviewed by Zack Atanasoff of WFUV radio about issues facing pollinators *May 12*
- Participated in a webinar training on using the Digital Sketch Mapping System, sponsored by the US Forest Service; about 30 participants nationwide *May 25*
- Participated in the spring meeting of the Cooperative Agricultural Pest Survey (CAPS) Committee, held in Jones Auditorium (12 participants) *May 31*
- Participated in a table-top exercise of the Incident Command System, held in Jones Auditorium (14 participants) *June 14*

STAFFORD, KIRBY C., III

- Was interviewed about tick testing by Phyllis Swebilius, New Haven Register *July 2, 2015*
- Was interviewed about tick removal by Laura Johannes, Wall Street Journal *July 6*
- Was interviewed about biological control programs in the state by Greg Hladky, Hartford Courant *July 7*
- Participated in a Tick IPM Working Group conference call *July 8*

- Was interviewed about gypsy moth, southern pine beetle, other invasive insects, and ticks by Jan Ellen Spiegel, CT Mirror *July 23*
- Was interviewed about ticks and tick research by John Burgeson, Connecticut Post *August 5*
- Was visited by Robert Koethe, Northeast Regional Office EPA, to discuss possible research opportunities with CAES *August 17*
- With Dr. Scott C. Williams, was interviewed by Caleb Hellerman in Redding, CT for a PBS program called Global Health Frontiers; with us in the filming were Michael Short and Megan Floyd *August 19*
- With Dr. Theodore G. Andreadis, participated in a Health Policy Round Table Discussion on Lyme disease in Connecticut sponsored by Congressman Joe Courtney in Old Lyme *August 21*
- Participated in a discussion on grants with the Bridgespan Group *August 27*
- Presented a talk on gypsy moth and winter moth at a forum organized by Representative Mike France in Ledyard (13 attendees) *August 27*
- Participated in a Tick IPM Working Group conference call *September 9*
- With Dr. Scott Williams and Megan Linske, was visited by Steve Young, Director of the Northeastern IPM Center, to discuss the partnership grant award and learn about the institution and region, and also met with Mason Kauffman and Steve Zatec *September 16*
- Presented a talk on ticks and tick control at the Connecticut Audubon center in Fairfield as part of their Master Naturalist's program *October 13*
- Was visited by Dr. Daniel Green, a clinical microbiology fellow at Yale University *October 15*
- Visited the Department of Entomology at Kansas State University and presented an invited talk as a distinguished alumnus titled "Ticks, Inquiries, and Invasions: A New England Perspective" (35 attendees) *October 18-20*
- Participated in the Forest Health Cooperators Workshop in Windsor *October 22-23*
- Participated in a Tick IPM planning committee conference call to discuss plans for a national tick IPM conference or workshop to be held in 2016 in the Washington, D.C. area *October 29*
- With Dr. Victoria Smith, participated in a conference call with Kate Aitkenhead, Craig Guthrie, and Jeffrey Davidson, USDA, about a plant pest ICS exercise in 2016 *October 29*
- Presented a talk on ticks and tick management for the NOFA Organic Land Care Course in Greenwich (45 attendees) *November 2*
- Participated in a conference call of the Tick IPM Working Group workshop planning committee *November 4*
- Participated in an emerald ash borer interagency planning meeting organized by Chris Donnelly, CT DEEP, to discuss outreach and response now that EAB is established in Connecticut (20 attendees) *November 4*
- Was visited by Dr. Scott Smedley and his students from Trinity College (16 attendees) *November 10*
- Spoke on invasive forest insects at the annual meeting of the Connecticut Association of Conservation and Inland-Wetland Commissions (CACIWC) (47 attendees) *November 14*
- Participated in a meeting of the Cooperative Agricultural Pest Survey (CAPS) committee at the Cottage at Lockwood Farm (10 attendees) *November 18*
- Spoke on ticks and tick-borne diseases at the annual meeting of the Connecticut Environmental Industry Council in Plantsville (125 attendees) *November 24*
- Provided a departmental overview to members of the Connecticut State Consulting Committee for Agricultural Science and Technology Education (6 attendees) *December 2*
- Participated in a meeting of the Connecticut Coalition Against Bed Bugs at the Station *December 2*
- Presented an update on tick management at the meeting of the Northeastern Mosquito Control Association in Newport, RI *December 8*
- Participated in a tick IPM working group conference call *December 9*
- Was interviewed about tick control research by free-lance writer Andrew Barton *December 10*

- Participated on a USDA ICS exercise planning conference call *December 21*
- Participated on a tick IPM symposium planning committee conference call *December 21*
- Presented the CAES seminar titled "The Birth of an Idea: A History of the First Agricultural Experiment Station" in Jones Auditorium (45 attendees) *January 13, 2016*
- Presented a talk titled "Tick Management in 2016" at the National Pest Management Association Eastern Conference in Pocono Manor, PA (approx. 60 attendees) *January 14*
- Participated in conference calls with U.S. Biologic, Inc. on the testing of the rodent-targeted Lyme vaccine trial *January 15*
- Participated in an EAB outreach meeting at the CTPA Headquarters in Wallingford *January 19*
- Presented a talk titled "Integrated Tick Management: A Review and Update" at the New York State Tick-Borne Disease Research Workshop II in Latham, NY (95 attendees) *February 3-4*
- Participated in a Tick IPM Working Group conference call *February 10*
- Participated in conference calls with U.S. Biologic, Inc. on the testing of the rodent-targeted Lyme vaccine trial *February 18*
- Presented a talk on "Integrated Tick Management" at the NOFA Organic Land Care Course at Three Rivers Community College in Norwich (36 attendees) *February 23*
- Presented a talk titled "Woodland Risks: It's Not Just Lyme Disease Anymore" at the Forest Health Monitoring Workshop in Jones Auditorium (45 attendees) *March 1*
- Was interviewed by Lori Mach, WNPR radio, about Lyme disease and other tick-associated diseases *March 9*
- Was interviewed by John Carlton, Fox61 News, television about spring tick activity *March 9*
- Was interviewed by Stefan Aleo, WFSB News, television about spring tick activity *March 10*
- Was interviewed by Kaitlyn McGrath, NBC-TV, about spring tick activity *March 10*
- Was interviewed by Karena Garrity, Valley Courier Newspaper, about ticks and tick-borne diseases *March 16*
- With Dr. Victoria L. Smith, met with State Plant Health Director Kate Aitkenhead, USDA-APHIS-PPQ, to review our joint plant protection plans and activities *March 29*
- Presented a talk on ticks and tick-borne disease prevention at the Northeastern Area Association of State Foresters (NAASF) Forest Health Committee meeting in Garden City, NY (25 attendees) *March 31*
- Was interviewed by Nancy Marek, UConn, about ticks, tick-borne diseases, and tick bite prevention *April 6*
- Was interviewed by Evan White, WFSB, about the lone star tick *April 11*
- Was interviewed by Marcia DeSanctis for Town & Country Magazine about the growing tick population and tick-borne diseases *April 11*
- Was interviewed by Taylor Rapalyea, Republican-American, about tick activity *April 12*
- Participated on the tick IPM symposium planning conference call *April 18*
- Was interviewed by Todd Lyon, New Haven Living Magazine, about ticks and work as a scientist participated in a photo shoot of entomologists for the "Players" feature of the magazine *April 29*
- Spoke on tick-borne diseases and tick bite prevention at StoneRidge retirement community in Mystic (60 attendees) *May 3*
- Spoke on tick-borne diseases and tick management at the Trumbull Public Library sponsored by the local health department, which was recorded by Trumbull Community Television to be available to a wider audience (18 attendees) *May 9*
- Presented a talk on tick-borne diseases and tick management to the Connecticut Audubon Naturalists Program in Fairfield, CT (8 attendees) *May 10*
- Was interviewed by Colleen Shaddox from Connecticut Health Investigative Team for a podcast (c-hit.org) *May 11*

- Served on the planning committee and presented a talk on "Deer-Targeted Methods-Topical Pesticides," a talk on "Integrated Tick/Pathogen Management," and moderated a session at the Integrated Tick Management Symposium in Washington, D.C. (143 attendees) *May 16-17*
- Was interviewed by Nala Rogers, Science Writer for The Wildlife Society, about the rodent targeted vaccine study *May 17*
- Participated in a Capstone mentor workshop at Quinnipiac University *May 19*
- Presented a talk on "Prevention and Control of Tick-Borne Diseases" at the Symposium on Vector-Borne Diseases in Connecticut in Jones Auditorium (100 attendees) *May 20*
- Was interviewed by Trevor Lilly, Redding Pilot, about the tick management projects in Redding *May 20*
- Participated in the spring meeting of the Cooperative Agricultural Pests Survey (CAPS) committee in Jones Auditorium (12 attendees) *May 31*
- Was interviewed by Matt Scott, Fox61 News, about the gypsy moth outbreak *June 1*
- Was interviewed by Anna Bisaro, New Haven Register, about the gypsy moth outbreak *June 2*
- Was interviewed by Jacquie Slater, WTNH News 8, about the gypsy moth outbreak *June 2*
- Was interviewed by Chris Hall, NBC Connecticut News, about the gypsy moth outbreak *June 2*
- Was interviewed by Nate Lynch, New London Day, about the gypsy moth outbreak *June 2*
- Was interviewed by Gregory Hladky, Hartford Courant, about the emerald ash borer *June 7*
- With Dr. Philip Armstrong, was interviewed by Sam Gingerella, WTIC-Radio, about the upcoming season for mosquitoes and ticks *June 8*
- Presented a talk on tick management at the New London County Agricultural Extension Council *June 9*
- Was interviewed by Gregory Hladky, Hartford Courant about the spread of the emerald ash borer *June 9*
- Was interviewed by Patrick Skahill, WNPR, Connecticut Public Radio, about the gypsy moth *June 9*
- Presented a talk on ticks at the New London County Extension Council annual meeting in Norwich (32 attendees) *June 9*
- Participated in an USDA table-top Incident Command System exercise in Jones Auditorium (14 participants) *June 14*
- Spoke about tick-borne diseases at the EPA Region 1 headquarters in Boston, MA (60 attendees plus 20 on conference connection) *June 15*
- Was interviewed by Matt Scott, Fox61 News, about the southern pine beetle and spruce trees *June 16*
- Was interviewed by Andrew Revkin, New York Times, about the gypsy moth fungus *June 20*
- Spoke about tick-borne and mosquito-vectored diseases in Westport (20 attendees) *June 20*
- Spoke to students about Entomology programs to students on a tour from Central Connecticut State University *June 23*
- Was quoted by the New Haven Register on the role of moving firewood in introducing new forest pests *June 24*
- Spoke about tick-borne diseases and tick management at Northwest Park Nature Center in Windsor (50 attendees) *June 25*
- Was interviewed by Sue Haigh, Associated Press, about the gypsy moth, and resulted in a front page article in The New Haven Register and also appeared in other newspapers *June 27*
- Was interviewed by Mary Jo DiLonardo, Mother Nature Network about the gypsy moth *June 29*
- Was interviewed by Morgan Heinz, Hartford Courant, about the gypsy moth, and resulted in a front page story on July 1st *June 30*
- Was interviewed by Hallie Metzger for the TIMPRO Connecticut Newsletter, about the gypsy moth outbreak *June 30*

STEVEN, BLAIRE T.

- Gave a short talk titled "From the Very Large to the Extremely Small: Including Microbiology in Climate Models" at Plant Science Day (150 attendees) *August 5, 2015*
- With Mr. Gregory Bugbee and Dr. Joseph Pignatello, met with State Representative Melissa Ziobron (34th District), the Town Manager of East Hampton, representatives on the Town of East Hampton's Lake Conservation Commission at the CAES to outline a planned study on harmful algal blooms in Lake Pocotopaug *August 10*
- Presented a CAES seminar titled "A Microbial Ecological Perspective on Sudden Vegetation Dieback in Coastal Wetlands" in Jones Auditorium (45 attendees) *May 10, 2016*

STONER, KIMBERLY A.

- Spoke about bee biodiversity and conservation to the Science Advisory Council of Audubon CT at their new refuge at Stratford Point in Stratford (9 attendees) *July 1, 2015*
- Spoke about bee conservation and planting flowers for bees at Natureworks Garden Center in North Branford (26 attendees) *July 16*
- Collected and discussed both pest and beneficial insects in the garden at the Common Ground High School and Environmental Center in New Haven (17 youths and 4 adults attended) *July 18*
- Was interviewed about bees by Chris Dehnel of the Willimantic Chronicle *July 27*
- Spoke to staff and interns at Jones Family Farm about bees, pollination, and pesticides, sharing data from Jones Farm about floral resources attractive to bees, data on pumpkin pollination, and pesticide residues in pollen and nectar of pumpkin plants (20 attendees, including 12 college students) *August 12*
- Hosted Dr. Rob Koethe of the Region 1 (New England) office of the US Environmental Protection Agency and discussed research on pesticides and bees *August 17*
- Led a "bug walk" for the New Haven Land Trust at the Quinnipiac Meadows Preserve (6 adults and 4 youths attended) *August 20*
- Was interviewed about bees and pollination by Bob Woods of Coastal Connecticut Magazine *September 3*
- Gave a talk titled "The Buzz About Bees" at the Guilford Public Library (60 attendees) *September 29*
- Presented information on plants utilized by specialist bees and bumble bees to the Urban Oasis Partnership meeting at the invitation of Katie Blake of Audubon CT, at the New Haven Parks Headquarters (15 attendees) *October 5*
- Gave a talk titled "Ongoing Research on Movement of Neonicotinoids and Exposure of Bees at The Connecticut Agricultural Experiment Station" as part of a workshop on Ornamental Horticulture and Bees at Penn State University *November 6*
- Gave a talk titled "The Buzz About Bees" to the Lower Farmington River and Salmon Brook Wild and Scenic Study Committee and the public at the Simsbury Public Library (35 attendees) *November 9*
- Participated in a meeting of the Landfill Legacy Work Group at the Hartford Department of Public Works, working on several options for the closed Hartford Landfill along I-91, including plantings for monarch butterflies and other pollinators (24 attendees) *November 19*
- Gave a talk titled "The Buzz About Bees" to the Hartland Land Trust at the Hartland School (45 attendees) *November 23*
- Spoke at the 12th District Environmental Planning Summit, held by State Senator Ted Kennedy, Jr., as a member of the panel on Reducing Pesticide Use and Ensuring Pollinator Health (60 attendees) *December 3*
- Spoke at New England Grows on "Keeping Bees Healthy" in Boston, MA (500 attendees, 50 at the Q&A afterward) *December 4*

- Met with Katherine Blake and Corrie Folsom-O'Keefe of Audubon CT about biodiversity studies on Urban Oases in New Haven, and how the Experiment Station might cooperate with Audubon CT and Common Ground School in identifying insects collected in these studies *December 11*
- Facilitated a Farmer-to-Farmer Session at the New England Vegetable and Fruit Conference on Pollinator Protection in Manchester, NH (35 attendees) *December 15*
- Spoke on "Pollination of Pumpkin and Winter Squash – Thanks to Bumble Bees!" at the New England Vegetable and Fruit Conference in Manchester, NH and also invited the speakers, organized, and moderated the session on Cucurbit Vine Crops (200 attendees) *December 16*
- Was interviewed about pollinator health and actions that might be taken by the state legislature to support pollinators by Susan Haigh of the State Capitol office of the Associated Press *January 21, 2016*
- With Dr. Richard Cowles and Dr. Theodore Andreadis, met with the Environment Committee of the state legislature about pollinator health and what action might be taken to protect and support pollinators *January 26*
- Toured the Hartford Landfill with the Landfill Legacy Work Group as preparation for planning pollinator plantings and other beneficial uses of the Hartford Landfill *January 28*
- Participated in a meeting of the Steering Committee for the New England Vegetable and Fruit Conference, Manchester, NH (28 participants) *February 2*
- Gave a tour of the Bee Lab and spoke to Paul and Hillary Peruzzi (son and mother) about Paul's research project collecting and analyzing pollen from honey bee hives *February 5*
- Was interviewed about planting for pollinators by Theresa Sullivan Barger, freelance writer for New Haven Living and Hartford Living magazines *February 5*
- Hosted the conference "Successfully Establishing Plants for Pollinators" in Jones Auditorium (59 attendees) *February 25*
- Due to the high level of interest, hosted the conference "Successfully Establishing Plants for Pollinators" again in Jones Auditorium (64 attendees) *February 26*
- Spoke to the Black Rock Garden Club in Bridgeport on "The State of Bees in Connecticut" (65 attendees) *March 13*
- Participated in a Professional Development Conference on Cover Crops for Soil Health in Baltimore, MD and worked with a team of farmers from RI and CT and professionals from the Natural Resources Conservation Service and the Eastern CT Conservation District on a series of cover crop demonstration projects that would demonstrate the pollinator benefits as well as benefits to soil health of cover crops *March 29-31*
- Was interviewed by Kendra Bobowick of the Newtown Bee about colony losses of honey bees and decline in species diversity of bumble bees in recent years *April 1*
- Held a charrette (design workshop) for planning an Urban Oasis pollinator garden at the CAES New Haven campus with Mr. Richard Cecarelli, who will be responsible for maintaining the garden, Chris Ozyck of the Urban Resources Initiative, who is the liaison with the Urban Oasis program, Barbara Yaeger of the Experiment Station Associates, Chris Tuccio of Naugatuck Valley Community College, who teaches a course in Landscape Design, and the students in Chris Tuccio's Landscape Design course *April 12*
- Participated in a press conference at the State Capitol at the invitation of State Senator Ted Kennedy, Jr. about the bill, "An Act Concerning Pollinator Health" *April 21*
- Spoke on "Planting for Bees" at the Experiment Station Associates workshop in Jones Auditorium *April 21*
- With Ms. Tracy Zarrillo and Mr. Mark Creighton, presented a display on bees and pollinator health at the invitation of Congresswoman Elizabeth Esty at the New Britain Bees Stadium in New Britain *April 22*
- Spoke to families of Arbor Day winners about life cycles of bees and pollination of plants as part of Arbor Day ceremonies *April 29*

- Was interviewed by Todd Lyon of New Haven Living magazine about bee life cycles, planting for bees, and causes of bee losses; and participated in a photo shoot of entomologists for the "Players" feature of the magazine *April 29*
- Spoke on "The Buzz About Bees" to the Leetes Island Garden Club of Guilford (35 attendees) *May 10*
- Was interviewed about bees and the program on bee health to be held in June in East Windsor by Eric Stoeker of the Journal Inquirer *May 31*
- Presented "The Buzz About Bees" at the invitation of the Agricultural Commission of East Windsor and the Connecticut Farm Bureau at Scout Hall in East Windsor (65 attendees) *June 14*
- Presented a talk on bumble bees as part of the Bumble Bee Jamboree at the Bellamy-Ferriday Garden in Bethlehem (16 adults and 7 youths attended) *June 25*

THIEL, PETER W.

- Organized First Aid/CPR/AED training through the American Red Cross in Jones Auditorium (32 attendees) *March 29, 2016*
- Was visited by the 5th grade class from St. Thomas Day School and spoke about Sudden Vegetative Dieback at Hammonasset State Park, and the role of purple marsh crabs (*Sesarma reticulatum*) (3 adults and 19 youths attended) *April 28*

THOMAS, MICHAEL C.

- Co-led the Farmington Valley Butterfly Count sponsored by the North American Butterfly Association (11 attendees) *July 11, 2015*
- Participated in the Dragonfly Society of the Americas Southwest BioBlitz held at City of Rocks State Park, NM (45 attendees) *August 28-29*
- Demonstrated insect collecting and preservation techniques to the Yale University Terrestrial Arthropod and University of Connecticut Entomology classes at the Yale Forestry Camp in Norfolk (12 student attendees) *September 11-12*
- Co-instructed a lab-field trip to Archbold Biological Research Station in Venus, Florida, for the Yale University EEB Terrestrial Arthropod Class (13 attendees) *October 21-25*
- With Mr. John J. Shepard, conducted a hands-on workshop on mosquito biology to a group of students from Long River Middle School in Prospect as part of the Yale-Peabody Fellows SEPA NIH program on mosquito biology (27 students and 3 adults attended) *November 5*
- With Mr. John J. Shepard, conducted a hands-on workshop on mosquito biology to a group of students from High Horizons Magnet School in Bridgeport as part of the Yale-Peabody Fellows SEPA NIH program on mosquito biology (24 students and 3 adults attended) *November 17*
- Met with Laura Saucier of the Department of Energy and Environmental Protection in Windsor to provide guidance on the Matianuck Dunes Natural Area Preserve management plan for rare and endangered invertebrates *December 3*
- Participated in an Executive Board meeting of the Connecticut Entomological Society in Middletown (5 attendees) *December 11*
- Met with Laura Saucier of the Department of Energy and Environmental Protection to discuss management plans for the State endangered Tiger Spiketail, *Cordulegaster erronea*, at Devil's Hopyard State Park in East Haddam *May 3, 2016*
- Gave a talk on "Insect Macro Photography" to the Connecticut Entomological Society at Sessions Woods in Burlington (12 attendees) *May 21*
- Participated in Connecticut State BioBlitz held at Two Rivers Magnet School in East Hartford *June 3-4*

TRIPLETT, LINDSAY R.

- Was interviewed by Nature News and Comment for the article "Rice Researchers Redress Retraction," about a new study in which a group of researchers answered a question left open after they retracted their own previous studies on the same topic http://www.nature.com/news/rice-researchersredress-retraction-1.18055 *July 21, 2015*
- Gave the first lecture of the 2015-2016 Sigma Xi lecture series at Quinnipiac University titled "American Heirloom: The Rice that Helped a Country Grow" (8 adult attendees) *September 15*
- With Dr. Teja Shidore, visited Dr. Gerry Berkowitz's laboratory at the Department of Plant Science and Landscape Architecture at UConn and learned about techniques for measuring early signaling events in plant defense and presented a departmental seminar titled "Self-killing Turned Outward: Novel Antibiotic Functions for a Family of Type III Secreted Proteins" (16 adult attendees) *September 17*
- Participated via Skype in the Master's defense examination of Mr. Valentin Trouiller, a Master's candidate from Blaise Pascal University, Clermont-Ferrand, France, who conducted a six-month internship at CAES for Dr. Triplett. He was granted a Master's degree in Genomics, Ecophysiology, and Plant Production *September 28*
- Presented the keynote lecture "American Heirloom: Using Heritage Crops to Solve Modern Agricultural Problems" to the QUIP-RS undergraduate research symposium at Quinnipiac University in Hamden (26 attendees) *October 8*
- Presented the keynote lecture "American Heirloom: Using Heritage Crops to Solve Modern Agricultural Problems" to the faculty and staff of Southern Connecticut State University for their Biology Seminar Series in New Haven (29 attendees) *October 13*
- Was invited to participate in a panel review of 5 proposals (details are confidential) *October 25-30*
- Was one of two American early-career molecular plant pathologists invited to speak at the 11th US-Japan Scientific Seminar on Plant-Pathogen Interactions, held in Takamatsu, Japan on "Direct Recognition of TAL Effectors: A Shared Strategy in Monocots and Dicots" (55 attendees) *October 25-29*
- Was invited to serve as co-organizer of the 12th US-Japan Seminar when it is held in the United States in 2020.
- Presented to the Quinnipiac Medical Students about possible internships *January 7, 2016*
- Judged the Worthington Hooker Science Fair *January 29*

WARD, JEFFREY S.

- Participated in an Audubon Connecticut Science Committee meeting in Stratford *July 1, 2015*
- Spoke on tree identification and habitats at the Connecticut Nursery and Landscape Association Summer Family Day in Stamford (34 attendees) *July 15*
- Attended the Connecticut Tree Protective Association summer meeting in Farmington *July 16*
- Was interviewed about giant hogweed in Connecticut by Tracy Phelan, WFSB-3 *July 17*
- Met with Hallie Metzer, Rebekah's Hill Flora and Fauna Preservation Society, and Paul Elconin and Maribeth Chassey, Weantinoge Heritage Land Trust, to discuss forest management in Goshen *July 23*
- Spoke about Japanese barberry control and relationship to tick densities at the Lyme Disease: Restoring Balance in the Body Workshop in Willington (38 attendees) *July 25*
- Was interviewed about the number of white pines in Connecticut by Will Rowlands, Connecticut Gardener *July 30*
- Was interviewed about control of running bamboo by Ehlayna Napolitano of the Voices Newspaper *August 4*
- Met with Michael Hveem (Executive Director) and Scott Matthies (Steward) of Joshua's Trust to discuss invasive control and forest restoration *August 14*

- Was interviewed about running bamboo biology and control by Ehlayna Napolitano of Voices Newspaper *August 20*
- Participated in a New England Society of American Foresters planning meeting *September 8*
- Gave an invited talk titled "Recognizing Herbivory Problems and What to Do" at the University of New Hampshire Deer Management workshop in Hillsborough, NH (43 attendees) *September 9*
- Spoke on "Silviculture for the Birds: Managing Forests for a Diversity Species" at the Coverts Project seminar in Norfolk (24 attendees) *September 19*
- Was interviewed about the fall foliage outlook by Ted Koppy, News12 Connecticut *September 22*
- Participated in a Connecticut Invasive Plant Council field tour investigating possible running bamboo escapes (4 attendees) *September 24*
- Attended an executive committee meeting of the Connecticut Urban Forest Council in New Haven *September 25*
- Met with Sue Martucci to examine poor survival of trees at the Connecticut Trees of Honor Memorial in Middletown *October 1*
- Participated in the CT Invasive Plant Working Group Steering Committee meeting in Storrs *October 6*
- Spoke on "The Dynamic Connecticut Forest" for the Adult Learning Program in Bloomfield (53 attendees) *October 6*
- Spoke on "The Link Between Deer, Invasive Plants, Mice, and Lyme Disease" for the Ashford Land Trust (18 attendees) *October 14*
- Spoke on "Homeowner Tree Care" for the Morris Cove Garden Club in New Haven (15 attendees) *October 14*
- Met with Sarah Hoskinson (Mianus River Gorge, Inc.) to discuss response of native species to invasive control *October 15*
- Spoke on "Invasive Plant Control" at the Watertown Land Trust annual meeting (22 attendees) *October 19*
- Was an invited participant in the Connecticut Landscape Scenarios Workshop at Yale University to develop alternative scenarios of 50 year landscape changes *October 22*
- Met with Dave Beers (Connwood, Inc.), Pat Corbett (Connecticut Water Company), and Richard Sullivan (Eversource) to discuss roadside forest management in Prospect *October 26*
- Met with William Hochholzer (DEEP Forestry), Tony Wilber (Tennett Tree Service), and Stephen Child (Eversource) to discuss roadside forest management in Voluntown *October 29*
- Spoke on "Every Tree Has its Place – or – Planting the Right Tree in the Right Place" for the Spring Glen Garden Club at the Cottage at Lockwood Farm (17 attendees) *November 9*
- Spoke on "Right Tree--Right Place: Homeowner Tree Care" for the Bethany Garden Club (21 attendees) *November 9*
- Participated in a Connecticut Invasive Plant Council meeting in Hartford *November 10*
- Spoke on invasive species control to the Oxford Land Trust (23 attendees) *November 23*
- Was interviewed about roadside forest management by Bob Miller of the Danbury News-Times *December 1*
- Was interviewed about the effect of warm weather on trees flowering by Nelson Oliveira of the Danbury News-Times *December 3*
- Was interviewed about the effect of warm weather on trees by Kevin Arnone of WTNH News 8 *December 7*
- Spoke on "Roadside Forests: Management Solutions for Storm Resilience, a "Stormwise" Approach" for a CLEAR webinar (56 attendees) *December 8*
- Participated in a New England Society of American Foresters planning meeting *December 15*
- With Dr. Adriana Arango-Velez, administered practical and oral examinations to arborist candidates for the Connecticut Tree Protection Examining Board *December 16*

- Was interviewed about the effect of warm weather on hemlock health by Nate Lynch of The Day *December 24*
- Spoke on "Como sembrar árboles" at the Connecticut Nursery & Landscape Association Winter Symposium & Expo in Plantsville (31 attendees) *January 15, 2016*
- Participated in a New England Society of American Foresters planning meeting *January 26*
- Was interviewed about pruning in winter by Kathy Connolly of The Day *February 5*
- Gave a CAES Seminar Series talk titled "Mixing Applied and Basic Research—Crop Tree Management" in Jones Auditorium (45 attendees) *February 17*
- Attended the annual meeting of the Connecticut Chapter of the Society of American Foresters in Middlefield *February 23*
- Was interviewed about running bamboo control by John Burgeson of the Connecticut Post *February 29*
- Spoke on precommercial crop tree management at the Forest Health Monitoring Workshop in Jones Auditorium (40 attendees) *March 1*
- Met with Connecticut DOT staff to discuss roadside forest management (6 attendees) *March 8*
- With Thomas Worthley (UConn), spoke on "Managing roadside forests" at the 96th Winter Meeting of the New England Society of American Foresters in Sturbridge, MA (45 attendees) *March 10*
- With Ms. Amanda Massa, visited with Bruce Lindsay, Westport Tree Warden, to advise on urban park management *March 11*
- Spoke on "STORMWISE: Integrating Arboriculture and Silviculture to Create Storm Resilient Roadside Forests" at the 20th Central Hardwood Forest Conference in Columbia, MO (35 attendees) *March 30*
- Spoke on "Twenty-Five Year Response of Non-Crop Trees to Partial Release During Precommercial Crop Tree Management" at the 20th Central Hardwood Forest Conference in Columbia, MO (80 attendees) *March 31*
- With Mr. Joseph P. Barsky and Ms. Amanda Massa, spoke about invasive plant control measures, forest management, and natural resource careers to high school students from Wamogo High School, Litchfield (17 students, 1 teacher) *April 8*
- Participated in a New England Society of American Foresters planning meeting *April 26*
- Was interviewed by Phil Leukhardt of the Hartford Courant about the effect of early April cold snap on trees *April 26*
- Spoke on "Tree care: A Homeowner's Guide" to the Evening Committee of the Branford Garden Club (15 attendees) *May 4*
- Spoke on forest management and invasive species control at a SCCRWA sponsored tour of Lake Gaillard (4 attendees) *May 12*
- Administered practical and oral examination to arborist candidates for the Connecticut Tree Protection Examining Board *June 8*
- Spoke about Japanese barberry control and relationship to tick densities at the Lyme disease: Restoring Balance in the Body workshop in Tolland (33 attendees) *June 11*
- Gave an invited lecture titled "Fire and silvicultural tools for securing oak regeneration" at North Atlantic Fire Science Exchange workshop "Fire in oak: regional differences, local applicability" in Westborough, MA (51 attendees) *June 16*
- Was interviewed about the impact of gypsy moth defoliation on forests by Aaron Kupek, WTIC 1080 radio *June 25*
- Met with CT DEEP and Regional Water Authority foresters to provide a summary of recent research and discuss oak regeneration (10 attendees) *June 28*

WHITE, JASON C.

- Attended a Consumer Product Safety Commission workshop titled "Quantifying Exposure to Engineered Nanomaterials from Manufactured Products: Address Environmental Health and Safety Implications" and gave two lectures titled "Accumulation and trophic transfer of engineered nanomaterials by plants" and "Using dietary intake modeling to project human intake of nanomaterials present in agricultural foods and commercial products" (30 attendees) *July 6-8, 2015*
- Met with Dr. Bernardo Cordovez of Optofluidics, Inc., to discuss nanomaterial detection platforms *July 7*
- With Dr. Brian Eitzer, Dr. Christina Robb, Dr. Walter Krol, Dr. Sanghamitra Majumdar, Ms. Kitty Prapayotin-Riveros, Mr. Michael Cavadini, Mr. Joseph Hawthorne, Mr. Craig Musante, and Ms. Terri Arsenault, participated in the FDA FERN cCAP monthly teleconference call *July 9*
- With Dr. Theodore Andreadis, met with representatives of the New Haven Preservation Trust *July 16*
- With Dr. Theodore Andreadis, met with Mr. Max Goldman of Senator Chris Murphy's office *July 16*
- Attended a USDA NIFA Food Safety Grant Program Review in Portland, Oregon, and presented a poster titled "Nanomaterial contamination of agricultural crops" (100 attendees) *July 24*
- With Dr. Blaire Steven, Dr. Joseph Pignatello, and Mr. Gregory Bugbee, met with State Representative Melissa Ziobron and members of the Lake Pocotopaug Association to discuss a potential research project on the lake *August 10*
- Was a participant in the FERN cCAP Technical meeting in Silver Springs, MD (30 attendees) *August 12*
- Participated in an organizational teleconference call for the upcoming Sustainable Nanotechnologies Organization (SNO) annual meeting in Portland, OR *August 17*
- Participated in the quarterly Association of Public Health Laboratories (APHL) Agriculture and Chemist Laboratory Managers call *August 19*
- Held a teleconference call with Professor Greg Lowry of Carnegie Mellon University regarding an upcoming NSF-sponsored workshop on the nexus of food, energy, and water systems being held in October *August 20*
- With Dr. Theodore Andreadis, met with representatives of the New Haven Preservation Trust (15 attendees) *August 26*
- As a member of her Ph.D. committee, attended the Dissertation Proposal Defense of Ms. Huiyuan Guo, candidate for a Ph.D. degree in the Plant Biology Graduate Program *August 31*
- Held a teleconference call with colleagues at the University of Florida concerning ongoing field experiments using nanoparticle amendments to suppress crop disease *September 1*
- With Dr. Christina Robb, Dr. Walter Krol, Ms. Kitty Prapayotin-Riveros, Mr. Michael Cavadini, Mr. Joseph Hawthorne, Mr. Craig Musante, Mr. John Ranciato, and Ms. Terri Arsenault, participated in a quarterly FDA ISO Accreditation MFRPS conference call *September 3*
- With Mr. Joseph Hawthorne and Dr. Arnab Mukherjee, participated in a CT DPH/14th Civil Support Team Medical and Analytical CBRNE (Chemical, Biological, Radiological, Nuclear and Enhanced Conventional Weapons) Symposium *September 9*
- With Dr. Brian Eitzer, Dr. Christina Robb, Dr. Walter Krol, Ms. Kitty Prapayotin-Riveros, Mr. Michael Cavadini, Mr. Joseph Hawthorne, Mr. Craig Musante, and Ms. Terri Arsenault, participated in the FDA FERN cCAP monthly teleconference call *September 10*
- Attended the monthly Laboratory Preparedness Advisory Committee meeting at the Department of Public Health Laboratory in Rocky Hill *September 14*
- Participated in an APHL-sponsored teleconference call for the Water Nanotechnology Paper Workgroup *September 21*
- With Dr. Arnab Mukherjee and Dr. Sanghamitra Majumdar, participated in a teleconference call with colleagues at North Dakota State University to discuss potential collaborative work on the impact of nanoparticle exposure on plants *September 21*

- With Ms. Kitty Prapayotin-Riveros, Mr. Michael Cavadini, Dr. Alia Servin, and Ms. Terri Arsenault, participated in an FDA AFRPS Technical Conference call for new grant awardees *September 23*
- With Dr. Brian Eitzer, Dr. Christina Robb, Dr. Walter Krol, Ms. Kitty Prapayotin-Riveros, Mr. Michael Cavadini, Mr. Joseph Hawthorne, Mr. Craig Musante, and Ms. Terri Arsenault, participated in the FDA FERN 2015-2020 grant awardee call *September 24*
- With Dr. Sanghamitra Majumdar, Dr. Roberto De La Torre-Roche, Dr. Alia Servin, and Dr. Luca Pagano, attended the 12th Annual International Phytotechnologies Conference in Manhattan, KS. Dr. White chaired the session of Plant-Nanoparticle Interactions, chaired the Society Business Meeting, and chaired an Editorial Board meeting of the *International Journal of Phytoremediation*. Dr. Sanghamitra Majumdar, Dr. Roberto De La Torre-Roche, Dr. Alia Servin, and Dr. Luca Pagano all attended the meeting with "PhytoScholar" travel awards from the National Institute of Environmental Health Sciences (NIEHS) *September 27-30*
- Attended the monthly Laboratory Preparedness Advisory Committee meeting at the Department of Public Health Laboratory in Rocky Hill *October 5*
- With Ms. Kitty Prapayotin-Riveros, Mr. Michael Cavadini, Mr. John Ranciato, Mr. Craig Musante, Dr. Alia Servin, and Ms. Terri Arsenault, participated in the CT AES Animal Feed Regulatory Program Standard (AFRPS) Y1 grant award lab "kick-off call" *October 5*
- With Dr. Brian Eitzer, Dr. Christina Robb, Dr. Walter Krol, Ms. Kitty Prapayotin-Riveros, Mr. Michael Cavadini, Mr. Joseph Hawthorne, Mr. Craig Musante, and Ms. Terry Arsenault, participated in the monthly FDA FERN cCAP teleconference call *October 8*
- Co-organized and attended an invitation only NSF-funded workshop titled "FEW Workshop for Applying Sustainable Nanotechnology to Optimize and Unify Food, Energy, and Water Systems" held at Carnegie Mellon University in Pittsburgh, PA *October 19-20*
- Joined the Ph.D. Dissertation Committee of Mr. Carlos Tamez of the University of Texas-El Paso Environmental Science and Engineering Program *October 21*
- Hosted Professor Shivendra Sahi of Western Kentucky University and discussed collaborative research on the analysis of biologically synthesized nanoparticles *October 29*
- Participated in the quarterly FDA FERN-wide teleconference call *October 29*
- Hosted Professor Lili He of the University of Massachusetts and three of her graduate students for the CAES Seminar Series and for discussion of ongoing collaborative projects *November 4*
- Chaired two sessions titled "Nanotechnology in Food and Agriculture" and gave a platform presentation titled "Nanomaterials and Crop Plants: Using Molecular Response to Assess Health and Environmental Safety after Exposure" at the 4th Annual Sustainable Nanotechnology Organization (SNO) Conference in Portland, OR (30 attendees) *November 7-10*
- With Dr. Brian Eitzer, Mr. Michael Cavadini, Mr. Joseph Hawthorne, Mr. Craig Musante, and Ms. Terri Arsenault, participated in the monthly FDA FERN cCAP teleconference call *November 12*
- Met with Professor Saion Sinha of the University of New Haven Department of Physics to discuss collaborative research projects *November 13*
- Remotely participated as a Committee member in the Ph.D. Dissertation Proposal of Ms. Wenjun Cai of the State University of New York College of Environmental Science and Forestry *November 16*
- Gave a lecture titled "Phytoremediation of Persistent Organic Pollutants" to an undergraduate Phytoremediation class at the University of Massachusetts Amherst (20 attendees) *November 17*
- Attended as a Committee member the Dissertation Proposal of Mr. Carlos Tamez of the University of Texas-El Paso Department of Chemistry *November 19*
- Attended the 2nd Annual Parma Nanotechnology Conference at the University of Parma in Parma, Italy and presented a lecture entitled "Nanotechnology and Agriculture in the United States" (75 attendees) as part of a Round-table discussion, and also presented a lecture entitled "Nanotechnology and the Environment: Applications and Implications" (100 attendees) *December 1-5*
- Joined the Dissertation Committee of Ms. Illya Aidee Medina Velo of the University of Texas-El Paso Department of Chemistry *December 6*

- Presented an invited lecture at the University of Connecticut Department of Chemistry Seminar series entitled "The Pros and Cons of Nanomaterial Interactions with Crops" (30 attendees) *December 7*
- With Dr. Brian Eitzer, Dr. Christina Robb, and Dr. Walter Krol, met with staff of the University of Connecticut Center for Environmental Science and Engineering (CESE) (3 attendees) *December 7*
- With Dr. Brian Eitzer, Mr. Michael Cavadini, Mr. Joseph Hawthorne, Mr. Craig Musante, Dr. Christina Robb, and Ms. Terri Arsenault, participated in the monthly FDA FERN cCAP teleconference call *December 10*
- Participated in the Northeast Regional Association of State Agricultural Experiment Station Directors teleconference call *December 15*
- Participated in a teleconference call with colleagues at Texas A&M University and Washington State University to discuss collaborative experiments on graphene nanomaterials *December 15*
- With Dr. Luca Pagano, participated in a Skype call with researchers at the Centre de Recherche et d'Enseignement de Géosciences de l'Environnement (CEREGE) in Aix en Provence, France to discuss collaborative experiments on the molecular effects of nanomaterial exposure (2 attendees) *December 16*
- With Dr. Walter Krol, participated in a teleconference call with CT DEEP and UConn CESE to discuss ongoing analysis of lobster tissue for synthetic pyrethroids (8 attendees) *December 21*
- Participated in a teleconference call for the Water and Nanotechnology Working Group of the Association of Public Health Laboratories (8 attendees) *December 22*
- With Dr. Walter Krol, participated in a teleconference call with CT DEEP and UConn CESE to discuss ongoing analysis of lobster tissue for synthetic pyrethroids (8 attendees) *December 29*
- Met with Professor Saion Sinha of the Department of Physics at the University of New Haven to discuss future collaborative research on engineered nanoparticle toxicity *January 11, 2016*
- With Dr. Brian Eitzer, Mr. Michael Cavadini, Mr. Joseph Hawthorne, Dr. Walter Krol, Mr. Craig Musante, Dr. Christina Robb, and Ms. Terri Arsenault, participated in the monthly FDA FERN cCAP teleconference call *January 14*
- Met with Professor Yangchao Luo from the Department of Nutritional Sciences at the University of Connecticut to discuss Station research programs and potential collaborative research *January 14*
- Participated in the Association of Public Health Laboratories (APHL) Agricultural Chemistry teleconference call *January 15*
- Gave an invited lecture entitled "Nanomaterial interactions with agricultural crops" at the Duke University Center for the Environmental Implications of Nanotechnology (CEINT) (40 attendees) *January 18*
- Was invited by the Eastern Analytical Symposium and Exposition (EAS) to organize and chair the Young Investigator Award Session at the November 2016 Conference in Somerset, NJ *January 21*
- Spoke by phone with Dr. Anil Patri of the US Food and Drug Administration (FDA) National Center for Toxicological Research NCTR-ORA Nanotechnology Core Facility regarding collaborative research projects *January 25*
- Spoke with Professor Greg Lowry of Carnegie Mellon University regarding a joint grant proposal submission to the NSF INFEWS Program *January 25*
- With Dr. Brian Eitzer, Mr. Michael Cavadini, Mr. Joseph Hawthorne, Mr. Craig Musante, Dr. Christina Robb, Ms. Kitty Prapayotin-Riveros, Dr. Alia Servin, Dr. Roberto De La Torre Roche, and Ms. Terri Arsenault, participated in the quarterly FDA ISO AFRPS teleconference call *January 26*
- With Dr. Theodore Andreadis, met with representatives from the University of Connecticut regarding joint preparation of the USDA Research Accomplishments Report and Plan of Work *January 29*
- With Mr. Michael Cavadini, Ms. Terri Arsenault, and Ms. Kitty Prapayotin-Riveros, attended the 5th annual Manufactured Food Regulatory Program Alliance (MFRPS) meeting and the 2nd Governmental Food and Feed Laboratories Accreditation in Louisville, KY *February 1-4*

- Spoke by phone with Dr. Nick Geitner of the Duke University Center for the Environmental Implications of Nanotechnology (CEINT) to discuss collaborative work on molecular modeling of nanoparticle/pesticide interactions *February 9*
- Participated in a National Information Management & Support System (NIMSS) training webinar *February 9*
- Attended a CHRO hearing on the CAES Affirmative Action Plan at the Legislative Office Building in Hartford *February 10*
- Participated in an FDA FERN Northeast Region teleconference call *February 11*
- With Dr. Brian Eitzer, Mr. Michael Cavadini, Mr. Joseph Hawthorne, Dr. Walter Krol, Mr. Craig Musante, Dr. Christina Robb, Ms. Kitty Prapayotin-Riveros, and Ms. Terri Arsenault, participated in the monthly FDA FERN cCAP teleconference call *February 11*
- Spoke by phone with Dr. John Fontana, who is the Laboratory Director of the Oregon Department of Public Health *February 12*
- With Dr. Brian Eitzer, Mr. Michael Cavadini, Mr. Joseph Hawthorne, Dr. Walter Krol, Mr. Craig Musante, Dr. Christina Robb, Dr. Alia Servin, Ms. Kitty Prapayotin-Riveros, Mr. John Ranciato, and Ms. Terri Arsenault, hosted Mr. Ken Stoub of Group Seven Laboratory Services who conducted an audit of the Analytical Chemistry MFRPS ISO Accreditation Program *February 16-18*
- Participated in a Skype call with Professor Mathews Paret of the University of Florida and discussed collaborative projects on using nanoscale micronutrients to suppress crop disease *February 18*
- Participated by Skype in the Ph.D. Proposal defense of Ms. Wenjun Cai of the SUNY College of Environmental Science and Forestry (ESF) *February 19*
- With Dr. Walter Krol, participated in a CT DEEP-led conference call of the Lobster Pesticide Study 2014 Steering Committee and discussed the conclusion of the year-long study *February 23*
- With Dr. Luca Pagano, participated in a Skype call with Dr. Fabienne Schwab of the European Centre for Research and Education in Environmental Geosciences Center (CEREGE) to discuss ongoing collaborative work *February 24*
- Hosted a tour of the Analytical Chemistry Department Laboratories for CT Senate President Martin Looney *February 25*
- Participated in a conference call with Doug Heitkemper and Mike Farrow of the FDA to discuss the technical agenda for the upcoming FDA FERN cCAP annual meeting *February 26*
- Participated in a Duke University CEINT workshop entitled "Engineered nano testing media harmonization" *February 29-March 2*
- Attended the monthly CT Preparedness meeting at the Department of Public Health Laboratory in Rocky Hill *March 7*
- With Dr. Brian Eitzer, Mr. Michael Cavadini, Mr. Joseph Hawthorne, Dr. Walter Krol, Mr. Craig Musante, Dr. Christina Robb, Ms. Kitty P.-Riveros and Ms. Terri Arsenault participated in the monthly FDA FERN cCAP teleconference call *March 10*
- Participated in a USDA NIFA reporting webinar *March 10*
- Participated by web-ex in the annual Editorial Advisory Board meetings of *Environmental Science & Technology* and *Environmental Science & Technology Letters March 17*
- With Ms. Kitty P.-Riveros, Mr. Michael Cavadini, Mr. Joseph Hawthorne and Ms. Terri Arsenault, participated in the quarterly FDA AFRPS grant progress update teleconference call with LCDR Ruiqing Pamboukian, Ph.D. *March 19*
- With Dr. Brian Eitzer, Dr. Sanghamitra Majumdar, Mr. Michael Cavadini, Mr. Joseph Hawthorne, Dr. Walter Krol, Mr. Craig Musante, Mr. John Ranciato, Dr. Christina Robb, Ms. Kitty P.-Riveros, Dr. Roberto de la Torre Roche, and Ms. Terri Arsenault, gave a tour and described Department programs to an upper level analytical chemistry class from Quinnipiac University (20 participants) *March 22*

- With Dr. Sanghamitra Majumdar, participated in a teleconference call with collaborators at the University of Massachusetts Amherst and the University of Texas El Paso to discuss preparation of a joint grant proposal submission to FDA *March 24*
- With Dr. Brian Eitzer, Dr. Christina Robb, Mr. Joseph Hawthorne, Dr. Sanghamitra Majumdar, and Ms. Terri Arsenault, participated in the annual FDA FERN cCAP technical meeting in New Orleans, LA *March 28-31*
- Attended the monthly CT Laboratory Preparedness meeting at the Department of Public Health Laboratory in Rocky Hill *April 4*
- Met with Ms. Sadia Younas of Southern CT State University regarding a summer internship in the Analytical Chemistry Department *April 6*
- Visited a third grade class at Fair Haven School in New Haven to talk about science and chemistry (20 attendees) *April 7*
- Participated in a conference call led by Michelle Hladik of the US Geological Survey regarding an upcoming Gordon Conference focusing on water, food and nanotechnology *April 8*
- Spoke by phone with Jan Spiegel of the CT Mirror regarding a new USDA grant that was awarded and with focus on nanoscale nutrients to suppress crop disease and enhance yield *April 9*
- With Dr. Wade Elmer hosted a teleconference call with co-investigators from The University of Texas El Paso and the Virtual Fertilizer Research Center regarding our new joint USDA funded project *April 11*
- Participated in the quarterly Association of Public Health Laboratories quarterly Agriculture/ Chemistry teleconference call *April 12*
- As a committee member, attended the Dissertation Proposal Defense of Ms. Aidee Illya Medina of the University of Texas, El Paso *April 14-15*
- With Dr. Luca Pagano, participated in a Skype call with Dr. Fabienne Schwab of CEREGE in Provence, France to discuss ongoing collaborative work *April 18*
- Met with SA Dan Coleman and SA Michael Syrax of the FBI to discuss nanotechnology *April 19*
- With Mr. Michael Cavadini, attended a meeting at CHRO in Hartford to discuss the CAES Affirmative Action Plan *April 20*
- Met with SA Dan Coleman and SA Michael Syrax of the FBI to discuss nanotechnology *April 21*
- Along with Dr. Wade Elmer hosted a teleconference call with co-investigators from The University of Texas El Paso and the Virtual Fertilizer Research Center regarding our new joint USDA funded project *April 25*
- With Dr. Sanghamitra Majumdar, participated in a conference call with co-investigators at the University of Massachusetts Amherst and The University of Texas El Paso to discuss a collaborative grant proposal being submitted to the US FDA *April 25*
- Was an invited speaker at the 2nd International Symposium on the Environmental Impact of Engineered Nanomaterials at the Ocean University of China in Qingdao China and gave a lecture entitled “Molecular and physiological response of crop species to engineered nanomaterial exposure” (150 attendees) *April 28-May 1*
- Spoke by phone with Mr. Davis Dunavin (a reporter with WSHU) concerning the recently released CT DEEP report on a study evaluating pesticide levels in Long Island Sound lobsters *May 3*
- Participated in a teleconference call organized by Dr. Byron Brehm-Stecher (Professor at Iowa State University) about participating in a symposium at the upcoming International Association of Food Protection (IAFP) meeting in St. Louis at the end of July *May 3*
- Attended the monthly CT Preparedness meeting at the Department of Public Health Laboratory in Rocky Hill *May 9*
- Participated in the quarterly Northeast Regional FDA FERN teleconference call *May 12*

- With Dr. Brian Eitzer, Mr. Michael Cavadini, Mr. Joseph Hawthorne, Dr. Walter Krol, Mr. Craig Musante, Ms. Kitty P.-Riveros, and Ms. Terri Arsenault participated in the monthly FDA FERN cCAP teleconference call *May 12*
- With Ms. Kitty P.-Riveros and Mr. Michael Cavadini participated in a monthly FDA AFRPS teleconference call *May 17*
- Met with Dr. James Scott of the University of Toronto and gave a tour of the Analytical Department laboratories and programs *May 19*
- Attended the SETAC Europe 26th Annual Meeting in Nantes France and gave a platform presentation entitled "Trophic transfer of engineered nanomaterials in terrestrial food chains" (100 attendees) and attended the annual SETAC Nanotechnology Advisory Group meeting in Nantes France and gave a presentation entitled "Nano-related work at the CT Agricultural Experiment Station" (25 attendees) *May 22-26*
- Met with Ms. Jan Spiegel of the CT Mirror regarding a new USDA-funded research project on using nanotechnology to suppress crop disease *June 1*
- Met with Ms. Jan Spiegel of the CT Mirror regarding a new USDA-funded research project on using nanotechnology to suppress crop disease *June 3*
- Attended the USDA Nanotechnology for Agricultural Systems Project Director Program review at Pennsylvania State University in State College and presented a posted entitled "Nanoscale nutrients suppress plant disease, increase macronutrient use efficiency, and increase yield" (50 attendees) *June 5-7*
- Participated in a USDA AFRPS webinar on project deliverables and year two funding requests *June 8*
- With Dr. Christina Robb, Mr. Michael Cavadini, Mr. Joseph Hawthorne, Mr. Craig Musante, and Ms. Terri Arsenault, participated in the monthly FDA FERN cCAP teleconference call *June 9*
- Met with Ms. Jan Spiegel of the CT Mirror regarding a new USDA-funded research project on using nanotechnology to suppress crop disease *June 10*
- Spoke by phone with Ms. Jane Philbrick, a Landscape Designer, concerning a phytoremediation project in Georgetown *June 21*
- Participated in a Skype call with Professor Nelson Marmiroli of the University of Parma, Italy, and his staff regarding ongoing collaborative research projects focused on the toxicity of engineered nanomaterials *June 22*
- Met with Professor James Kearns of SCSU and discussed Department research and regulatory projects *June 22*
- With Dr. Sanghamitra Majumdar, met with Dr. Quan Zeng and Dr. Ravi Patel to discuss LC-MS analysis of novel antimicrobial compounds from their research *June 23*
- Participated in a quarterly FDA FERN-wide teleconference call *June 23*
- Chaired the quarterly CAES Safety Committee meeting *June 24*
- Spoke by phone with Professor Leanne Gilbertson of the University of Pittsburgh on preparation of a joint USDA proposal focused on nanoscale nutrient delivery *June 24*
- Participated in an FDA FERN cCAP Project Directors call and training session on project reporting and deliverables *June 27*
- Attended the "Environmental Sciences: Water" Gordon Conference in Holderness NH and gave a presentation entitled "Nanomaterials and the food supply: Assessing the balance between applications and implications" (170 attendees) *June 28-30*

WILLIAMS, SCOTT C.

- Was interviewed about small mammal trapping and residential blacklegged tick management in Redding by Melinda Wenner Moyer of Nature magazine *July 22, 2015*
- Co-led a botanical hike for the Connecticut Botanical Society in North Guilford (9 attendees) *July 25*

- With Mr. Michael Short and Ms. Megan Linske, conducted a small mammal trapping demonstration and deer exclosure explanation to students in the Wildlife Management Techniques class in the Department of Natural Resources and the Environment at the University of Connecticut (20 students and 1 teacher attended) *September 14*
- As Executive Treasurer, participated in the 27th Annual Connecticut Urban Forest Council Conference and 11th Annual Forest Forum in Plantsville *October 28*
- With Mr. Michael Short and Ms. Megan Linske, spoke about research on deer and rabbit browsing of oak stump resprouts to a tour group at Sessions Woods Wildlife Management Area in Burlington (30 attendees) *October 27*
- Gave an invited lecture titled "The Role of Deer in Spreading Invasive Plants and Preventing Native Plant Regeneration" at a meeting of the Connecticut Invasive Plant Working Group in Storrs (50 attendees) *October 6*
- Spoke on "Ticked Off! Invasive Plants, Ticks, Deer and Lyme Disease—A Surprising Connection" at the Annual Meeting of the Connecticut Chapter of the Appalachian Mountain Club in Portland (35 attendees) *November 8*
- With DEEP Wildlife Division Biologist Michael Gregonis, led an interpretive hike for the Executive Board of the National Wildlife Federation at Yale-Myers Forest in Union (18 attendees) *November 8*
- Met with Maureen Massa (Southold, NY Tick Committee) to discuss about tick management research and strategies *November 10*
- Participated in a Graduate Committee meeting of University of Connecticut master's degree student Kelsey Schwenk to discuss her plan of study and thesis research *November 12*
- Participated in a Graduate Committee meeting of University of Connecticut Ph.D. student Ms. Megan Linske to discuss classes and dissertation research *November 12*
- With Mr. Michael Short and Ms. Megan Linske hosted the Connecticut Future Farmers of America (FFA) Association's Forestry Career Development Event at Lockwood Farm. Thirty-two students and eight teachers from eight different schools competed in their general forestry knowledge, forestry equipment, tree identification, wood products, tree measurements, and compass use *November 13*
- With Mr. Michael Short and Ms. Megan Linske, consulted with Town of Guilford Environmental Planner Kevin Magee on the location of deer exclosures in the Town's East River Preserve in Guilford *December 7*
- With Mr. Michael Short and Ms. Megan Linske, met with staff at Bobbex, Inc. to explain the results of an experimental animal repellent trial in Monroe *December 8*
- Gave an invited talk to graduate students in the Department of Natural Resources and the Environment at the University of Connecticut about non-academic employment opportunities (8 students) *December 9*
- Participated in the quarterly meeting of the Executive Board of the Connecticut Urban Forest Council in Middlefield *December 11*
- With Dr. Jeffrey Ward, Mr. Michael Short, and Ms. Megan Linske, met with the wildlife biology class from Lyman Hall High School about careers in the natural resources field *January 12, 2016*
- With Mr. Michael Short and Ms. Megan Linske, met with Guilford Health Director Dennis Johnson about participating in a potential tick management research project *January 14*
- Hosted the quarterly meeting of the Executive Board of the Connecticut Urban Forest Council in New Haven *January 22*
- Presented "I'm Stumped--Impacts of Rabbit and Deer Browse on Oak Stump Sprout Regeneration" at the Forest Health Monitoring Workshop in New Haven (40 attendees) *March 1*
- Participated in a graduate committee meeting with University of Connecticut student Kelsey Schwenk in Storrs *March 4*
- Participated in the Annual Meeting of the Executive Board of the Northeast Section of The Wildlife Society in Annapolis, MD *April 3*

- Hosted the Annual Meeting of the membership of the Northeast Section of The Wildlife Society in Annapolis, MD *April 4*
- Met with DEEP Wildlife Division Biologist Michael Gregonis and MDC Forester Andrew Hubbard about a collaborative deer browse research project, Barkhamsted *April 18*
- Gave an invited lecture titled "The Role of Deer in Spreading Invasive Plants and Preventing Native Plant Regeneration" at the Northeast Natural History Conference, Springfield, MA *April 23*
- Gave an invited lecture titled "Managing Japanese Barberry Infestations Reduces Blacklegged Tick Abundance and Infection Prevalence with *Borrelia burgdorferi*" at the Trustees of Sunset Farm Annual Meeting in West Hartford (60 attendees) *April 24*
- Hosted the St. Thomas's Day School 5th grade class on a tour of CAES which included presentations by Dr. Gale Ridge, Greg Bugbee, Mark Creighton, Katherine Dugas, Jennifer Fanzutti, Megan Linske, and Peter Thiel (3 teachers and 18 students attended) *April 28*
- Hosted a field visit for consulting botanist Bill Moorhead regarding invasive plant control and regeneration in Redding *May 3*
- Participated in a conference call for the Executive Board of the Connecticut Urban Forest Council *May 5*
- Gave a brief talk to visiting FFA students about research activities at The Connecticut Agricultural Experiment Station (18 students and 1 teacher attended) *May 5*
- With Dr. Kirby Stafford and Ms. Megan Linske, attended the Integrated Tick Management Symposium: Solving America's Tick-Borne Disease Problem in Washington, DC *May 16-17*
- Was interviewed by Nala Rogers for The Wildlife Professional about the recent release of the Northeast Section of the Wildlife Society's position statement on management of chronically overabundant deer *May 18*
- Hosted the St. Thomas's Day School 1st grade class on a tour of CAES which included presentations by Dr. Wade Elmer, Dr. Claire Rutledge, Ms. Katherine Dugas, Mr. Mark Creighton, and Ms. Jennifer Fanzutti (19 students and 4 teachers attended) *May 18*
- Gave an invited lecture titled "New Realities in Suburban Deer Management" at the 2016 Business Meeting and Conference of the International Hunter Education Association in Vergennes, VT (150 attendees) *May 25*
- With Mr. Michael Short and Ms. Megan Linske, conducted a botanical inventory for the Guilford Land Conservation Trust in Guilford *May 27*

ZARRILLO, TRACY A.

- Presented a display on bees and pollinator health, with Dr. Kimberly Stoner and Mr. Mark Creighton, at the invitation of Congresswoman Elizabeth Esty at the New Britain Bees Stadium in New Britain *April 22, 2016*
- Presented Thesis seminar, The Bees of Grass Island Preserve, at Southern Connecticut State University (10 attendees) *April 29*
- Provided informational displays and handouts for a pollinator event held at the Coastal Center at Milford Point Audubon Society *May 21*
- Participated in the University of Connecticut BioBlitz held at Two Rivers Magnet School in East Hartford on the Hymenoptera team *June 3-4*

ZENG, QUAN

- Gave a presentation titled "Where Did All the Fire Blight Go in 2015?" in which he discussed recent findings in the streptomycin resistance survey of the fire blight populations in New England and answered questions regarding disease occurrence, dissemination, and management of fire blight http://massfruitgrowers.org/2015/2015summermeeting.html at the Massachusetts Fruit Growers summer meeting in Phillipston, MA (120 attendees) *July 21, 2015*

- Gave a poster presentation titled “Comparative Genomics of 15 Acidovorax Pathogens Provide Insights into the Emergence of a New Turfgrass Disease and the Host Specificity of Acidovorax” (150 attendees), attended two workshops and committee meetings, and was elected as the Vice Chair of the Bacteriology Committee of the American Phytopathological Society, starting August 2015, at the American Phytopathological Society Annual Meeting in Pasadena, CA *July 31*
- Presented the CAES seminar titled “Using Comparative Genomics Approaches to Understand an Emerging Turf Grass Disease: What Questions Can We Ask and What Do We Learn?” in Jones Auditorium (40 attendees) *October 7*
- Presented the talk “Fire Blight in New England in 2015 and Streptomycin Resistance” at the first annual Northeastern IPM Center (NEIPMC) Online Conference and met with colleagues from the U.S. and Canada *October 20*
- Visited faculty members, graduate students, and post-docs in the Dept. of Molecular, Cellular, and Developmental Biology at Yale University and presented a talk on “Disease Emergence and Pathogen Host Specificity, New Insights into a Bacterial Disease on Turf Grass” (40 adult attendees) *November 16*
- Delivered a guest lecture and a lab session at the University of Connecticut, Storrs on common bacterial pathogens, diseases, and pathogenicity factors along with a laboratory practice using a multiplex PCR detection of bacterial pathogens (17 students) *December 9*
- Was interviewed by the Northeastern IPM Center for their upcoming issues on the topic of pesticide resistance and provided an update on his current project with Dr. Dan Cooley on surveying the New England region for streptomycin resistance in the fire blight population *February 11, 2016*
- Gave a presentation titled “Current research in *Erwinia amylovora* and Fire Blight on Apples” to a Plant Physiology Class from Southern CT State University (16 attendees) *April 14*
- Visited the Department of Plant, Soil, and Microbial Sciences at Michigan State University and met with Dr. George W. Sundin, Dr. Ching-Hong Yang, and Dr. Chris Waters to discuss disease management efficacy of the T3SS inhibitors in fire blight management *June 1-3*
- Presented the invited seminar “Exploration on Developing Novel Management Strategies of Bacterial Plant Diseases: From Antimicrobials to Flower Microbiome” (35 adult attendees) *June 3*

ADVANCES IN KNOWLEDGE

DEPARTMENT OF ANALYTICAL CHEMISTRY

Service, research, and outreach activities in the Department are conducted within the focus areas of **Food Safety** and **Environmental Monitoring/Remediation**. Activities within each area are often complimentary. A breakdown of samples expressed as a function of source is shown below.

Source of Sample	Numbers of samples analyzed
Department of Agriculture	25
Department of Consumer Protection	331
Department of Energy and Environmental Protection	80
FDA, Health Depts., Cities/Towns, Misc. Foundations	21
Proficiency Test Samples	10
University Research Collaborators	2,215
CAES Departments	221
Grand Total	2,903

I. SERVICE ACTIVITIES

Analyses are conducted on a wide range of sample types submitted to the Department of Analytical Chemistry by other state and federal agencies, municipalities, law enforcement, non-profit groups, businesses, university collaborators, and other departments at the Connecticut Agricultural Experiment Station (CAES). This list is not intended to be all-inclusive.

1. ANALYSES ON BEHALF OF CONNECTICUT DEPARTMENT OF AGRICULTURE

Analytical Chemistry has two long-standing programs with the CT Department of Agriculture (DoAg) involving the chemical analysis of commercial feed and fertilizer products.

a. Animal Feeds:

- Analyst: John Ranciato
- Goal: To assure products are in compliance with stated label guarantees.
- Summary: This was one of the primary analyses of the Station in the late 1890s. Products for household pets and commercial agricultural operations are included. Samples are collected by inspectors from DoAg. Analytical results are reported to DoAg, who in turn report findings to the product dealer and/or manufacturer.
- Results: From July 1, 2015 to June 30, 2016, we received and completed analysis of 21 feed samples. These samples were analyzed for protein, fat, moisture, fiber, and select micronutrients. Samples deficient in one or more analytes (determined according to the investigational allowances outlined in the Official Publication of the Association of American Plant Food Control Officials) numbered 12 (57%). Analytical findings are turned over to CT DoAg for regulatory response. Joint funding with the DoAg has been acquired from the FDA to facilitate inclusion in the Animal Feed Regulatory Program Standards (AFRPS); this 5-year cooperative agreement will allow the Department to bring mycotoxin analysis in animal feeds by liquid chromatography high resolution mass spectroscopy (LC-HRMS) under the scope of ISO accreditation.

b. Fertilizers:

- Analysts: John Ranciato
- Goal: To assure products are in compliance with stated label guarantees.
- Summary: This was one of the primary analyses of the Station in 1875. Products from residential and commercial agricultural operations are included. Samples are collected by inspectors from DoAg. Analytical results are reported to DoAg, who in turn reports findings to the product dealer and product manufacturer.
- Results: From July 1, 2015 to June 30, 2016, we received and completed analysis of 71 samples for macronutrients, such as nitrogen, available phosphoric acid, and potash, and for micronutrients, including but not limited to boron, sulfur, cobalt, magnesium, and iron. Samples deficient in one or more analytes (determined according to the investigational allowances outlined in the Official Publication of the Association of American Plant Food Control Officials) numbered 40 (56%). Analytical findings are turned over to the CT Department of Agriculture for regulatory response.

c. Analysis of seaweed samples

A newer collaborative project with the CT DoAg Bureau of Aquaculture involves the chemical and microbial analysis of seaweed being grown commercially in CT for sale to restaurants. Chemical analysis happens in the Department of Analytical Chemistry; the microbial analysis happens at the Department of Public Health (DPH) Laboratory Environmental Microbiology Section. During the current reporting period, 11 samples were received for analysis of pesticides by both liquid and gas chromatography with mass spectrometry (LC-MS; GC-MS), as well as polychlorinated biphenyls (PCBs) by GC with electron capture detection (GC-ECD), and select heavy metals by inductively coupled plasma mass spectrometry (ICP-MS). Results are reported to DoAg Aquaculture staff for a decision on regulatory action. All samples analyzed this year have been judged suitable for sale on the basis of chemical analysis results.

2. ANALYSES ON BEHALF OF CONNECTICUT DEPARTMENT OF CONSUMER PROTECTION, FOOD AND STANDARDS DIVISION

Analyses conducted for the CT Department of Consumer Protection (DCP) are important to public safety. The results of these analyses are reported quickly and can lead to the recall of products that have levels of chemical residues deemed unacceptable by regulatory agencies.

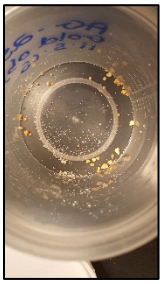
a. Pesticide residues in food:

- Analysts: Walter Krol, Brian Eitzer, Michael Cavadini, Terri Arsenault
- Summary: As part of the Manufactured Food Regulatory Program Standards (MFRPS), we determine concentrations of agrochemicals and total arsenic in fresh and processed foods from local, domestic, and imported sources offered for sale in CT and assure compliance with established tolerances. MFRPS survey samples are collected by DCP Inspectors and results are published in periodic Station Bulletins available by mail and at www.ct.gov/caes. From July 1, 2015 through June 30, 2016, a total of 136 samples of food were analyzed for pesticide residues. Of the 136 samples analyzed, 66 (48.5%) contained a total of 141 residues. Of these 66 samples, there were three samples each containing one violative residue. There were 44 different pesticide active ingredients found at an average concentration of 0.273 µg/Kg, and the average number of pesticide residues per sample was 2.13.
- With US FDA funding and support, the Department has received new equipment and after 5 years of preparation, has applied to the American Association for Laboratory Accreditation (A2LA) for ISO 17025 Accreditation of the MFRPS.

Impact: The Department's MFRPS serves as the sole surveillance and monitoring effort in the state, assuring that the food supply within CT is safe and free from chemical adulteration.

b. Miscellaneous samples

- Analyst: John Ranciato, Brian Eitzer
- Summary: From July 1, 2015 to June 30, 2016, 106 consumer complaint samples were submitted by CT DCP for analysis, including foreign material identification, product adulteration, or tampering. For some samples, we rely on the expertise in other CAES Departments, including Plant Pathology and Ecology, Entomology, and Forestry and Horticulture.



3. ANALYSES ON BEHALF OF DEPARTMENT OF CONSUMER PROTECTION, LIQUOR CONTROL DIVISION

a. Beverages/products for ethanol content

- Analyst: Terri Arsenault
- Goal: To provide % ethanol content for label registration and taxation purposes.
- Summary: We analyzed four products such as beers, wines, and liquors for ethanol content. Results were submitted to DCP in support of label registration.

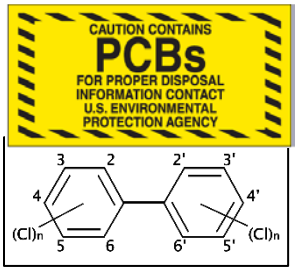
b. Beverage authenticity

- Analyst: Terri Arsenault
- Goal: To determine if products offered to customers at CT establishments are authentic as to brand.
- Summary: 24 alcoholic products were examined for authenticity; 11 samples were found to not match the chromatographic profile of comparison authentic samples. These results are returned to the DCP Division of Liquor Control, who determine appropriate regulatory action. A conductivity meter that was supplied to Liquor Control inspectors for field determination of vodka authenticity continues to be successfully used. Elemental profile as determined by inductively coupled plasma with mass spectrometry (ICP-MS) or optical emission spectroscopy (ICP-OES) is now also used during adulteration investigations.

4. ANALYSES ON BEHALF OF DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION (DEEP), WASTE MANAGEMENT BUREAU

a. Analysis of PCBs (polychlorinated biphenyls)

- Analysts: Joseph Hawthorne, Brian Eitzer
- Goals: To ascertain the extent of polychlorinated biphenyl (PCB) contamination. Common matrices include soils, water, oil, sediments, and surface wipes.
- Summary: From July 1, 2015 to June 30, 2016, 44 samples were analyzed from pre-existing sites and/or spill locations in CT. Sample collection is performed by the DEEP PCB Enforcement Unit as part of mandatory long-term monitoring of these areas. The findings are reported to DEEP for assessment of continued regulatory compliance. In addition, two proficiency tests were successfully completed as part of this program.

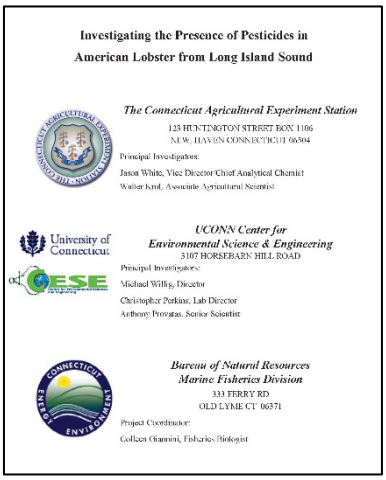


b. Analysis of pesticides

- Analysts: Brian Eitzer, Terri Arsenault, Michael Cavadini
- Goals: To ascertain pesticide concentration associated with misapplication or drift in support of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Additional samples are analyzed in support of DEEP surface and groundwater monitoring programs. Matrices include soils, waters, oils, sediments, and surface wipes. By request, water, vegetation, and soil samples can now be analyzed for glyphosate using liquid chromatography-mass spectrometry (LC/MS).
- Summary: From July 1, 2015 to June 30, 2016, 29 samples were analyzed under this program.

Impact: The analysis of samples collected from surveillance programs for soil, surface/groundwater, and sediments, as well as those that are part of active misapplication investigations, enable DEEP to enforce current state and federal regulations on pesticides and to promote overall environmental health.

c. Analysis of lobster tissue for synthetic pyrethroids


Investigating the Presence of Pesticides in
American Lobster from Long Island Sound

The Connecticut Agricultural Experiment Station
123 HUNTINGTON STREET BOX 1106
NEW HAVEN CONNECTICUT 06504
Principal Investigators:
Jason White, Vice Director/Chief Analytical Chemist
Walter Krol, Associate Agricultural Scientist

University of Connecticut
UCONN Center for Environmental Science & Engineering
3107 HORSEBARN HILL ROAD
Principal Investigators:
Michael Willig, Director
Christopher Perkins, Lab Director
Anthony Provatas, Senior Scientist

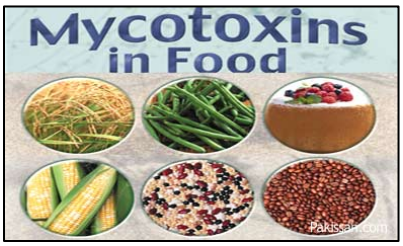
Bureau of Natural Resources
Marine Fisheries Division
333 FERRY RD
OLD LYME CT 06371
Project Coordinator:
Colleen Giannini, Fisheries Biologist

- Analysts: Walter Krol, Jason C. White
- Goals: To determine the presence and quantity of synthetic pyrethroids in lobster tissues collected from Long Island Sound.
- Summary: After preliminary results from a DEEP-funded University of CT Center for Environmental Sciences and Engineering (CESE) study could not be confirmed by our laboratory, DEEP initiated the formation of a steering committee which includes members of CAES, CESE, several divisions of DEEP, EPA, the Pyrethroid Working Group, and a representative from Earthplace. Under the auspices of this committee, both CAES and CESE jointly conducted a full method validation study. After the validation was accepted by the Working Group, samples of meat and hepatopancreas from 45 lobsters collected from Long Island Sound were analyzed; no detectable residues of synthetic pyrethroids or methoprene were found.

5. Analyses on behalf of Municipal and Federal Agencies

a. Analysis of samples for FDA Food Emergency Response Network (FERN)

- Analysts: Craig Musante, Terri Arsenault, Brian Eitzer, Christina Robb, Walter Krol, Kitty P.-Riveros, Joseph Hawthorne, Michael Cavadini, Jason C. White



- Summary: The Department of Analytical Chemistry continues its work with the FDA as part of the Food Emergency Response Network Chemistry Cooperative Agreement Program (FERN cCAP). This program enables research and analyses on chemical contaminants such as pesticides, poisons, toxins, and heavy metals in food. The Department participated in an FDA-led multi-lab validation of an inductively coupled plasma mass spectrometry (ICP-MS) method to determine arsenic and nine other heavy metals in a range of food matrices. Staff are currently preparing for a new FDA project where milk bound for export to the European Union will be tested by this newly validated method. Staff scientists participated in a mycotoxin study led by the FDA Center for Food Safety and Applied Nutrition. Dr. Christina Robb has begun investigating methods related to the detection of the plant toxins ricin and abrin. Lastly, Dr. Brian Eitzer and Ms. Terri Arsenault both served as instructors for FDA courses on LC-MS and GC-MS FERN methods, respectively; these training courses are open to FDA staff and other state laboratories.

Impact: The Department's participation in FERN has resulted in the acquisition of significant funding to support staff, including post-doctoral researchers, and highly sensitive analytical equipment. In addition to being used for FDA work, these resources are also directly applied to our state programs in a manner that directly benefits the citizens of Connecticut.

b. Analysis of samples for municipalities and other groups

- Analysts: Terri Arsenault, Brian Eitzer, Walter Krol, Craig Musante, John Ranciato

• Summary: From July 1, 2015 through June 30, 2016, Department staff analyzed several dozen samples for municipalities or other groups. As in previous years, this included the analysis of soils from schools and various other locations (community gardens, municipal property) for heavy metals. We also analyzed foods and other products, such as ethnic chewing sticks, for heavy metals at the request of the New Haven Health Department.

Impact: The findings of low levels of heavy metals in chewing sticks and other similar items assists local health departments in effectively and safely regulating consumer products. In addition, analysis of soil samples on elementary school grounds allows staff to make appropriate decisions about the location of student-run gardens.

6. ANALYSES ON BEHALF OF OTHER STATION DEPARTMENTS

a. Elemental Analysis - Department of Plant Pathology and Ecology

• Analyst: Craig Musante, Roberto De La Torre Roche, Jason C. White

• Summary: In conjunction with Dr. Wade Elmer of the Department of Plant Pathology and Ecology, elemental analysis of several hundred samples of various crops grown in the presence or absence of nanoscale micronutrient amendments was conducted. Dr. Elmer and Dr. White acquired a USDA AFRI NIFA research grant to conduct additional research on this topic; the $480,000 grant began March 1, 2016 and includes co-investigators in Washington, D.C. and El Paso, TX. Additional details on this project can be found in the Department of Plant Pathology and Ecology section of this document.

7. ANALYSIS OF CHECK SAMPLES

• Analysts: Walter Krol, Terri Arsenault, Joseph Hawthorne, Christina Robb, Brian Eitzer, Craig Musante, Michael Cavadini

• Summary: Annual proficiency testing samples related to our FDA FERN work, FDA ISO Accreditation program, as well as performance evaluation samples for our polychlorinated biphenyl (PCB) regulatory program, were completed during the reporting period. All of these testing regimes serve to ensure accurate and reliable laboratory results.

II. RESEARCH ACTIVITIES

Research projects in the Department of Analytical Chemistry include applied and fundamental studies. Research is often stimulated by our service work and in turn, research results often impact service activities.

1. FOOD SAFETY

• *Improvement of analytical methods for determination of pesticide residues in food*

• Investigators: Brian Eitzer, Terri Arsenault, Walter Krol, Christina Robb, Sanghamitra Majumdar, Craig Musante, Joseph Hawthorne, Jason C. White

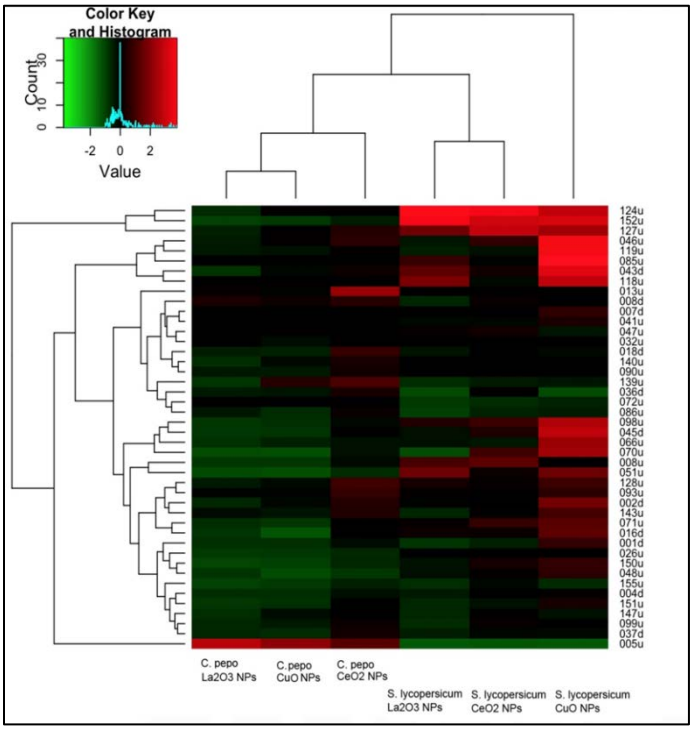
• Summary: We continue to participate in or lead several FDA coordinated research projects. Three of these projects have been completed this year and involved validating the use of high resolution LC-MS and LC-MS/MS platforms for the screening of pesticides, toxins (fungal, plant), and poisons. We are participating in a working group focused on validating software for a newly acquired GC-MS from the FDA. We are also continuing our pursuit of ISO Accreditation in two programs (MFRPS, AFRPS), which will be required for future FDA FERN participation. Last, we have initiated projects investigating the

presence of abrin and related compounds in seeds from various plant species. The overall goal of these projects is to develop robust and accurate methods that the FDA could deploy as part of large-scale surveillance programs.

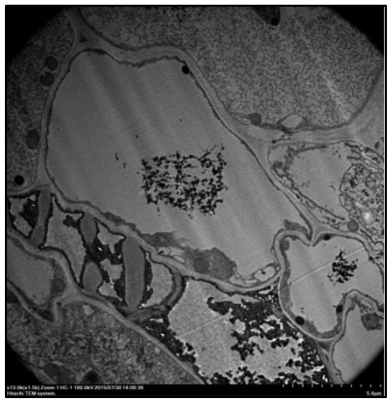
Impact: The development and validation of new, more sensitive equipment and analytical techniques will enhance food safety surveillance activities in the state and serve to better protect the public against incidental or intentional adulteration.

Project 2: *Nanoparticle fate in agricultural systems*

- Investigators: Craig Musante, Roberto De La Torre-Roche, Joseph Hawthorne, Sanghamitra Majumdar, Luca Pagano, Jason C. White



- Summary: Nanomaterials (NM), with at least one dimension less than 100 nm (one billionth of a meter), have unique physical and chemical properties not observed at the bulk scale. Nanotechnology, which takes advantage of these useful nanoscale properties, has impacted numerous sectors, including electronics, health care, cosmetics, agriculture, pharmaceuticals, and food processing. Although use has been widespread and is increasing rapidly, the consensus among the scientific community is that understanding of the fate and effects of nanomaterials in the environment is currently inadequate to accurately assess risk. We are interested in the use of nanomaterials in agriculture, including pesticide and fertilizer formulations. Also of concern is the presence of nanomaterials in biosolids, which are often applied to agricultural fields to aid plant growth. Research in our laboratory has focused on defining the impact (physiological and molecular toxicity, accumulation) of NMs on food crops, with a focus on the risk posed to humans from exposure to these contaminated plants. Recent work has shown that metal oxide nanoparticles of cerium, lanthanum, and copper cause unique molecular changes in exposed tomato and zucchini; the response of plants to non-nanoparticle forms of these elements is substantially different. Additional studies are focusing on how exposure to NM can impact the accumulation and toxicity of other contaminants, including pesticides such as chlordane and imidicloprid, as well as pharmaceuticals such as tetracycline and carbamazepine. Last, work focusing on NM trophic transfer from soil through food crops, herbivores, and invertebrate\vertebrate carnivores is being conducted. Additional co-investigators on this project include colleagues at the University of Massachusetts, Texas A&M University, State University of New York College of Environmental Science and Forestry, Southern Illinois University-Carbondale, University of Texas El Paso, the US National Institute of Standards and Technology, The University of Parma in Italy, Hasselt University in Belgium, Peking University in China, and the Ocean University of China.



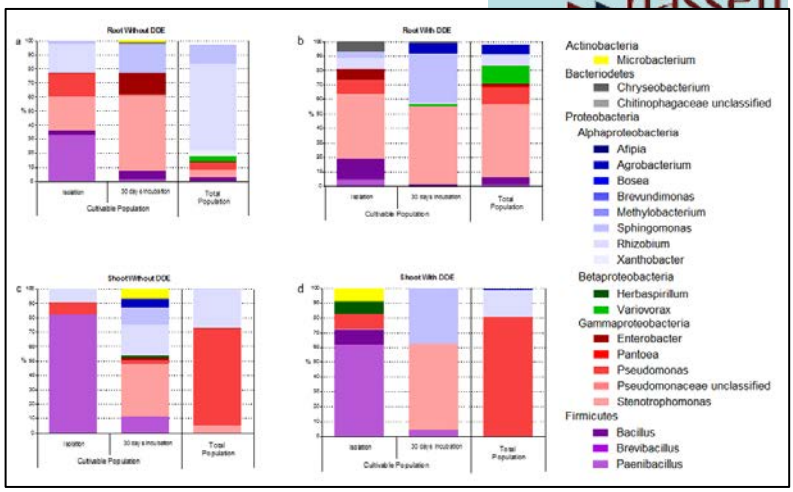
Impact: Our research has demonstrated that the toxicity of nanomaterials to crops can be significantly different from that of the corresponding bulk material. Current investigations have also shown the NM may also transfer from one trophic level to the next, presenting significant potential for

food chain contamination. Lastly, molecular investigations are now being used to develop more sensitive endpoints of exposure/effects and to provide more useful information in support of accurate and meaningful risk assessments.

2. ENVIRONMENTAL MONITORING/REMEDIATION

Project 1: *Phytoremediation of soils contaminated with weathered persistent organic pollutants (POPs)*

- Investigators: Joseph Hawthorne, Nele Eevers (Hasselt University, Belgium), Jason C. White



- Summary: Endophytic bacteria are microorganisms that reside inside plants and are known to be important to metabolism and health. In collaborative work with investigators at Hasselt University in Belgium, endophytic bacteria were isolated from zucchini that had previously been shown to remove significant quantities of weathered persistent organic pollutants (POPs) from soil. In pure culture, these bacteria were shown to have the ability to biodegrade DDE, a common persistent metabolite of the legacy insecticide DDT. In field trials, we observed that exposure to DDE actually altered the plant endophytic community, possibly selecting organisms that promoted tolerance and potentially degradation of the contaminant. The significance of these shifts in the microbial community to enhanced phytoremediation strategies is currently being evaluated.

Impact: The capacity to degrade or accumulate weathered POPs is a unique ability seemingly restricted to *C. pepo* (zucchini/pumpkin). The current investigations are designed to understand key plant-bacterial interactions in an effort to optimize remedial potential.

Project 2: *Analysis of Pesticides in Connecticut Pollen - Baseline Survey*

- Investigators: Brian Eitzer, Kim Stoner (Department of Entomology)
- Summary: We are continuing our research on the exposure of honey bees to pesticides. Our current focus is a long-term study in which we analyze the pesticides in pollen collected by foraging honey bees at the same location throughout the growing season for several years. Long-term studies provide a baseline assessment that can be used to track changes over several years. We are currently monitoring the pesticide load from two locations using traps to collect pollen balls from the bees as they return to the hive. During any individual collection period, the honey bees can visit a wide variety of crops bringing very different pollen back to the hive (see photo of pollen from a single sample). Each of these different crops could have different amounts of pesticides. As might be expected, when you examine these over the course of a growing season there is a wide variety of

pollen in the collections and the pesticides present from those plants can also vary widely; they vary in which pesticides are found, when they are found, and how much of them are found.

Impact: Honey bees are being exposed to pesticides. Long-term monitoring from the same hives and locations provides baseline data that can be used to assess temporal trends and changes in pesticide exposure.

Project 3: *Pollination security for fruit and vegetable crops in the Northeast*

- Investigators: Brian Eitzer, Kim Stoner (Department of Entomology), Anne Averill (University of Massachusetts), Frank Drummond (University of Maine), Bryan Danforth (Cornell University)
- Summary: We are participating in a multi-year study to examine pollination security in specialty crops. Four crops are being studied: apples in New York, cranberries in Massachusetts, blueberries in Maine, and cucurbits in Connecticut. Among the factors being examined for each crop is the levels of pesticides present in each system. In addition to the analysis of honey bee pollens during the past year, we have also examined pollen collected by Osmia bees (see photo of bee house) from the apple orchards and pollen collected from bumble bees visiting cranberry bogs. These other pollinator communities play an important role in our agricultural systems and their pesticide exposure (and risk) may not be the same as it is for honey bees.

Impact: Knowledge of pesticide exposure to pollinator communities and the resulting ability of those communities to pollinate crops can be used to guide farmers in the proper use of pesticides so as to insure not only crop pollination but also protection from pests and pathogens.

Project 4: *Quantifying exposure of honey bees and bumble bees to neonicotinoids in nectar and pollen of ornamental plants*

- Investigators: Brian Eitzer, Kim Stoner (Department of Entomology), Richard Cowles (Valley Laboratory), Douglas Dingman (Department of Entomology)
- Summary: The potential harm to pollinators caused by neonicotinoid pesticides is a topic that has been the focus of much recent attention. This attention has led to public calls for "bee safe" plants. The nursery and bedding plant industry is concerned because they use some of these compounds to protect their plants but need to sell those plants to the public. During the past year, we have collected pollen from honey bee hives located at three nurseries during an entire growing season. These samples are currently undergoing pesticide analysis and we will try to speciate the pollens in selected samples with high pesticide loads. We are also examining the pesticide amounts in pollen and nectar

directly sampled from model plants treated by various techniques with these pesticides (see photo of nectar collection). These studies of model plants can inform us on the relative risk of these differing pesticide treatment methods.

Impact: Knowledge of which plants are being visited by pollinators and the concentration of pesticides in those plants will allow the nursery and bedding plant industries to modify their pesticide use practices in ways that will mitigate the impact on pollinators.

PUBLIC OUTREACH

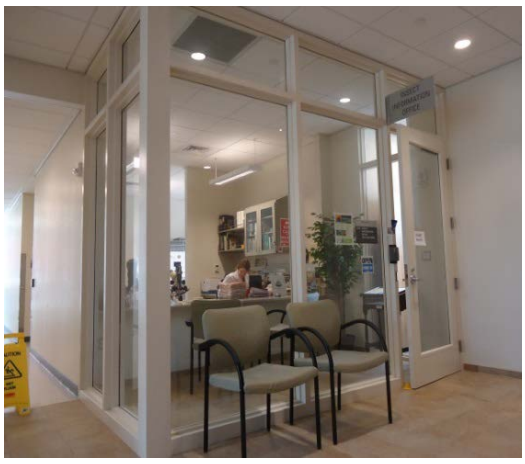
Telephone/Internet Inquiries: We receive approximately 200 calls and emails from the public each year requesting information on issues such as pesticides in food and the environment, heavy metals in food, soils, and consumer products. In some instances, we refer the caller to a more appropriate CAES department or state agency.

Station Bulletins and Fact Sheets: Station Bulletins are typically published annually by our Department. These bulletins are available in printed form and on the CAES website (www.ct.gov/CAES). They are also available at libraries throughout Connecticut. Fact sheets are articles written for the general public regarding topics of timely and widespread interest. These are also available on our website and in printed form.

DEPARTMENT OF ENTOMOLOGY

The Department of Entomology is involved in a variety of service, research, pest surveillance, and plant regulatory activities. The primary service activities are provided through the Kenneth A. Welch Insect Information Office (IIO). Staff in this office answer insect-related questions and identify insects and related arthropods for the public, government agencies, growers, and business organizations. All scientists provide information to citizens of Connecticut by answering telephone inquiries, making farm visits, participating in meetings of growers and other groups, and speaking on their research. Most of the research in the Department has a major applied aspect, addressing the integrated management of ticks, pests of field crops, nurseries, and orchards, wood-boring insects, invasive insects, and honey bees and other bee pollinators.

The Office of the State Entomologist at the Connecticut Agricultural Experiment Station, created by the Connecticut General Assembly in 1901, is part of the Department of Entomology with responsibility, in part, to ensure our nursery industry is free of plant pests and certify their products for shipment to other states and outside the United States. The Connecticut Green Industry (i.e., nursery, greenhouse, floriculture, sod, Christmas trees) is the largest agricultural business in Connecticut. The industry estimates that environmental horticulture generates $1.022 billion gross income supporting 48,000 full and part-time jobs in Connecticut. In conjunction with regulatory activities, Department staff conducts a surveillance program in Connecticut for a variety of established pests and for exotic plant pests, some of regulatory concern, that represent a threat to our green industry, forests, and urban ornamental trees and shrubs. Surveillance for plant pests is performed in partnership with the United States Department of Agriculture (USDA) through the Cooperative Agricultural Pest Survey (CAPS) program and the U.S. Forest Service. In addition, we participate in a Forest Pest Survey and Outreach Program supported by the USDA. For plant diseases of regulatory concern, we work closely with the Plant Disease Diagnostic Laboratory in the Department of Plant Pathology and Ecology. We also conduct forest health surveys and a statewide aerial survey for gypsy moth defoliation (and any defoliation by other insects) and a gypsy moth egg mass survey. The results of our plant and forest surveys for 2015 may be found later in the Department's research activities along with summaries of our regulatory activities. The Office of the State Entomologist and the Apiary Inspector also oversee registration of beekeepers and inspection of honey bee colonies for pests and disease.



The Insect Information Office

The staff of the Department of Entomology also take a lead in providing extensive outreach activities for the Experiment Station by providing information to both children and adults about the Experiment Station's research at public events and at health and agricultural fairs, such as the Eastern States Exposition (Big E) in Springfield, MA; Celebrating Agriculture in Woodstock, CT; the Garden Expo in Fairfield, CT; the Yale Peabody Museum's Biodiversity Day, Norwalk-Wilton Tree Festival, and the Connecticut Flower and Garden Show. The Insect Information Office is located in the new addition to the renovated Jenkins-Waggoner Laboratory and has a laboratory, office, public reception, and a climate controlled collections room.

Service Activities

Insect Inquiry Office: Dr. Gale E. Ridge works out of the New Haven insect information office. Insect identification services date back to nearly the inception of the institution starting with the first Annual Report of the Connecticut Agricultural Experiment Station published in 1877. The station announced that it was offering to "identify useful or injurious insects…..and to give useful information on the various subjects of Agricultural Science for the use and advantage of the citizens of Connecticut."

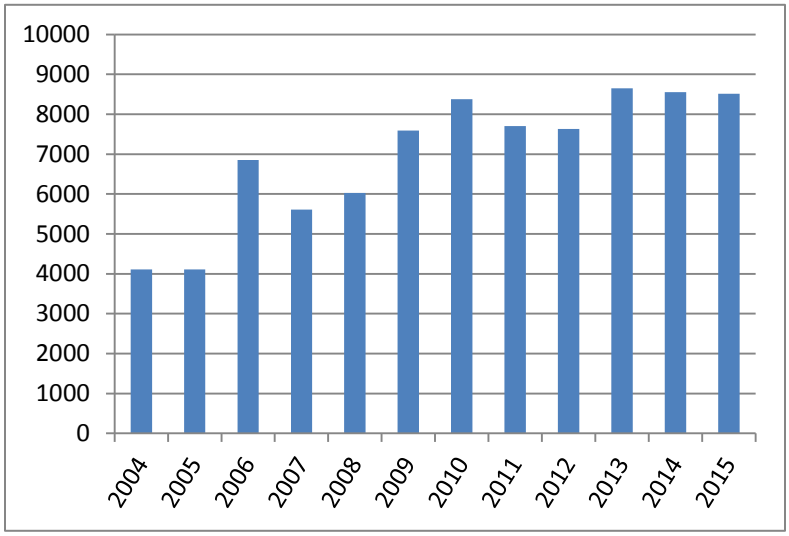


Figure 1. Number of inquiries from FY 2004/2005 to FY* 2015/2016.

Since 2000, there has been a trend away from traditional communication such as mail and visitors to mostly cell phone calls and the internet. Phone calls remain the primary citizen contact followed by email inquiries.

The office serves private citizens, pest management professionals, the real estate industry, nurseries, land care businesses, arborists, health departments, other medical professionals, charities, manufacturing, the hospitality industry, schools, colleges, and universities, housing authorities, museums, municipalities, libraries, law enforcement, state government, and the media. Between July 1, 2015 and June 30, 2016, the insect inquiry office handled at least 8,516 recorded inquiries. There were 961 categories of inquiries including insects, arachnids, animals, use of pesticides, insect damage, general entomology, and horticultural issues. Of these, 38% were related to man and medical issues, 3% undetermined, 54% natural resources, and 5% food related. Bed and bat bug inquiries remain the leading inquiry with 2,782 (33%) of the identifications performed by the office. Delusory parasitosis cases continue to remain high with 189 requests for help (3%). These are time-consuming psychological cases that encompass multiple phone calls, emails, and visits which often involve medical professionals. In order of numbers, the second highest query were beetles (437), followed by Gypsy moth (407), mosquitoes (402) then ticks, animals (especially chipmunks and voles), honey bees, hemlock woolly adelgid, and forest pests. This last spring (2016), there was a more severe outbreak of the Gypsy moth (*Lymantria dispar dispar*) compared to 2015 with widespread defoliation in Middlesex and New London Counties. As it was during the springs of 2014 and 2015, there was little to no rain at a crucial time to either prevent or reduce inoculation of the caterpillars by the spores of the entomopathogenic fungus *Entomophaga maimaiga*, which needs moisture to infect the insects. In addition to this, an incursion of winter moth in eastern

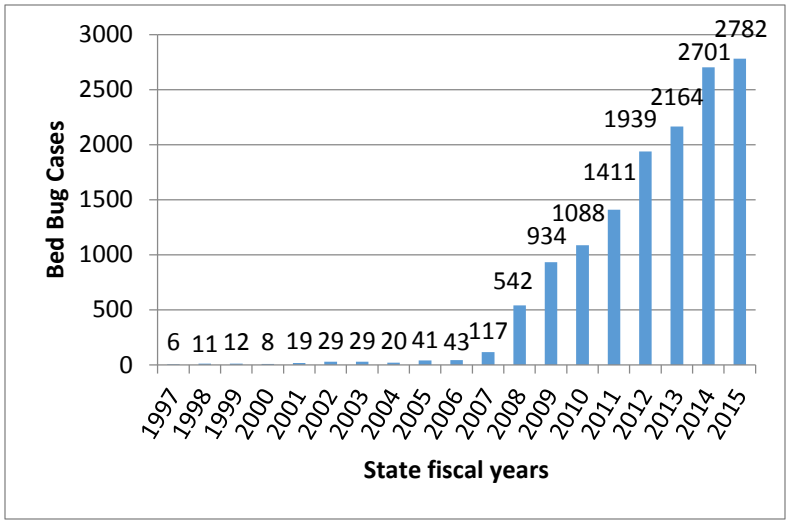


Figure 2. Number of bed bug inquiries from FY 1996 to 2015.

Connecticut towns from Rhode Island compounded defoliation. During September and October of 2015, Drs. Ridge and Stafford assisted in a murder case by estimating the time a young woman's body was exposed to black blow flies (*Phormia regina*) using forensic entomology techniques. During the fall of 2016, Dr. Ridge ran numerous trainings on bed bugs for the Mattress Recycling Council as part of a requirement for a recently enacted Connecticut mattress recycling law, Act 13-42. On May 3, An Act Concerning the Rights and Responsibilities of Landlords and Tenants Regarding the Treatment of Bed Bugs passed the Connecticut House and Senate to become law. Written by attorney Judith R. Dicine (CCABB legal counsel) assisted by Dr. Ridge and lead by Representative Larry Butler (Waterbury district), it took five years to get the law passed.

Tree stripped by Gypsy moth caterpillar feeding. Photo: Robert Standish, Hadlyme, CT.

The office continued to lead in public outreach. In February 2016, Dr. Ridge and the Connecticut Coalition Against Bed Bugs (CCABB) board arranged to have a second display of a bed bug informational billboard put up on the I-91 (Hartford) and I-95 (Bridgeport) interstate corridors. There were numerous State and New England wide presentations and training programs for bed bugs as well. The Connecticut Coalition Against Bed Bugs chaired by Dr. Ridge continued to publish public education outreach material, provide bilingual services, and held bed bug forum number IX in April 2016. The office also nurtures young scientists and has had Eva Muca from Southern Connecticut State University and Sarah Saxe from Amity High School in the laboratory researching bed bug and cockroach behavior and interactions. The office continues to build collaborative relationships and led projects with local, state, and federal agencies to better serve the needs of the citizens of Connecticut.

CAPS and Forest Pest Programs: The Cooperative Agricultural Pest Survey and Forest Pest Survey and Outreach Project (FPSOP), supported by the USDA-APHIS-PPQ and overseen by State Survey Coordinator Katherine Dugas and Deputy State Entomologist Dr. Victoria L. Smith, are two programs that provide for pest survey and educational outreach on the identification and risks posed by a number of potential invasive insects and plant diseases. With worldwide trade and travel increasing, we are at an increased risk of foreign plant species, plant diseases, and insect pests being introduced into the U.S. In Connecticut, the CAPS program has largely conducted surveys in nurseries, Christmas tree farms, state parks, and conservation and public lands. In 2016, CAPS is surveying for a number of oak and maple insect pests and the plant pathogen *Phytophthora ramorum*. This includes the biosurveillance program for exotic beetles related to the emerald ash borer using the native *Cerceris* wasp. Additional grape and orchard commodity surveys are supported by the Farm Bill. The FPSOP program main objective is outreach and education about handling the loss of ash from the emerald ash borer and also works with the national Don't Move Firewood Campaign and Connecticut Master Gardeners.

Bird and Butterfly Garden: The Bird and Butterfly Garden is a partnership of The Federated Garden Club of Connecticut, the Spring Glen Garden Club of Hamden, and The Connecticut Agricultural Experiment Station. Most maintenance and improvements to the garden are done by farm manager Richard Cecarelli and his staff. The garden is open to the public Monday-Friday 8:30 a.m.-4:00 p.m., it is closed on the weekends and state holidays. The garden creates several favorable habitats for our native birds, butterflies, and pollinating insects and helps us determine which plants may work best in Southern Connecticut gardens. Plants are labeled for easy identification. The Bird & Butterfly Garden at Lockwood Farm is listed in the "Nature Conservancy Open Days Directory for New England."

Jeffrey Fengler and Jane Canepa-Morrison observed 10 different butterfly species, 14 species of birds, and 11 other species around the garden on Plant Science Day on August 5, 2015.

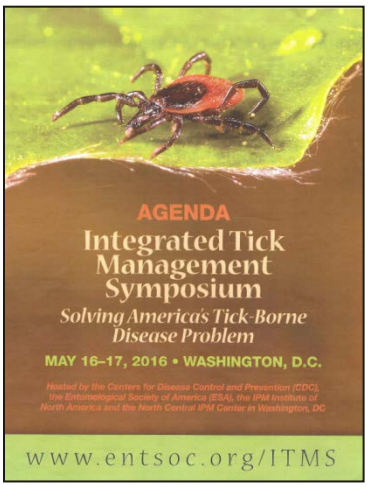
Butterflies & Moths	*Birds*	*Other*
Cabbage White	Northern Mockingbird	European Honeybee
Eastern Tiger Swallowtail	Mourning Dove	Green Frog
Silver-spotted Skipper	Turkey Vulture	Bumblebee spp.
Peck's Skipper	Barn Swallow	Large Milkweed Bug
Tawny-edged Skipper	European Starling	Carolina Locust
Monarch	Gray Catbird	Japanese Beetle
Clouded Sulfur	Red-winged Blackbird	Wandering Gilder (dragonfly)
Question Mark	House Finch	Carolina Locust
Eastern Comma	Rock Dove	Common Green Darner (dragonfly)
Giant Swallowtail	American Goldfinch	Clamptip Emerald (dragonfly)
Spicebush Swallowtail	Red-tailed Hawk	Beefly sp.
	Chipping Sparrow	European Paper Wasp
	Great Blue Heron	
	Sharp-shinned Hawk	

Sponsored Meetings and Conferences: The annual Forest Health Workshop was held in Jones Auditorium at the Experiment Station on March 1, 2016. This annual workshop included cooperators from DEEP, UConn, UConn Extension, and USDA, and is a conversation among those of us concerned with the health of the forests. Station presenters included Philip Armstrong, Carole Cheah, Katherine Dugas, Yonghao Li, Chris Maier, Claire Rutledge, Kirby Stafford, Peter Trenchard, Jeff Ward, and Scott Williams. Victoria Smith organized the event. There were 60 people in attendance.

Tia Blevins, Katherine Dugas, Jeff Fengler, Steve Sandrey, Victoria Smith, and Peter Trenchard participated in the annual meeting of the Eastern Plant Board/Horticultural Inspection Society/Cooperative Agricultural Pest Survey, held at HarbourTowne Resort in Saint Michaels, MD on

April 4-7, 2016. Steve Sandrey received the Distinguished Service Award from the HIS. There were approximately 80 participants at all three concurrent meetings.

Dr. Kirby Stafford served on the planning committee of the Tick IPM Working Group with members from the Centers for Disease Control (CDC), University of Rhode Island, and the IPM Institute of North America, Inc. for a national Tick IPM Symposium sponsored by the Entomological Society of America (ESA) and the CDC, which was held in Washington, D.C. on May 16-17, 2016.



Research Activities
Integrated Tick Management (ITM)

Lyme disease (LD) continues to be the most commonly reported vector-borne disease in the United States. According to the Centers for Disease Control and Prevention, it affects over 300,000 people each year. The blacklegged tick, *Ixodes scapularis*, is the vector for *Borrelia burgdorferi*, the causal agent for Lyme disease, and at least five other human pathogens.

In the interdepartmental integrated tick management project, Dr. Kirby C. Stafford (Department of Entomology), Dr. Scott C. Williams (Department of Forestry and Horticulture), and Dr. Goudarz Molaei (Department of Environmental Sciences), began the fourth year of a field study at residences in four neighborhoods in Redding, CT, which aimed at estimating the effectiveness of integrated and individual management strategies in reducing tick populations and human exposures to tick-borne diseases in residential areas. The project was funded by a cooperative agreement (i.e., grant) from the Centers for Disease Control and Prevention (CDC) for the period from 2012 through 2016. The neighborhoods in the ITM study were: 1) an untreated control; 2) homes treated with a combination of a fipronil-based rodent bait box (Select TCS™) and spray applications of the entomopathogenic fungus *Metarhizium anisopliae* (Met52® EC); 3) a neighborhood designated only for a white-tailed deer (*Odocoileus virginianus*) reduction program; and 4) a neighborhood with homes utilizing the combined treatment with bait boxes and *M. anisopliae* and limited deer reduction conducted in 2013 and 2014.

Fipronil-based rodent bait box

Technicians Heidi Stuber, Megan Linske, and Michael Short assisted with sampling of black-legged tick (*Ixodes scapularis*) and white-footed mouse (*Peromyscus leucopus*) populations in the four residential neighborhoods where the field experiment is being conducted with seasonal resource assistants Sarah McQuade, Megan Carroll, Erica Rayack, and Magali Bazzano in 2016. Host-seeking ticks were sampled by dragging the perimeter of each property biweekly May-August and white-footed mice (*Peromyscus leucopus*) were live-trapped using Sherman box traps. Each captured mouse was sedated, marked with a unique ear tag, processed for ticks, and a blood sample was taken for serological analysis. Results from

the first three years of the study showed the combined bait box and *M. anisopliae* applications reduced host-seeking nymphal blacklegged tick populations on residential properties by an average of 85.7, 71.1, and 92.0% in 2013, 2014, and 2015, respectively. The deer component of the project was terminated in 2015 with the removal of only 11 deer due to opposition from local hunters despite town support. We found a significant ($P < 0.05$) reduction in host-feeding ticks on white-footed mice at the properties treated with the fipronil-based bait from 2013-2015. While the results for the fourth year (2016) are pending, three years of data indicate that an integrated control approach to tick management using a spray application and bait boxes can effectively reduce tick abundance and the risk of Lyme disease and other tick-associated diseases.

Rodent Targeted Vaccine (RTV)

A residential field study of oral Lyme disease bait targeting the reservoir mouse and chipmunk hosts was begun in spring 2015 and continued in 2016 by Drs. Kirby C. Stafford, Scott C. Williams, and Goudarz Molaei working with U.S. Biologic Inc. The Lyme disease vaccine is an OspA-based vaccine, which has been shown to reduce the prevalence of infection in the rodent hosts and subsequently in the blacklegged tick population in the laboratory and in an initial forest plot study. However, a new bait formulation has not been evaluated, especially in a residential setting. The bait is delivered in bait boxes to quantify delivery and consumption. There are 22 home sites receiving the RTV bait and 11 control (untreated) properties. Studies using the biomarker Rhodamine-B in untreated bait in 2014 at the participating properties showed that the bait formulation was readily consumed by nearly 81-92% of the mice. Bait consumption in 2015 and 2015 has been high. Blood samples from live-captured mice will be tested for response to the vaccine and ticks collected from the homes will be tested for the Lyme disease spirochete *B. burgdorferi*, and the pathogens that cause anaplasmosis and babesiosis.

Comparison of the bait with and without the Rhodamine-B red dye (left) and an open bait box with the RTV bait (right).

Impact: Lyme disease continues to be a major public health concern with around 300,000 cases in the United States each year. Integration of several tick reduction strategies and evaluation of new methods should help provide homeowners and small communities with information on ways to reduce tick numbers or the prevalence of infection sufficiently to reduce the risk of disease.

Tick Overwintering Study

With support from the Northeast IPM Center, the first year of a study looking at the survival of *I. scapularis* under different environmental conditions was conducted by Dr. Kirby Stafford and Dr. Scott Williams at CAES and Charles Lubelczyk at the Maine Medical Research Center Institute (MMRCI) over the winter of 2015-2016. Previously, we had found a positive relationship between greater winter precipitation and snow and an increased abundance of *I. scapularis* nymphs the following summer. Snow can moderate temperatures and provide moisture. This study examined survival with no cover, leaf litter

cover, snow cover, or both leaf litter and snow cover. Nymphal ticks were placed in special "tick pots" buried in the ground (white top in left picture in leaf litter below) with temperature and humidity data loggers. The study was conducted at Lockwood Farm in Hamden, CT and in Cape Elizabeth, ME. The lowest survival (77%) in Connecticut was observed for the ticks where both leaf litter and snow were removed. By contrast, the highest survival (94%) was obtained in the tick pots with no leaf or snow removal, where the habitat was most conducive to overwintering survival. Tick survival in Maine was much lower, ranging from only 3 to 23%.

Tick pot without leaf cover (left) and covered with snow (right).

Pollination of Pumpkin and Winter Squash in Farm Fields in Connecticut

Pumpkins and winter squash are entirely dependent on insects to carry pollen from male flowers to female flowers in order to set fruit. Dr. Kimberly Stoner, with assistance from Morgan Lowry and seasonal research assistants, has been studying pollination of pumpkins and winter squash in experimental field plots and on farmers' fields in Connecticut starting from 2012 until 2015. These farmers' fields ranged in size from 0.02 ha to 10.9 ha in area, and included those with and without pesticides, and growing only pumpkin or a diversity of pumpkins and winter squash (*Cucurbita* spp.). Although farmers are primarily interested in effects on yield, direct measurement of pollen deposition can be useful for evaluating whether pollination deficit or adequacy is affecting yield, or whether other factors may be limiting yield.

In experimental plots at Lockwood, Griswold and Windsor, fruit set, survival to harvest, and fruit characteristics (weight, diameter, seed number, and seed weight) were compared for pumpkin (*Cucurbita pepo* (L.) cv. Gladiator) female flowers with natural or supplemental pollination in seven trials in three years. No significant differences were found for any of these characteristics. In these sites and in 74 additional sites in farmers' fields, pollen deposition was found to be generally above the level needed for full fruit set, based on data for pumpkin from the horticultural literature.

Peponapis female.

In previous years, we found that counting bees along field transects, the method used in previous studies of pumpkin and squash pollination, was not an accurate predictor of pollen deposition in the field. In order to understand this further, we began making video recordings of bee behavior on female pumpkin and squash flowers in 2014, and in 2015 we made videos of behavior on both male and female flowers. In the 41 hours of video data of female flowers from 8 farms we have analyzed so far, bees make contact with the stigma (the female reproductive organ) of the flower at a rate of 0.50 bees per minute. At this rate, the 13 bee visits per stigma required for full pollination, according to the horticultural literature, would be

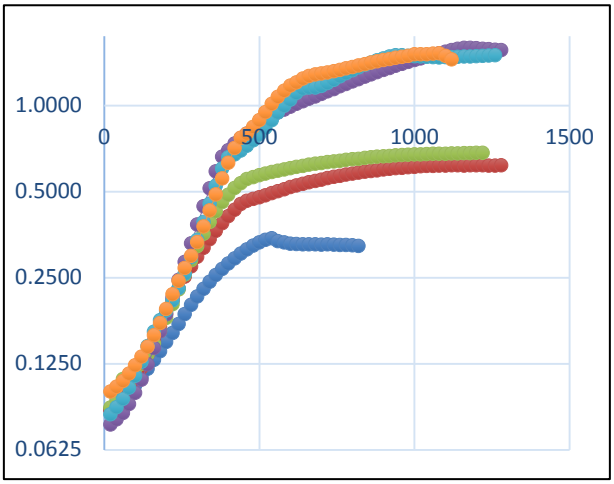
accomplished in 26 minutes, although the female flowers are open and receptive to pollination for several hours from dawn until about 11 a.m. What is remarkable about these data is that even though the proportion of the three major bee species varied tremendously from one farm to another, the rate of bee contact with the stigma were still high at all the farms. The common eastern bumble bee (*Bombus impatiens*) was the most abundant pollinator, accounting for 68% of contacts with the stigmas over all farms, but on one farm this species accounted for only 17% of the contacts, while on another it made all 100% of the contacts. Still, the rate of bee contact with the stigma on the two farms was 0.48 and 0.39 bee contacts per minute, respectively.

In conclusion, all the pumpkin and squash fields we studied had adequate pollination for good yield over four years of study. We are dependent on just three bee species for nearly all pollination of these crops, and some farmers are depending on only one species for all of their pumpkin and squash pollination. We need especially to pay attention to the health of *Bombus impatiens*, which is the most important pollinator of this crop, and which also pollinates many other vegetable and fruit crops.

Protecting honey bee hives from American Foulbrood Disease and Nosemosis

Diseases of honey bees caused by bacterial and fungal infections (i.e., American foulbrood (AFB) and nosemosis, respectively) continually cause considerable economic loss to beekeepers and agriculture. Dr. Douglas W. Dingman, has continued investigations on the bacterium *Paenibacillus larvae*, causative agent of the disease AFB in larvae of honey bees (*Apis mellifera*). Enzyme kinetic studies of *P. larvae* enolases have now been determined to have a significant difference in activity rate (i.e., Vmax and Km values) when compared between genotypes. Kinetic parameters for strain NRRL B-9545 (genotype ERIC I)(Vmax=0.5 mmoles/min/mg; Km=0.57 mM) and strain SAG 10367 (genotype ERIC II)(Vmax=0.7 mmoles/min/mg; Km=0.33 mM) revealed a 3-fold higher catalytic efficiency for enolase in the ERIC II strain in comparison to enolase in the ERIC I strain. If enolase activity affects growth rate (enolase is a key metabolic enzyme involved in glycolysis), then virulence (rate of lethality) will likely be influenced. A difference in growth rate was not observed between genotypes. Therefore, the difference in enolase kinetics between subspecies of *P. larvae* was interpreted as not influencing growth rate.

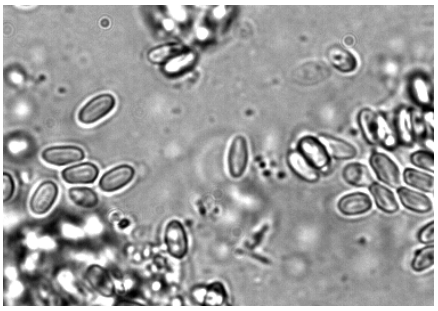
Measurement of bacterial growth rate profiles between strains of *P. larvae* subspecies *larvae* (*Pll*) and *P. larvae* subspecies *pulvifaciens* (*Plp*) have demonstrated a subspecies difference in total cell density at the end of logarithmic growth. This difference in density is hypothesized to be a result of thiamine limitation. *Pll* strains are unable to synthesize thiamine, whereas, *Plp* strains synthesize thiamine. Initial tests supplementing growth medium with thiamine for *Pll* strains demonstrated some increase in cell density. It is possible that thiamine limitation has an influence on lethality differences that are observed between the different subspecies.



Growth profiles showing different cell densities following logarithmic growth.

Having complete genomes from multiple strains of each *P. larvae* subspecies will aid molecular investigations into disease differences. Currently, four complete or partial genomic DNA sequences are available in the NCBI GenBank database. The complete genomic DNA sequence for *P. larvae* strain SAG 10367 (*Plp*) has been determined and a rough assembly of the genome has been performed. Confirmation and polishing (i.e., correction analysis) of the assembly is in progress. Genomic DNA for three other strains have been purified and analyzed in preparation for genomic DNA sequencing. ERIC-

PCR analysis was performed for proper subspecies classification on new bacterial strains obtained over the year and to confirm identity of strains undergoing genomic DNA sequencing. Twenty-six 16S-rDNA sequences obtained for various *P. larvae* and *Brevibacillus latersporus* strains were released to the International database repository NCBI GenBank as a means to aid in the differentiation and classification of these similar bacteria.



Spores of *Nosema* sp. in honey bee feces.

Nosemosis, caused by the microsporidia *Nosema ceranae* and *Nosema apis*, is a disease of honey bees that largely goes undetected by beekeepers until the bee hive is near collapse. Because this disease is prevalent in CT bee hives, Dr. Douglas Dingman has organized workshops to train Connecticut beekeepers on microscopic analysis of honey bees for the presence of Nosema. This workshop trains beekeepers to effectively use a compound microscope and how to estimate the level of infection within a bee hive using sequential sampling. Through this simple procedure, the relative health of the bee colony can be determined and corrective measures employed if needed.

Impact:

Beekeepers, being aware of the prevalence of these diseases, wish to make informed decisions on control and treatment procedures of the diseased hives. The findings and presentations given this year help beekeepers (and scientists studying these diseases) better understand the characteristics of these microbial diseases. Advancing knowledge pertaining to *P. larvae* genomic organization and gene content will aid future scientific investigation exploring comparative differences in disease properties at the level of the genome.

Determining the biological source of bacterial contamination of three CT watersheds

Microbial Source Tracking (MST) is a method of using molecular biological techniques to amplify and identify bacterial DNA within a water sample for the purpose of specifically identifying the biological source of the bacterial contamination. This procedure provides a much more specific approach to identifying the source of fecal contamination of waterways. In cooperation with Mark Cooper (Director of Health, Westport Weston Health District), Peter Fraboni (Earthplace, Westport, CT), and Dr. Adalgisa Caccone (Yale University), Dr. Douglas W. Dingman has begun a one-year survey to perform MST on three waterways (Sassco Brook watershed, Goodwives River watershed, and Farm River Watershed) that drain into Long Island Sound from CT. Filtered water samples are being collected and frozen at -80C, monthly. DNA extraction, amplification, and source identification of the bacteria within the samples will begin shortly.

Biosurveillance for Exotic Buprestidae and the Wasp Watcher Program

The wasp watcher program was begun in the spring of 2010. *Cerceris fumipennis* is a native digging wasp that provisions its nest with adult Buprestidae, including emerald ash borer. It is used as a tool for detecting and monitoring emerald ash borer and other invasive buprestid species by intercepting its prey as female wasps return to their nest. The wasp was responsible for the first detection of EAB in Connecticut, and remains our main tool for detecting and monitoring EAB in the state. We are in the seventh year of our Wasp Watcher program. Over the course of the program, we have trained 125 watchers. In 2016, 28 watchers from previous years are signed on, 10 for their sixth year, as well as 7 new watchers. Since 2010, Watchers have collected over 8,000 beetles and detected EAB in 32 new towns. We have also used this system to examine the native buprestid fauna of Connecticut, and have detected over 70 species of beetles with this tool. Of these, 21 are new state records. One of these,

Agrilus smaragdifrons detected in 2015 in Berlin, CT, is a newly detected non-native species from Asia. While little is known about its biology, it appears to feed on Tree of Heaven.

New Wasp Watchers at White Memorial Conservation Center proudly show off a caught beetle.

Classical Biological Control of Emerald Ash Borer

Following the detection of EAB in Connecticut, the determination was made to join the USDA APHIS/PPQ biological control program for EAB. In May 2013, Dr. Claire Rutledge began releases of the gregarious endoparasitoid *Tetrastichus planipennisi* and the egg parasitoid *Oobius agrili* in Middlebury and Prospect, CT. The parasitoids are shipped from the USDA APHIS emerald ash borer mass-rearing facility in Brighton, MI. Releases have been made in ten towns in Connecticut altogether, the others being Hamden, Sherman, Cromwell, Litchfield, Plymouth, Simsbury, East Haddam, and East Windsor. Each release site receives parasitoids for 2 years. As of June 2016, 162,902 *T. planipennisi* and 29,928 *O. agrili* have been released.

After releases, the next step is to determine if the parasitoids have established in the environment. Our first two release sites, Middlebury and Prospect did not receive any releases in 2015. In fall 2015, we peeled trees at those sites, and sites nearby looking for EAB larvae parasitized by *T. planipennisi*. We found them both at the initial release site, and at sites up to 2.5 m from the original site, strongly suggesting that the parasitoid has established in Connecticut, and is spreading. We are still attempting to recover the much smaller, and elusive *O. agrili*.

Larvae of the endoparasitoid *Tetrastichus planipennisi* and the remains of an EAB larva. Canfield Park is approximately 2.5 m from the release site in Prospect, CT.

Host Range of Emerald Ash Borer

Flower of white fringetree, a newly discovered host of EAB.

Emerald ash borer is known to attack and kill all species of North American Ash (genus *Fraxinus*). In 2014, it was discovered that EAB can also attack and kill another native tree, White Fringetree (*Chionathus virginicus*), which is in the same family as ash. In the summer of 2015, in collaboration with Dr. Adriana Arango-Velez (Department of Forestry and Horticulture) experiments were conducted to compare the ability of EAB to utilize white fringetree as a host with its ability to utilize white ash. We also looked at the impact of drought on the trees' interaction with the borer. It was found that while EAB can survive in white fringetree, by all measures of larval establishment, survival and growth rate, white ash is a superior host for EAB. This suggests that white fringetree is unlikely to be as adversely impacted as ash by EAB, but that it could serve as a reservoir host in situations where ash is no longer present.

Southern Pine Beetle in Connecticut, expansion of geographical and host range

Southern pine beetle (SPB) *Dendroctonus frontalis* (Coleoptera: Curculionidae), has been a major pest of the timber industry in the south for years. It has been moving northward from Honduras over the last 400 years. It was discovered in Long Island in October 2014. It was discovered in Connecticut in March 2015 on red pine in Wharton Brook State Park. Since this initial discovery, we have detected SPB across the state in all counties except Tolland and Windham and in six species of tree: red pine, Scots pine, pitch pine, Norway spruce, white spruce, and white pine. Traps set along a north-south gradient in 2015 found live beetles in only the southernmost sites, suggesting that SPB did not survive the winter in northern Connecticut. However, in summer 2016, traps at the same sites found SPB in both the southern sites and two more northern sites. Numbers of individuals trapped are still very low, and no new tree infestations have been found, but the suggestion that SPB is overwintering is of concern. Work is ongoing to understand the potential impact of this beetle in Connecticut. This project is being done in collaboration with Dr. Adriana Arango-Velez (Department of Forestry and Horticulture).

Inner bark of a southern pine beetle-infested red pine from Wharton Brook State Park. You can see adult galleries, larval galleries (round), and the blue stain fungi, which the beetle carries and helps to kill the tree.

Range Expansion of the Japanese Cedar Longhorned Beetle

The Japanese cedar longhorned beetle (*Callidiellum rufipenne*) was discovered in potted arborvitae in Connecticut in 1998. This discovery marked the first time that this exotic beetle was found in Connecticut and was associated with live plants. Based on an extensive survey conducted between 1999 and 2001, this newly introduced threat to woody plants in the cedar family was confined largely to the southern four counties (one record from the southernmost point in Hartford County). During the survey, beetles were detected with trap-logs of various species of cedar by capturing adults on sticky bands around 2-foot sections of trunks and by rearing adults from infested wood.

In 2014, adults of the Japanese cedar longhorned beetle were reared from the dead wood of eastern red cedar (*Juniperus virginiana*), the main wild host, to the north of the previous known distributional range. Based on this find, Dr. Chris Maier and his assistants, Morgan Lowry and Tracy Zarrillo, initiated a new survey in 2016 to determine the current distribution of this potential nursery pest. Fortunately, a less labor-intensive method was available for the survey because Dr. Maier had discovered that adults of this invasive beetle were attracted to traps baited with lures that contained ketols.

Adult male of the Japanese cedar longhorned beetle.

During the first of a two-year survey with traps baited with a lure of ketols and ethyl alcohol, Dr. Maier and his assistants found that the beetle had expanded its range northward to the Massachusetts state line. The beetle was found in 99 towns in eight counties in 2016, whereas in 1999-2001 it was captured in 56 towns in five counties. Next year, the survey will focus on towns in the northwestern and northeastern part of the state where few traps were deployed in 2016 and where few beetles were captured. Although the survey is only at its midpoint, it is clear that potted junipers and cedars in garden centers or stressed landscape plants in the northern half of the state, as well as the southern half, may potentially be infested by this invasive beetle.

Attraction of the Japanese Cedar Longhorned Beetle to Novel Attractants

Although Dr. Maier discovered that adults of the Japanese cedar longhorned beetle were attracted to a lure of mixed ketols that were commercially available, he also participated in research to develop an even better attractant. In a cooperative project that was organized by Yunfan Zou, University of California at Riverside, it was discovered that both males and females respond significantly better to a blend of racemic 3-hydroxyhexan-2-one and a novel natural product, 1-(1*H*-pyrrol-2-yl)-1,2-propanedione than to other chemicals. The reason for the attraction to pyrrole, which apparently acts as synergist that is not produced by the beetles, remains a mystery. If a lure that contains 3-hydroxyhexan-2-one and the pyrrole were produced commercially, it would provide a powerful tool for detecting the invasive longhorned beetle in new areas.

Impact of the Lily Leaf Beetle

The lily leaf beetle (*Lilioceris lilii*) feeds upon Asiatic and Oriental lilies that are grown throughout Connecticut. Both the larvae and the bright red adults of this European beetle devour the foliage and the flowers of lilies, sometimes killing plants. Although this invasive beetle prefers Asiatic lilies, it has spread from gardens into the wild where it now threatens the health of native lilies, such as the Canada lily (*Lilium canadense*), the Turk's-cap lily (*L. superbum*), and perhaps other plant species in the lily family.

In earlier research, Dr. Maier and his assistants documented that the lily leaf beetle has a negative impact upon the growth of the Canada lily. In 2016, new research was initiated to evaluate the potential threat to other liliaceous plants. Based on initial choice experiments in the laboratory, this invasive beetle readily feeds upon Canada lily, Indian cucumber (*Medeola virginiana*), Solomon seal (*Polygonatum pubescens*), and twisted stalk (*Streptopus roseus*). Field work in northern Connecticut has revealed that the adults will feed and lay eggs upon twisted stalk, as well as the Canada lily. Based upon initial field experiments, however, the larvae cannot complete development on Solomon seal, Indian cucumber, or twisted stalk.

Longhorned Beetles of Connecticut

Longhorned beetles (family Cerambycidae) have been collected in Connecticut since the mid-1860s; nonetheless, relatively little is known about their biology within the state. Dr. Maier and his assistants are engaged in a long-term study of the identity, the distribution, and the hosts of longhorned beetles of Connecticut. To gather biological data, they have captured these wood-borers in traps baited with various sex pheromones or host volatiles, reared adults from wood infested by larvae, collected adults on flowers, attracted adults to light-traps, captured adults in flight interception and bait traps, and examined label data on adult specimens in museums.

To date, Dr. Maier and his assistants have recorded 197 species of longhorned beetles in Connecticut. They have reared 98 species from dead or stressed trees in the northeastern United States. Reared species used an average of 3.5 hosts per species. The rearings have revealed the presence of species not previously known from Connecticut and have provided many new larval host records. Among the reared species, the red-headed ash borer (*Neoclytus acuminatus*) had the broadest host range, developing in 32 tree species.

Dr. Maier, Morgan Lowry, and Tracy Zarrillo also are developing a database, which now has entries for over 20,000 specimens of longhorned beetles. Biological data compiled in this database include floral hosts, larval hosts, distribution, activity periods, and methods of sampling. This database will assist in developing management plans for destructive species of longhorned beetles and possibly for species of conservation concern. Ultimately, the database will be used to develop an annotated checklist of the longhorned beetles of Connecticut.

M.C. Thomas

Urgleptes querci, a longhorned beetle with a broad host range and a wide distribution in the Northeast.

NURSERY AND PLANT INSPECTION ACTIVITIES

Plant inspection and regulatory services are coordinated and conducted through the Office of the State Entomologist, whose members are State Entomologist Dr. Kirby Stafford, Deputy State Entomologist Dr. Victoria Smith, Plant Inspectors Peter Trenchard, Stephen Sandrey, Jeffrey Fengler, and Tia Blevins, Apiary Inspector Mark Creighton, and State Survey Coordinator Katherine Dugas.

Nursery Inspection and Certification Two-hundred seventy five nurseries were certified to conduct intra- and interstate business. There were 697 nursery inspections during the growing season.

Nursery Insects and Diseases The most important diseases and pests found in nurseries (in order of prevalence) were aphids on various trees and shrubs, boxwood leaf miner, Rhododendron leaf miner, lacebug, thrips, imported willow leaf beetle, and lily leaf beetle.

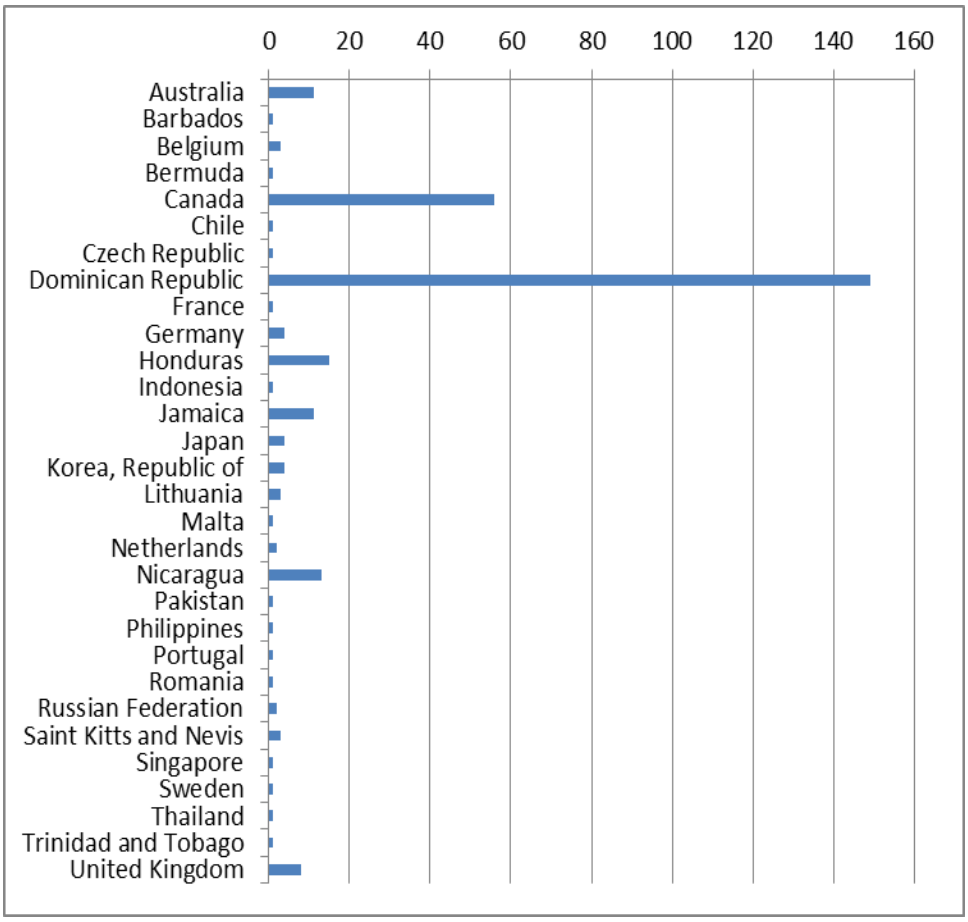
Japanese Beetle Certification to Canada Eight Connecticut nurseries, which met the inspection requirements of the US/Canada Japanese Beetle Harmonization Plan, shipped 26,112 plants to Canada in 2015.

Nursery Dealer Permits Nursery dealer permits were issued to 172 firms. One-hundred forty three of these companies operate individual outlets. The remaining businesses have more than one outlet each. In total, there were 612 outlets.

Phytosanitary Certificates Three-hundred one phytosanitary inspection certificates were issued covering the shipment of the following plant materials to 30 destinations outside the United States. One hundred forty seven consignments were bound for the Dominican Republic (tobacco), fifty seven to Canada (ornamental plants), and fifteen to Honduras (tobacco).

Product	Quantity
Bulbs	169
Bulbs & Tubers (Dahlia & Gladiolas) (# Bags)	192
Bulbs & Tubers (Dahlia & Gladiolas) (Kilos)	7
Chinese Tree Peony (plants)	2
Greenhouse plants	
Rhizomes	38
Plants	371
Nursery stock	
Unrooted cuttings	4,000
Plants (B and B)	19,978
Orchids (plants)	2,922
Perennials	
Bare root plants	1,568
Potted plants	17
Seeds (bags)	242
Seeds (kilos)	44
Tobacco	
Bales	74,100
Boxes	6,109
Bundles	72,999
Cartons	8,125
Pounds	2,268
Walnut shells (bags)	176
Walnut shells (boxes)	1
Walnut shells (cartons)	2
Walnut shells (drums)	353

Destinations for out of country exports from CT are as follows.



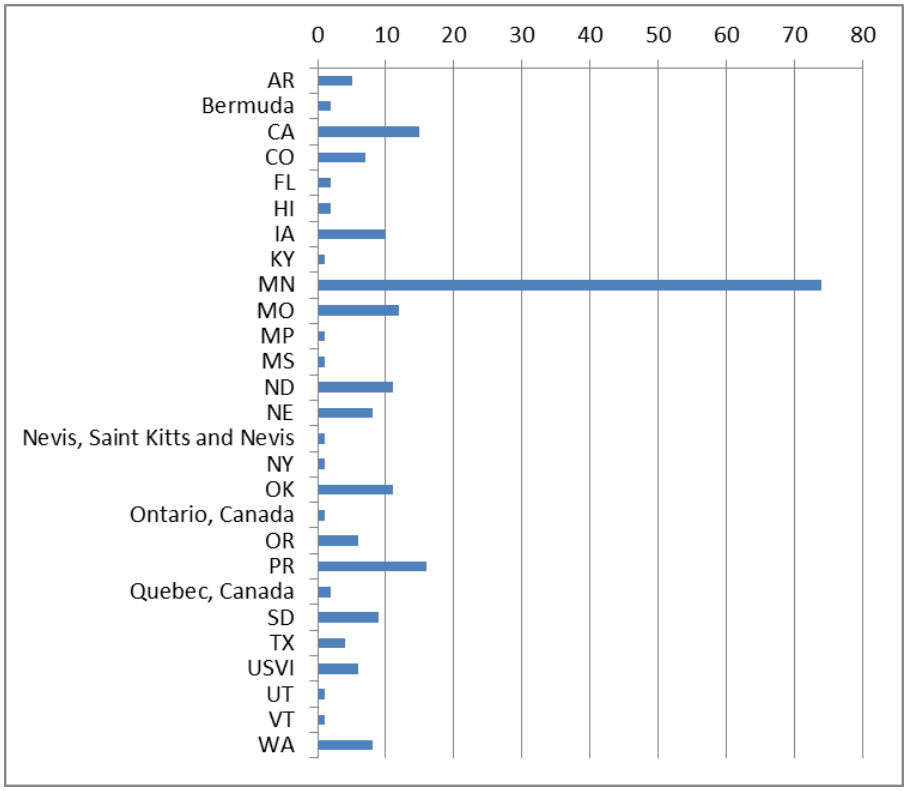
Two hundred eighteen inspections were made to assist nurseries moving the following plants interstate, either to destinations in other states, to the CITES port, or to US Territories and Puerto Rico (27 listed destinations). Seventy two consignments were bound for Minnesota, fifteen to California, and twelve to Missouri.

Product	Quantity
Nursery stock (containers)	50,374
(bare root plants)	1,608
Greenhouse plants	2,321
Seed (# Bags)	33
Orchids	13

Special Inspections Five inspections were made for 311 individual plants to assist homeowners moving out of state.

Permits to move live plant pests, noxious weeds, and soil In 2015, there were seventy-six PPQ 526 Permits (Permit to move live plant pests, noxious weeds, and soil) approved in CT. There were two PPQ 525 Permits (Permit to move soil) approved in CT. There were four Controlled Import Permits issued. There were three permits for Post Entry Quarantine approved.

Destinations for out of state export from CT, including US Territories and Puerto Rico.



Boxwood Blight There were one hundred twenty five inspections for boxwood blight. None was detected at any production nursery on plants originating in CT. Homeowners continue to report boxwood blight on plants in landscapes. Efforts continue to educate landscapers about boxwood blight and its consequences.

Chrysanthemum White Rust In 2015 we inspected 164,837 plants for CWR, caused by *Puccinia horiana*. No positives were detected.

Gypsy Moth Due to drought conditions in spring of 2015, the fungus that usually keeps gypsy moth larvae in check did not "kick in," and there was considerable damage due to larval feeding. We observed defoliation due to gypsy moth on 175,273 acres, mostly in Middlesex, New Haven, and New London counties. Combined damage due to both gypsy moth and winter moth totaled 4,166 acres, mostly in southern New London County. In November and December 2015, a gypsy moth egg mass survey was conducted in 80-95% favorable host sites on a 7-mile grid (102 sites) throughout Connecticut. Egg mass counts were very high in many locations, indicating a high potential for another outbreak in 2016.

Asian Longhorned Beetle We conducted 89 inspections of 7,390 trees in all counties of CT for presence or signs of ALB infestation.

Hemlock Woolly Adelgid and Elongate Hemlock Scale These pests have been present in CT for many years, and continue to cause patchy damage and decline among the remaining population of hemlocks. Statewide in 2015, 6,060 acres were affected by HWA and EHS. Scale insects, such as elongate hemlock scale and circular scale, are increasing in some areas, and may be more of a factor in tree damage and mortality than HWA.

Emerald Ash Borer Emerald ash borer has been detected in all eight counties; the quarantine for this insect was extended statewide to encompass all of Connecticut. Detection efforts include trapping using

purple panel traps and monitoring of *Cerceris* colonies. During aerial survey in 2015, we mapped 2,456 acres defoliated by EAB, and expect acreage and mortality to increase in 2016.

Winter Moth Damage due to feeding by winter moth larvae has been concentrated in coastal New London County, and continues to increase. Over 3,109 acres were affected in 2015. Parasitoids of winter moth have been released in this area, but their effectiveness in reducing populations has not been significant as yet; a lag time of up to 5 years is expected.

Southern Pine Beetle This insect was recently detected in CT, and damage estimates are still in the preliminary stage. The infestation appears to be widespread, however.

Orange Striped Oak Worm Orange striped oak worm caused defoliation on 1,763 acres, mostly in New London County.

Anthracnose Diseases of Hardwoods Anthracnose diseases, caused by a number of foliar-infecting fungi, caused damage on 2,011 acres, scattered statewide.

Red Pine Scale Red pine scale caused damage on just 7.6 acres. Red pine is a very limited species in CT.

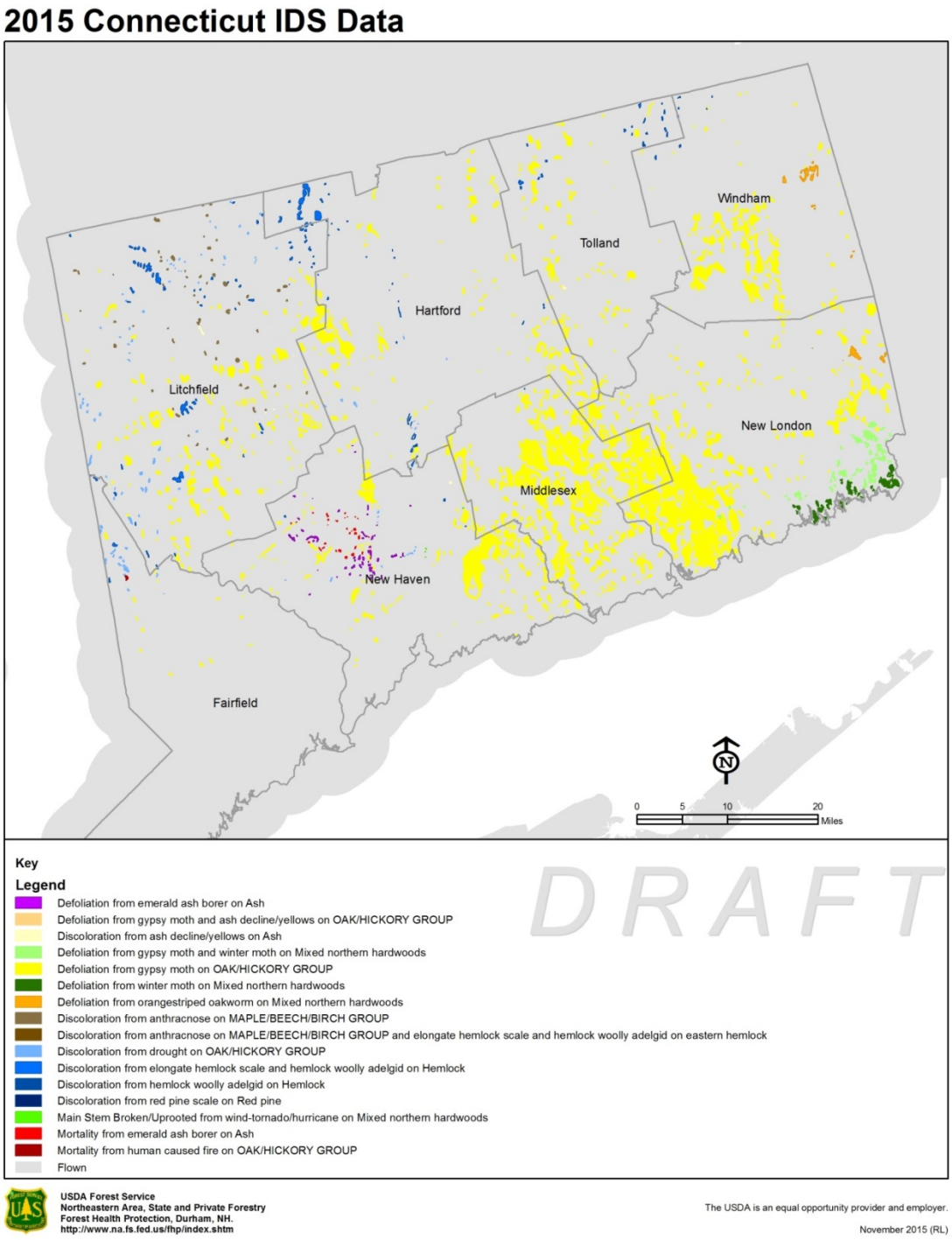
Cynipid Gall Wasp Cynipid gall wasp was detected on the Bluff Point Coastal Reserve in New London County and adjoining areas in the town of Stonington in late 2014. The infestation has not been delimited.

Apiary Inspection During the 2015 season, Connecticut had one thousand three hundred eighty registered beekeepers maintaining 7,080 hives. In 2015, one thousand eighty nine hives were inspected. Unofficial estimates indicate that there could be another 400 beekeepers/800 colonies that have yet to register. Unofficial estimates indicate that over 3000 packages of honey bees were imported into Connecticut for sales to new beekeepers and to replace losses. American foulbrood was detected in three hives; these were destroyed by burning. Colony inspection determined Varroa mite infestation and the viral complex associated with Varroa infestation as the primary reason for colony mortality. CT beekeepers continue to lose colonies overwinter in higher numbers; the Bee Informed Winter Loss report for CT in 2015 was 57.5 % (an increase of 18%). These losses are slightly higher than regional and nationwide trends. The viral pathogens that cause deformed wing virus (DWV), Israeli acute paralysis virus (IAPV), acute bee paralysis virus (ABPV), and even the rare chronic bee paralysis virus (CPBV) were detected in Connecticut as part of the USDA Honey Bee Pests and Diseases Survey. Due to high winter losses in 2015, local beekeepers struggled to replace losses with package bees from southern states. Despite these challenges, beekeeping interest is still strong with over 900 new beekeepers being trained this winter. There were one hundred twenty Apiary Certificates of Health issued. Three certificates were issued for export out of CT, and one hundred seventeen certificates for interstate movement of honey bees.

Environmental Conditions Drought conditions in CT persisted for most of 2015. Drought stress was mapped on 2,367 acres of forested land, and sporadic brushfires have occurred, causing damage on 80 acres. Storm damage was also detected on 29 acres.

During the summer 2015, we established 40 permanent forest plots on state, Nature Conservancy, and municipal water company properties. In this short-term (5 year) survey, we will examine the death/replacement of trees due to emerald ash borer. Within each plot, 20 trees were tagged and will be evaluated for signs of EAB infestation, including branch and tip die back, woodpecker activity, and bark loss. We will measure the trees at Diameter at Breast Height (DBH) as a way to monitor their health. Plots were established in all counties of CT. In general, our forests remain healthy.

Areas of forest damage mapped during the 2015 aerial survey are illustrated below.



DEPARTMENT OF ENVIRONMENTAL SCIENCES

Environmental Chemistry
(Joseph Pignatello)

A. Interactions of Contaminants with Environmental Particles (Dr. Joseph Pignatello, Dr. Charisma Lattao, Dr. Feng Xiao, Dr. Peng Yi, Dr. Beatrix Gámiz, and Mr. Marc Teixidó)

1. Investigation of Sorbate-Induced Plasticization by Solid-State NMR Spectroscopy (Dr. Joseph Pignatello and Dr. Charisma Lattao)

We previously proposed that the sorption of organic compounds in natural organic matter (SOM; e.g., humic substances, soil organic matter, coals) may induce expansion of the nanopores and cause softening, or plasticization of the matter. Such behavior is characteristic of glassy polymers. Sorbate-induced swelling and plasticization are linked to sorption hysteresis of organic compounds which has important implications for the fate and bioavailability of organic contaminants. However, the hypothesis requires molecular-level confirmation. This study aimed to investigate sorbate-induced plasticization of Pahokee peat, a high organic matter soil, for different sorbates using nuclear magnetic resonance (NMR) techniques.

The plasticization of Pahokee peat soil was studied on sorption of different proton-free apolar and polar aromatic and aliphatic compounds, including C_6D_6, $CDCl_3$, CCl_4, C_2Cl_4, CBr_4, C_6D_5Cl, and C_5D_5N. The swelling and plasticization of Pahokee peat soil was verified at the molecular level by ^1H wide-line and two-dimensional wide-line separation (2D WISE) NMR. The use of ^1H wide-line shapes is the traditional technique for studying molecular dynamics, but afflicted by the lack of spectral resolution. 2D WISE, with one dimension displaying ^{13}C chemical shifts and the second showing ^1H wide-line shapes, is capable of providing information on molecular dynamics of specific functional groups.

Our results show that the segments of Pahokee peat soil sorbed with C_6D_6, C_2Cl_4, and C_5D_5N become more mobile, but the changes due to the plasticization were small. Both C_6D_6 and C_5D_5N selectively increased the mobility of specific components: C_6D_6 of the nonpolar alkyl domains, and C_5D_5N of both the nonpolar alkyl domains and aromatic components.

Some liquid solutes at high concentrations (2-5 wt%) are capable of slightly “softening” natural organic matter of a soil, which supports the hypothesis that natural organic matter in Pahokee peat soil is in a glassy state that is subject to plasticization. (Cao et al., 2016)

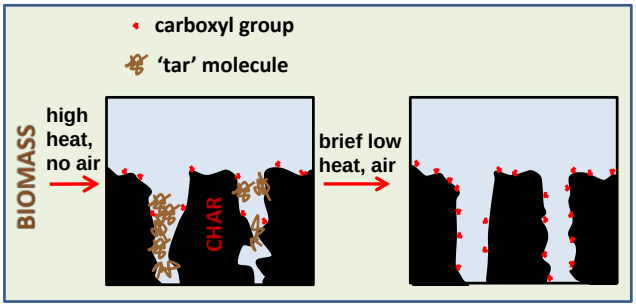
2. ISOT Calc, a versatile tool for parameter estimation in sorption isotherms (Dr. Joseph Pignatello and Mr. Marc Teixidó)

Geochemists and soil chemists commonly use parametrized sorption data to assess transport and impact of pollutants in the environment. However, this evaluation is often hampered by a lack of detailed sorption data analysis, which leads to inaccurate transport modeling. To this end, we present a novel software tool to precisely analyze and interpret sorption isotherm data. Our developed tool, coded in Visual Basic for Applications (VBA), operates embedded within the Microsoft Excel™ environment. It consists of a user-defined function named ISOT_Calc, followed by a supplementary optimization Excel macro (Ref_GN_LM). The ISOT_Calc function estimates the solute equilibrium concentration in the aqueous and solid phases (C_e and q, respectively). Hence, it represents a very flexible way to optimize sorption isotherm parameters, as it can be carried out over the residuals of q, C_e, or both simultaneously (i.e., orthogonal distance regression). The developed function includes the most usual sorption isotherm

models as predefined equations, as well as the ability to easily introduce custom-defined ones. Regarding the Ref_GN_LM macro, it allows parameter optimization by using a Levenberg-Marquardt modified Gauss-Newton iterative procedure. In order to evaluate the performance of the presented tool, both function and optimization macro have been applied to different sorption data sets described in the literature. Results showed that optimization of the isotherm parameters was successfully achieved in all cases, indicating the robustness and reliability of the developed tool. Thus, the presented software tool, available to researchers and students for free, has proven to be a user-friendly and interesting alternative to conventional fitting tools used in sorption data analysis. (Beltran et al., 2016)

3. Effects of Post-Pyrolysis Air Oxidation of Biomass Chars on Adsorption of Neutral and Ionizable Compounds. (Dr. Joseph Pignatello and Dr. Feng Xiao)

This study was carried out to understand the effects of thermal air oxidation of biomass chars experienced during their formation or production, on their adsorptive properties towards various compounds, including five neutral nonpolar and polar compounds and seven weak acids and bases (pK_a, 3−5.2) selected from among industrial chemicals and the triazine and phenoxyacetic acid herbicide classes. Post-pyrolysis air oxidation (PPAO) at 400 ^{o}C of anoxically-prepared wood and pecan shell chars for up to 40 min enhanced the mass-normalized adsorption at pH ~7.4 of all test compounds, especially the weak acids and bases, by up to 100-fold. Both general and specific effects were identified. The general effect results from "reaming" of pores by the oxidative removal of pore wall matter and/or tarry deposits generated during the pyrolysis step. Reaming creates new surface area and enlarges nanopores, which helps relieve steric hindrance to adsorption. The specific effect results from creation of new acidic functionality that provides sites for formation of very strong, charge-assisted hydrogen bonds (CAHB) with solutes having comparable pK_a values as the acidic group. The CAHB hypothesis was supported by competition experiments and the finding that weak acid anion adsorption increased with surface carboxyl content, despite electrostatic repulsion from the growing negative charge. The results provide insight into the effects of air oxidation on pollutant retention. (Xiao and Pignatello, 2016)

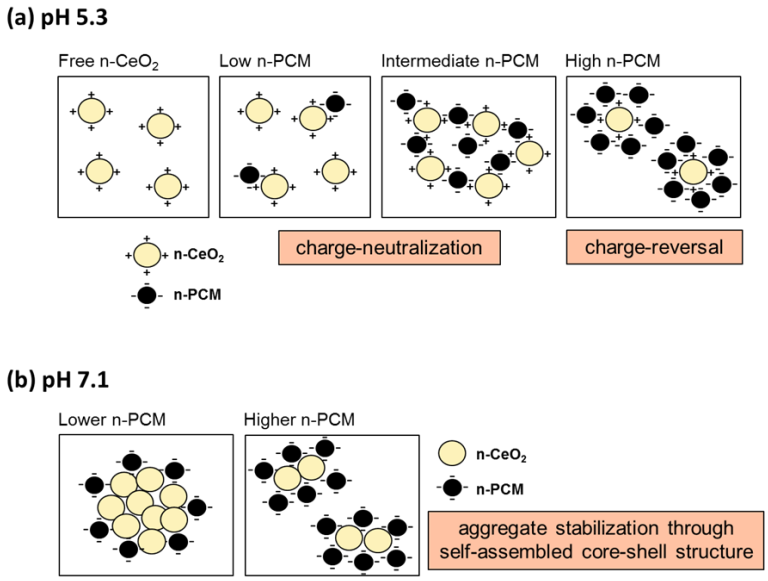


Schematic showing the "reaming" of nanopores in a char by post pyrolysis air oxidation.

4. Heteroaggregation of Cerium Oxide Nanoparticles and Nanoparticles of Pyrolyzed Biomass. (Dr. Joseph Pignatello and Dr. Peng Yi)

Heteroaggregation of engineered nanomaterials (ENM) with natural particles is critical to the environmental mobility of ENM. We studied heteroaggregation of ceria nanoparticles (n-CeO_2) with nanoparticles of pyrogenic carbonaceous material (n-PCM) derived from pecan shell biochar. The n-CeO_2 is a model for metal oxide ENM, and the biochar is a model for natural chars, as well as human-made chars produced for use in soil remediation and agriculture such as biochar. The TEM and STEM images of n-PCM identify both hard and soft particles, both C-rich and C,O,Ca-containing particles (with $CaCO_3$ crystals), both amorphous and "onion-skin"

C-rich particles, and traces of nanotubes. Heteroaggregation was evaluated at constant n-CeO_2, variable n-PCM concentration by monitoring hydrodynamic diameter and electrokinetic charge (zeta potential) by dynamic light scattering under conditions where n-PCM is "invisible." At pH 5.3, where n-CeO_2 and n-PCM are positively and negatively charged, respectively, and each stable to homoaggregation, heteroaggregation is favorable and occurs by a Charge Neutralization-Charge Reversal mechanism (CNCR). In the CNCR mechanism, primary heteroaggregates that form in the initial stage are stable at low or high n-PCM concentration due to electrostatic repulsion, but unstable at intermediate n-PCM concentration, leading to secondary heteroaggregation. The greatest instability coincides with full charge neutralization. At pH 7.1, where n-CeO_2 is neutral and unstable alone, and n-PCM is negative and stable alone, heteroaggregation occurs by a Charge-Accumulation, Core-shell Stabilization (CACS) mechanism. In the CACS mechanism, n-PCM binds to and forms a negatively charged shell on the neutral surface of the nascent n-CeO_2 core, stabilizing the core-shell heteraggregate at a size that decreases with n-PCM concentration. The CNCR and CACS mechanisms give fundamental insight into heteroaggregation between oppositely-charged nanoparticles, as well as between neutral and charged nanoparticles. (Peng et al., 2015)

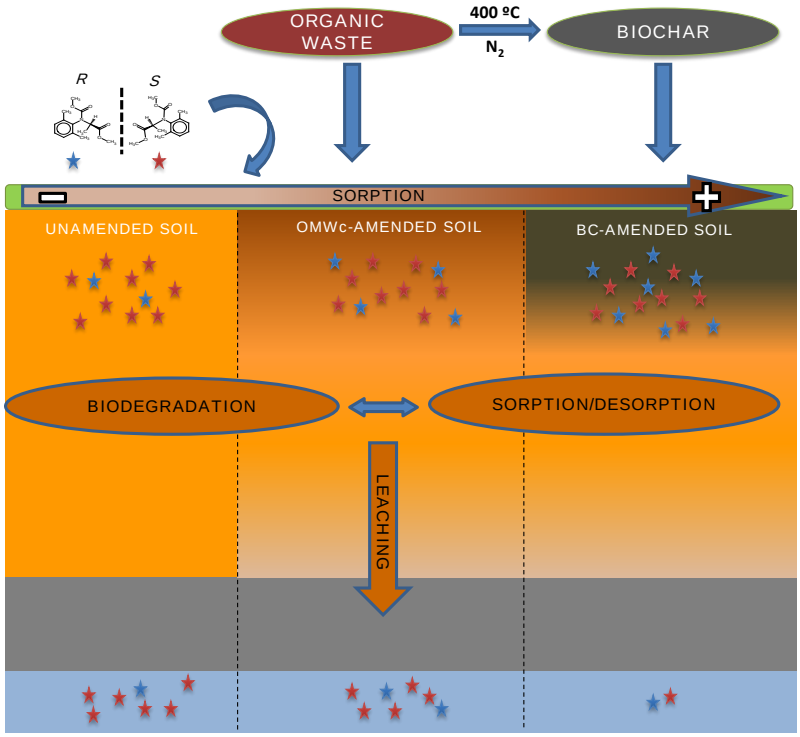


Schematic showing mechanism of heteroaggregation of n-CeO_2 and n-PCM at different n-PCM concentrations at (a) pH 5.3 where they are oppositely charged; and (b) pH 7.1 where n-CeO_2 is uncharged and n-PCM is negatively charged.

5. Environmental fate of the fungicide metalaxyl in soil amended with composted olive-mill waste and its biochar: an enantioselective study (Dr. Beatrix Gámiz and Dr. Joseph Pignatello)

Many organic pollutants are chiral and reach the environment as mixtures of optical isomers or enantiomers. For such chiral pollutants, environmental remediation and water pollution control strategies should consider the behavior of the different optical isomers separately. We investigated how amending a sandy loam soil with composted olive-mill waste (OMWc) or its biochar (BC) at 2% (w:w) affected the sorption, degradation, and leaching of each of the two enantiomers of the chiral fungicide metalaxyl. Sorption of metalaxyl enantiomers was higher on BC ($K_d \approx 145$ L kg^{-1}) than on OMWc ($K_d \approx 22$ L kg^{-1}), was not enantio-selective in either case, and followed the order BC-amended > OMWc-amended > unamended soil. Both enantiomers showed greater resistance to desorption from BC-amended soil

compared to unamended and OMWc-amended soil. Dissipation studies revealed that the degradation of metalaxyl was more enantioselective (*R* > *S*) in unamended and OMWc-amended soil than in BC-amended soil. The leaching of both *S*- and *R*-metalaxyl from soil columns was almost completely suppressed after amending the soil with BC and the process was less enantioselective compared to unamended soil and OMWc-amended soil. Our findings show that addition of BC affected the final enantioselective behavior of metalaxyl in soil indirectly by reducing its bioavailability through sorption, and to a greater extent than OMWc. BC showed high sorption capacity to remove metalaxyl enantiomers from water, immobilize metalaxyl enantiomers in soil, and mitigate the groundwater contamination problems particularly associated with the high leaching potential of the more persistent enantiomer. (Gámiz et al., 2016)



Schematic depicting the transport and transformation of metalaxyl in the subsurface.

B. Bioavailability of Contaminants in Environmental Particles (Dr. Joseph Pignatello and Ms. Yanyan Zhang)

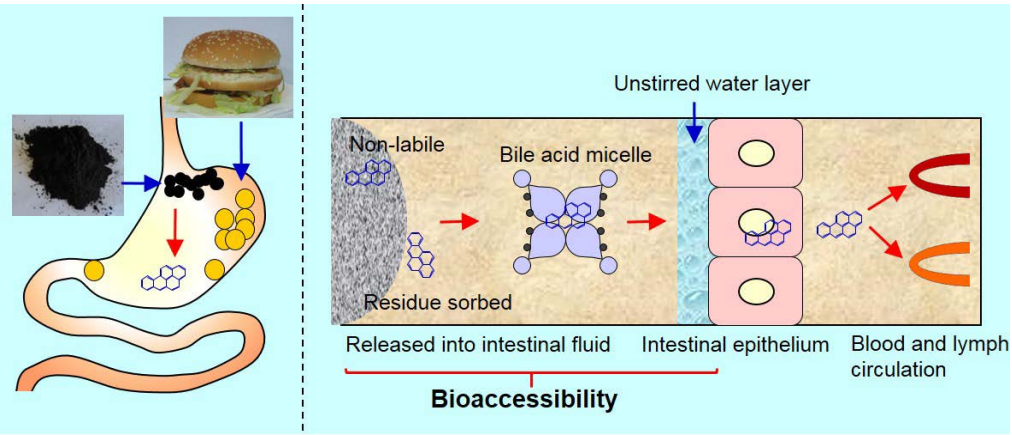
1. Bioaccessibility of PAHs in Fuel Soot Assessed by an *in vitro* Digestive Model with Absorptive Sink: Effects of Food Ingestion and Bioaccessibility of Nitro- and Oxy-PAHs. (Dr. Joseph Pignatello and Ms. Yanyan Zhang)

Soot, especially fuel soot, often contains high levels of polycyclic aromatic hydrocarbons (PAHs), some of which are carcinogenic. Soot can enter the human digestive tract via dermal contact with soil or other environmental particles and then hand-to-mouth activities. Young children are especially susceptible to soil ingestion by this route: the amount of soil ingested by 95% of children in developed countries is estimated to be up to 200 mg/day. Other routes of oral exposure to soot-borne PAHs include consumption of charred particles in grilled and fried food, intake of soil or dust particles clinging to vegetables, and the swallowing of expectorant containing inhaled atmospheric soot particles. The level of

exposure to PAHs through ingestion of soot will depend on local sanitation conditions, PAH concentrations, and bioavailability of PAHs in the soot within the digestion tract. The initial study, reported in last year's Record of the Year, introduced the *in vitro* digestive model used to determine the bioaccessible fraction (B_{app}) of 11 PAHs present in a fuel soot collected from local commercial fuel oil boilers. A novel feature of the model, which includes mouth, stomach, and small intestinal stages, is that it includes a silicone polymer sheet as a third-phase absorptive sink to simulate passive transfer of PAHs to intestinal epithelium during the small intestine stage where absorption of nutrients (and contaminants) predominates in the human GI tract. The B_{app} is defined as the fraction found in the digestive fluid plus sheet after digestion.

In the second study, we investigated the effects of changing physiological conditions in the digestive tract expected with food ingestion on the B_{app}. We determined that B_{app} was independent of gastric pH and addition of non-lipid milk representing dietary proteins and carbohydrates, whereas it increased with bile acids concentration (2.0–10 g/L), small intestinal pH (5.00–7.35), and addition of soybean oil representing dietary lipid (100% and 200% of the mean daily ingestion by 2-5 year olds in the U.S.). B_{app} of PAHs increases with small intestinal pH due to the combined effects of mass transfer promotion from nonlabile to labile sorbed states in the soot, weaker sorption of the labile state, and increasingly favorable partitioning from the digestive fluid to the silicone sink. Under fed conditions, B_{app} increases with inclusion of lipids due to the combined effects of mass transfer promotion from nonlabile to labile states, and increasingly favorable partitioning into bile acid micelles. Our results indicate significant variability in soot PAH bioaccessibility within the range of physiological conditions experienced by humans, and suggest that bioaccessibility will increase with co-consumption of food, especially food with high fat content. (Zhang et al., 2015)

In addition to PAHs, soot may also contain nitro and oxygenated derivatives of PAHs. Therefore, in the third study, we measured B_{app} of native concentrations of 1-nitropyrene (1N-PYR), 9-fluorenone (9FLO), anthracene-9,10-dione (ATQ), benzo[*a*]anthracene-7,12-dione (BaAQ), and benzanthrone (BZO). Along with B_{app}, we determined the 24-h sheet-digestive fluid partition coefficient ($K_{s,24h}$), the soot residue-fluid distribution ratio of the labile sorbed fraction after digestion ($K_{r,lab}$), and the maximum possible (limiting) bioaccessibility, B_{lim}. The B_{app} of PAH derivatives was positively affected by the presence of the sheet due to mass-action removal of the sorbed compounds. In all cases B_{app} increased with imposition of fed conditions. The enhancement of B_{app} under fed conditions is due to increasingly favorable mass transfer of target compounds from soot to fluid (increasing bile acid concentration, or adding food lipids) or transfer from fluid to sheet (by raising small intestinal pH). Food lipids may also enhance B_{app} by mobilizing contaminants from nonlabile to labile states of the soot. Compared to the parent PAH, the derivatives had larger $K_{r,lab}$, despite having lower partition coefficients to various hydrophobic reference phases including silicone sheet. The B_{lim} of the derivatives under the default conditions of the model ranged from 65.5% to 34.4%, in the order, 1N-PYR > ATQ > 9FLO > BZO > BaAQ, with no significant correlation with hydrophobic parameters, nor consistent relationship with B_{lim} of the parent PAH. Consistent with earlier experiments on a wider range of PAHs, the results suggest that a major determinant of bioaccessibility is the distribution of chemical between nonlabile and labile states in the original solid. (Zhang et al., in press)



C. Pollution Prevention and Remediation (Dr. Joseph Pignatello, Dr. Hsin-Se Hsieh, Mr. Bing Yang, and Ms. Yi Yang)

1. Activation of Hydrogen Peroxide and Solid Peroxide Reagents by Phosphate Ion in Alkaline Solution. (Dr. Joseph Pignatello and Mr. Bing Yang)

Hydrogen peroxide and its derivatives can serve as useful bulk oxidants for degrading contaminants in soil and water. Since H_2O_2 itself is not very reactive, it must be activated. Solutions of a model compound methylene blue (MB) were treated with hydrogen peroxide (HP), urea hydrogen peroxide (UHP), sodium perborate (SPB), sodium percarbonate (SPC), or calcium peroxide (CP). In unbuffered systems, addition of HP or UHP was ineffective in decolorizing MB, whereas addition of SPB or SPC was moderately effective due to the known ability of borate and carbonate ions, respectively, to activate H_2O_2. Decolorization of MB in HP, UHP, SPB, and SPC systems was greatly accelerated when mixtures were buffered at pH 10 with phosphate (25 mM) compared to mixtures where pH was unadjusted, NaOH-adjusted, or carbonate-adjusted. Decolorization correlated strongly with peroxide decomposition, implying a shared pathway. Decolorization was highly inefficient relative to peroxide decomposition, however. This study represents the first example, to our knowledge, demonstrating activation of H_2O_2 by phosphate towards oxidation of organic compounds. It is suggested that the reactive oxidant species responsible for decolorization and peroxide loss in the presence of phosphate is, or is derived from, HPO_5^{2-}. (Yang et al., 2016)

2. Effect of Matrix Components on UV/H_2O_2 and UV/$S_2O_8^{(2-)}$ Advanced Oxidation Processes for Trace Organic Degradation in Reverse Osmosis Brines from Municipal Wastewater Reuse Facilities. (Dr. Joseph Pignatello and Ms. Yi Yang)

When reverse osmosis brines from potable wastewater reuse plants are discharged to poorly-flushed estuaries, the concentrated organic contaminants are a concern for receiving water ecosystems. UV/hydrogen peroxide (UV/H_2O_2) and UV/persulfate (UV/$S_2O_8^{2-}$) advanced oxidation processes (AOPs) may reduce contaminant burdens prior to discharge, but the effects of the high levels of halide, carbonate and effluent organic matter (EfOM) normally present in these brines are unclear. On the one hand, these substances may reduce process efficiency by scavenging reactive oxygen species (ROS), hydroxyl ($^{\bullet}OH$) and sulfate ($SO_4^{\bullet-}$) radicals. On the other, the daughter radicals generated by halide and carbonate scavenging may themselves degrade organics, offsetting the effect of ROS scavenging. UV/H_2O_2 and UV/$S_2O_8^{2-}$ AOPs were compared for degradation of five pharmaceuticals spiked into brines obtained from two reuse facilities and the RO influent from one of them. For UV/H_2O_2, EfOM scavenged ~75% of the $^{\bullet}OH$, reducing the degradation efficiency of the target contaminants to a similar extent; halide and

carbonate scavenging and the reactivities of associated daughter radicals were less important. For UV/$S_2O_8^{2-}$, anions (mostly Cl^-) scavenged ~93% of the $SO_4^{\bullet-}$. Because daughter radicals of Cl^- contributed to contaminant degradation, the reduction in contaminant degradation efficiency was only ~75-80%, with the reduction driven by daughter radical scavenging by EfOM. Conversion of $SO_4^{\bullet-}$ to more selective halogen and carbonate radicals resulted in a wider range of degradation efficiencies among the contaminants. For both AOPs, 250 mJ/cm^2 average fluence achieved significant removal of four pharmaceuticals, with significantly better performance by UV/$S_2O_8^2$ treatment for some constituents. Accounting for the lower brine flowrates, the energy output to achieve this fluence in brines is comparable to that often applied to RO permeates. However, much higher fluence was required for the least reactive pharmaceutical. Comparing AOP application to the RO influent or brine, equal or greater removal was achieved for brine treatment for comparable energy input. AOP treatment of brines could be applied to reduce, but not eliminate, contaminant burdens prior to discharge. (Yang et al., 2016)

3. Activated carbon-mediated alkaline hydrolysis of methyl bromide. (Dr. Joseph Pignatello and Dr. Hsin-Se Hsieh)

Activated carbons (ACs) are commonly used to remove organic contaminants from waste streams by adsorption. But besides acting as absorbents, ACs can mediate oxidation-reduction, elimination, dehydrohalogenation, and hydrolytic reactions through special properties of the graphene-like surface or involvement of surface functional groups. In this ongoing project, we investigated the role of AC in mediating the alkaline hydrolysis of methyl bromide (CH_3Br) as a model. Methyl bromide is a pre-shipment and quarantine fumigant and its removal from fumigation vent streams is imperative due to its ozone-depleting and greenhouse gas properties. In an anticipated mode of application, methyl bromide is passed through a reactor in which sodium hydroxide solution is sprayed over a bed of activated carbon. The decay of CH_3Br in1M NaOH with powdered AC followed a two-term rate law corresponding to reactions in the aqueous and adsorbed states. The reaction in each state produced methanol and bromide and had identical activation energies, consistent with S_N2 displacement by hydroxide. The adsorbed-state reaction was inhibited by added bromide, nitrate, or perchlorate salt following the classical chromatographic elution order. Conversely, the adsorbed-state reaction was accelerated by sorption or grafting of quaternary ammonium (NR_4^+) compounds and the activation energy was reduced. The results indicate that AC mediates alkaline hydrolysis by anion exchange of hydroxide ions. (Pignatello and Hsieh, manuscript in preparation)

Mosquito Trapping and Testing Program

(Dr. Philip M. Armstrong, Mr. John Shepard, Mr. Michael Thomas, Mr. Michael Misencik, Ms. Angela Bransfield)

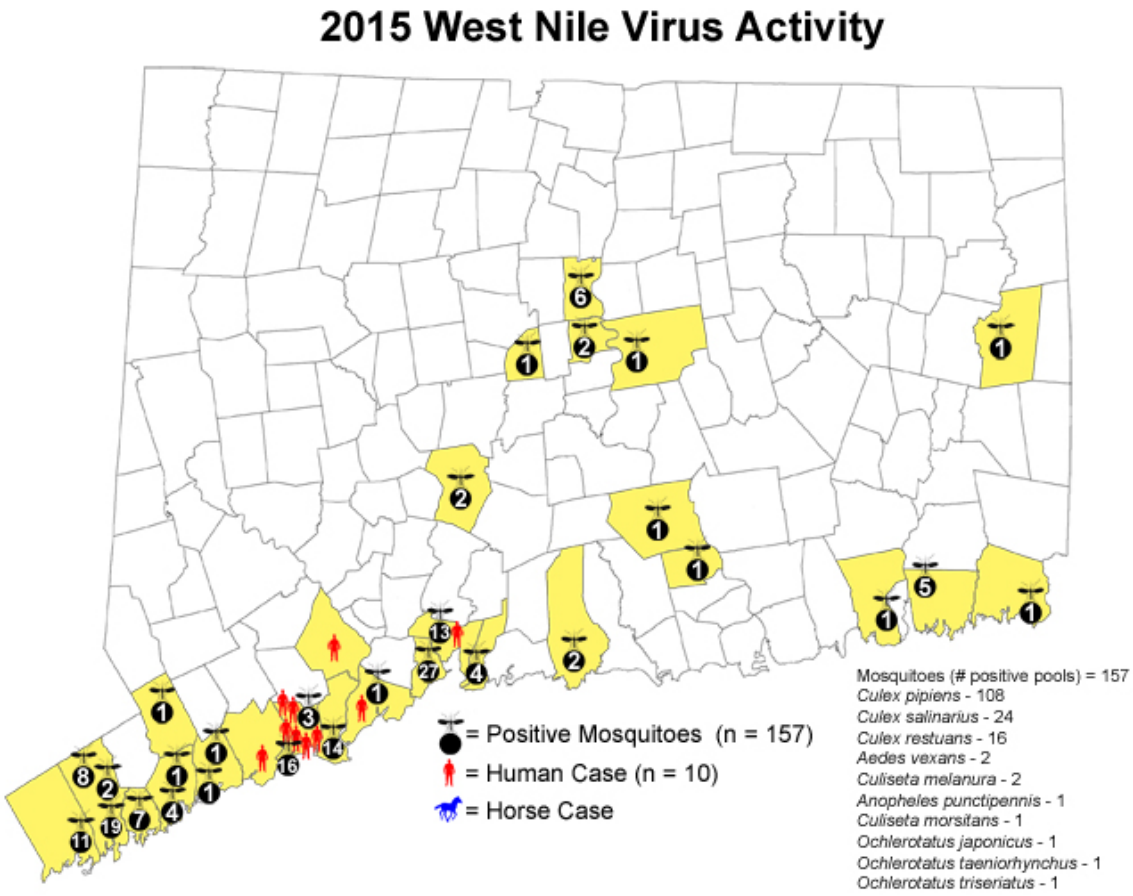
Mosquito-borne viral diseases constitute an annual threat to human health in Connecticut. A comprehensive surveillance program complemented by science-based controls and timely public outreach are the most effective ways of protecting the public and reducing the risk of human disease. Experiment Station scientists and technicians monitor mosquitoes and eastern equine encephalitis (EEE) and West Nile virus (WNV) activity at 91 locations throughout Connecticut from June-October. The objectives of the surveillance program are to provide: 1) early evidence of local virus activity; 2) information on the abundance, distribution, identity, and infection rates of potential mosquito vectors and; 3) information that is used to assess the threat of WN virus and EEE to warn the public and guide the implementation of mosquito control measures. The CAES is responsible for conducting all mosquito trapping and testing activities.

In 2015, statewide mosquito trapping was conducted from June 1 through October 16. Approximately one-third of the sites were located in densely populated residential locales along an urban/suburban corridor in the coastal southwestern corner of the state extending up through the Connecticut River Valley. Trap sites typically included parks, greenways, golf courses, undeveloped wood lots, sewage treatment plants, dumping stations, and temporary wetlands associated with waterways. Trapping locations in the other regions of the state were established in more sparsely populated rural settings that included permanent fresh-water swamps (red maple/white cedar) and bogs, coastal salt marshes, horse stables, and swamp-forest border environs.

Mosquito trapping was conducted with CO_2 (dry ice)-baited CDC miniature light traps equipped with aluminum domes, and gravid mosquito traps baited with a lactalbumin-yeast-hay infusion. Traps were placed in the field in the afternoon, operated overnight, and retrieved the following morning. Trapping frequency was minimally made once every ten days at each trap site over the course of the entire season. Adult mosquitoes were transported alive to the laboratory each morning in an ice chest lined with cool packs. Mosquitoes were immobilized with dry ice and transferred to chill tables where they were identified to species with the aid of a stereo microscope (90X) based on morphological characters. Female mosquitoes were pooled in groups of 50 or fewer by species, collection date, trap type, and collection site and stored at -80^{o}C until processed for virus.

Aliquots of each mosquito pool were inoculated into Vero cell cultures for detection of West Nile virus (WNV), eastern equine encephalitis (EEE), and other mosquito-borne arboviruses of public health importance. Virus isolates from mosquito pools were tested for WN, EEE, Flanders (FL), Jamestown Canyon (JC), Cache Valley (CV), Trivittatus (TVT), Highlands J (HJ), LaCrosse (LAC), St. Louis Encephalitis (SLE), and Potosi (POTV) viruses. Isolated viruses were identified by Real Time (TaqMan) reverse transcriptase polymerase chain reaction (RT-PCR) or standard RT-PCR using virus-specific primers. All of the virus isolation work was conducted in a certified Bio-Safety Level 3 laboratory at the CAES.

In 2015, a total of 177,509 mosquitoes (13,377 pools) representing 41 species were trapped and tested. A total of 157 isolations of WNV were made from 10 mosquito species: *Culex pipiens* = 108, *Cx. salinarius* = 24, *Cx. restuans* = 16, *Aedes vexans* = 2, *Culiseta melanura* = 2, *Anopheles punctipennis* = 1, *Cs. morsitans* = 1, *Ochlerotatus japonicus* = 1, *Oc. taeniorhynchus* = 1, *Oc. triseriatus* = 1, collected at 29 sites in 24 towns in 6 counties (Fairfield, Hartford, Middlesex, New Haven, New London, and Windham). The first positive mosquitoes were collected on July 20, and the last on September 29. The majority of WNV activity was detected in densely populated urban and suburban regions in southern Fairfield and New Haven counties. Ten human cases of WNV-associated illness were locally acquired (8 = encephalitis/meningitis, 2 = fever) with no fatalities. Date of onset ranged from August 9 to October 9. Human cases were temporally and spatially consistent with WN virus isolations from mosquito pools. No horse cases of WN virus infection were reported. There were no EEE isolations made from mosquitoes, and there were no equine or human cases reported. Other mosquito-borne viruses isolated included: Jamestown Canyon virus = 12 isolates from 10 species (June 3 - July 29); Cache Valley virus = 24 isolates from 6 species (July 20 – September 15); Potosi virus = 8 isolates from 4 species (August 25 - September 28); Trivittatus virus = 1 isolates from 1 species (July 8); La Crosse encephalitis virus = 1 isolate from 1 species (July 28).

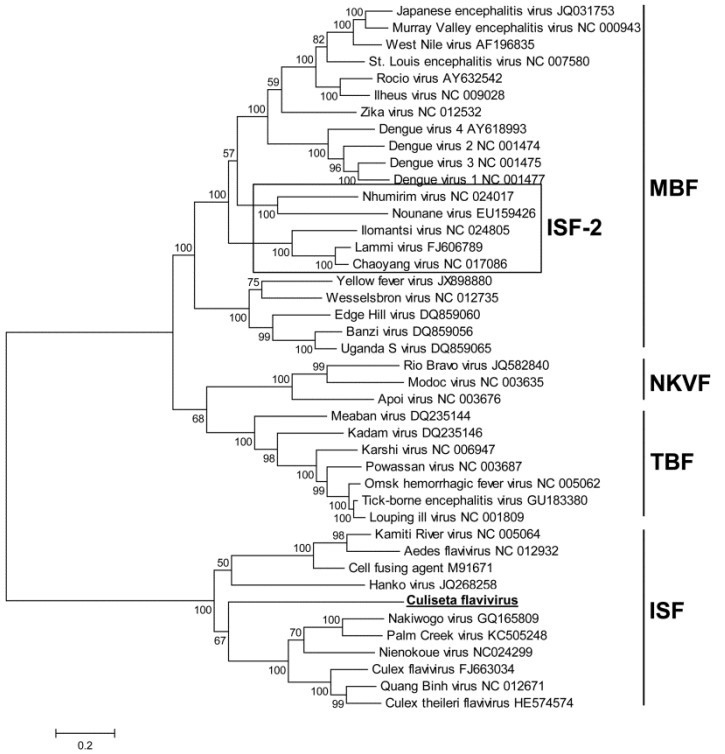


Participation in the statewide surveillance program provides timely information about levels of virus activity in the mosquito population which is used to monitor virus amplification within enzootic transmission cycles, and assess risk of human infection. This information is used to inform the public and health care providers of these risks, guide vector control efforts, and prevent disease outbreaks. In addition, this large-scale sampling effort also informs our understanding of the ecology of mosquitoes and mosquito-borne viruses. Additional studies on the role of different mosquito species to serve as vectors of viral pathogens may be used to target anti-vector interventions more effectively.

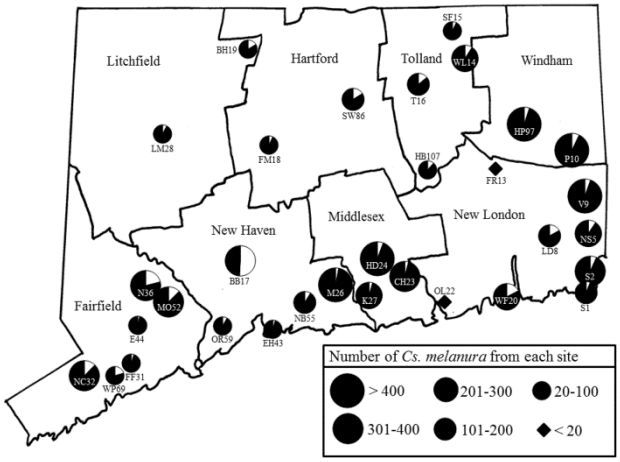
Epidemiology of Mosquito-borne Viral Diseases

A. Isolation of a Novel Insect-Specific Flavivirus from *Culiseta melanura* in the Northeastern U.S. (Mr. Michael Misencik, Dr. Theodore G. Andreadis, and Dr. Philip M. Armstrong)

The genus Flavivirus includes a number of newly-recognized viruses that infect and replicate only within mosquitoes. To determine whether insect-specific flaviviruses (ISFs) may infect *Culiseta* (*Cs.*) *melanura* mosquitoes, we screened pools of field-collected mosquitoes for virus infection by reverse transcription-polymerase chain reaction (RT-PCR) targeting conserved regions of the NS5 gene. NS5 nucleotide sequences amplified from *Cs. melanura* pools were genetically similar to other ISFs and most closely matched Calbertado virus from *Culex tarsalis*, sharing 68.7% nucleotide and 76.1% amino acid sequence identity. The complete genome of one virus isolate was sequenced to reveal a primary open reading frame (ORF) encoding a viral polyprotein characteristic of the genus *Flavivirus*. Phylogenetic analysis showed that this virus represents a distinct evolutionary lineage that belongs to the classical ISF group. The virus was detected solely in *Cs. melanura* pools, occurred in sampled populations from Connecticut, New York, New Hampshire, and Maine, and infected both adult and larval stages of the mosquito. Maximum likelihood estimate infection rates (MLE-IR) were relatively stable in overwintering *Cs. melanura* larvae collected monthly from November 2012-May 2013 (MLE-IR=0.7-2.1/100 mosquitoes) and in host-seeking females collected weekly from June-October 2013 (MLE-IR=3.8-11.5/100 mosquitoes). Phylogenetic analysis of viral sequences revealed limited genetic variation that lacked obvious geographic structure among strains in the northeastern U.S. This new virus is provisionally named Culiseta flavivirus (CsFV) based on its host association with *Cs. melanura*.



In this study, we describe a novel ISF infecting *Cs. melanura* mosquitoes collected from the northeastern US. *Cs. melanura* is a bird-biting mosquito species that serves as the main vector of eastern equine encephalitis virus (EEEV) and a secondary vector of WNV in eastern North America. Culiseta flavivirus was found at high infection rates in *Cs. melanura* populations in the northeastern U.S. Many of the findings, including the presence of the virus in larvae and the stable infection rates throughout the study period, suggest that CsFV is maintained in *Cs. melanura* populations through vertical transmission, and that it does not amplify through horizontal transmission. The high prevalence of CsFV infection throughout Connecticut also highlights the possibility that CsFV may be interfering with the transmission of WNV, a widespread flavivirus and human pathogen, through superinfection exclusion. Further studies are needed to determine the impact of CsFV on WNV infections in *Cs. melanura*.



Epidemiology and Population Genetics of Mosquitoes

A. Population Genetics of *Culiseta melanura,* the Main Vector of Eastern Equine Encephalitis Virus in Eastern USA and Canada (Dr. Goudarz Molaei, Dr. John Soghigian, Dr. Theodore G. Andreadis, Mr. Michael Thomas, Mr. John Shepard)

Eastern equine encephalitis virus (EEEV) is a highly pathogenic mosquito-borne arbovirus, with active transmission foci in freshwater hardwood swamps in eastern North America, where enzootic transmission is maintained between the ornithophilic mosquito *Culiseta melanura* and wild passerine birds. EEEV is responsible for occasional outbreaks of severe disease in humans and equines, resulting in high mortality and neurological impairment in most survivors. In the past, human disease outbreaks in the northeastern U.S. have occurred intermittently with no apparent pattern; however, during the last decade we have witnessed recurring annual emergence where EEEV activity had been historically rare, and expansion into northern New England where the virus had been previously unknown. The underlying factors responsible for this sustained resurgence are unclear. Although *Cs. melanura* is considered the principal enzootic vector, the role this species plays in epidemic/epizootic transmission to humans and equines is not well defined. Despite the importance of *Cs. melanura* in the EEEV transmission cycle, little is understood about the population genetic structure of this species. Due to potentially low gene flow and local adaptation, populations of *Cs. melanura* may differ in vector-host interactions and vectorial capacity with profound impacts on public health and vector control. We are investigating population genetics of *Cs. melanura*, with the objectives to: 1) examine spatial and temporal variations in population genetic structure of *Cs. melanura*, 2) evaluate the potential impact of variations in population genetic structure of *Cs. melanura* on the risk of human and equine infection in EEEV foci, and 3) investigate the occurrence of population structuring and gene flow patterns. This research project will elucidate previously uncharacterized yet fundamental features of the population genetic structure of *Cs. melanura*, reveal how it might impact vector-host interactions and vectorial capacity of this species, and provide a basis to understand the involvement of *Cs. melanura* in epidemic/epizootic transmission of EEEV to humans and equines. An assembled genome of *Cs. melanura* would be only the fourth non-Anopheline mosquito genome sequenced, and the first of its genus. Genome information could be utilized for comparative genomic analyses to explore gene family expansion/contraction information, and gene ontology to evaluate how this important vector differs from other vectors. Further evaluation of genome could also provide information on diapause gene families (due to the cold hardiness of this genus), odorant binding and receptor gene families (due to their potential importance in host seeking), and detoxification gene families (due to their potential relationship with pesticide resistance and success under environmental stressors).

B. Host Choices of Mosquitoes at Eastern Equine Encephalitis Virus Foci in Connecticut (Dr. Goudarz Molaei, Mr. John J. Shepard, Dr. Theodore G. Andreadis, and Mr. Michael C. Thomas)

Eastern equine encephalitis virus (EEEV) is a highly pathogenic mosquito-borne arbovirus, with active transmission foci in freshwater hardwood swamps in eastern North America, where enzootic transmission is maintained between the ornithophilic mosquito *Culiseta melanura* and wild passerine birds. The role of other locally abundant mosquito species in virus transmission and their association with vertebrate hosts as sources of blood meals within these foci are largely unknown but are of importance in clarifying the dynamics of enzootic and epidemic/epizootic transmission. Blood-engorged mosquitoes were collected from resting boxes at four established EEEV foci in Connecticut during 2010-2011. Mosquitoes were identified to species, and the identity of vertebrate hosts was determined based on mitochondrial *cytochrome b* gene sequences of polymerase chain reaction products. The vertebrate hosts of 12 mosquito species were identified. *Culiseta morsitans*, *Culex restuans*, and *Cx. pipiens* acquired blood meals exclusively from avian hosts; whereas *Aedes cinereus*, *Aedes Canadensis*, and *Ae. stimulans* obtained blood meals solely from mammals. Species that fed opportunistically on both avian and mammalian

hosts included: *Aedes thibaulti*, *Anopheles punctipennis*, *An. quadrimaculatus*, *Coquillettidia perturbans*, and *Ae. abserratus*. Mixed blood meals originating from both avian and mammalian hosts were identified in *An. quadrimaculatus* and *Culex territans*. Our findings indicate that Wood Thrush, Tufted Titmouse, and a few other avian species serve as hosts for mosquitoes, and likely contribute to maintenance of EEEV. Our study supports the role of *Cs. morsitans* in enzootic transmission of EEEV among avian species. *Culex territans* will seek blood from multiple vertebrate orders, suggesting that this species may contribute to epizootic transmission of the virus. Our findings support roles for *Cq. perturbans* and *An. quadrimaculatus* as epidemic/epizootic vectors to humans, horses, and white-tailed deer.

C. An Integrated and Individual Tick Management Program to Reduce Risk of Lyme Disease in a Residential Endemic Area (Dr. Kirby C. Stafford III, Dr. Goudarz Molaei, Dr. Scott Williams)

Lyme disease (LD) represents the most frequently diagnosed human tick-borne disease in North America. A variety of prevention and control methods, including personal protective measures, habitat modification, applications of biological and natural compounds, and host-targeted control measures, have been examined for reducing tick abundance and risk for LD. We are investigating the efficacy and associated costs of several existing and new tick control measures individually and in the framework of the ITM approach to reduce the number of infected ticks in the inland LD endemic neighborhoods in Redding, CT. The primary objectives of this CDC-funded project are to: 1) develop a reduced risk/integrated tick management (ITM) approach to tick control, 2) measure efficacy of individual methods and an ITM approach to reduce infected ticks, infected reservoirs, and questing tick populations, 3) determine most effective timing and method of implementation of each tick control method and analyze costs for individual components of an ITM program, and 4) create a "LD decision support system," By incorporating entomological data and other information acquired by the proposed project into our decision support system, we will provide guidance on the most effective control measures that will help stakeholders to protect themselves in an environmentally safe manner. The approach and findings generated from this project will easily be extended to other LD endemic regions.

D. Evaluation of a Lyme disease Vaccine (Rodent-Targeted Vaccine, RTV) in an Integrated Pest Management Framework (Dr. Kirby C. Stafford III, Dr. Goudarz Molaei, Dr. Scott Williams)

The paucity of cost-efficient strategies to limit tick-borne pathogen exposures is becoming increasingly problematic for public health in the northeastern U.S. as incidence rates of tick-borne diseases continue to rise and new tick-borne pathogens emerge. We have initiated a collaborative research project to investigate the effectiveness of a rodent-targeted vaccine (RTV) in controlling Lyme Borreliosis in two residential neighborhoods during 2014-2016 in Redding, CT. Properties in one neighborhood will receive the RTV treatment only (delivered in rodent bait boxes), and properties in the other neighborhood will receive the RTV treatment in combination with applications of the biological tick control compound based on the fungus *Metarhizium anisopliae* (Met52). Following collection of baseline tick and mouse data during May-June 2014, we have started delivering RTV, using bait boxes at the study properties. We repeated the RTV application in 2016. Spray applications of Met52 are also underway on the study properties in the RTV+Met52 neighborhood (experimental plot), for comparison purposes.

E. Spatiotemporal Modeling of Human Lyme Disease and Tick Distributions in Connecticut (Dr. Goudarz Molaei, Dr. John Anderson, Dr. Kirby Stafford, Joshua Warren and Theodore Cohen)

This study focuses on examining potential relationship between human Lyme disease cases and tick testing data in Connecticut generated at the CAES Tick Testing Program. The datasets include human Lyme disease cases, number of identified ticks, tested ticks and positive ticks for *Borrelia burgdorferi*, the causative agent of Lyme disease. Average yearly temperature and total amount of snow, deer population for each town are also incorporated into analyses. We are comparing several different models

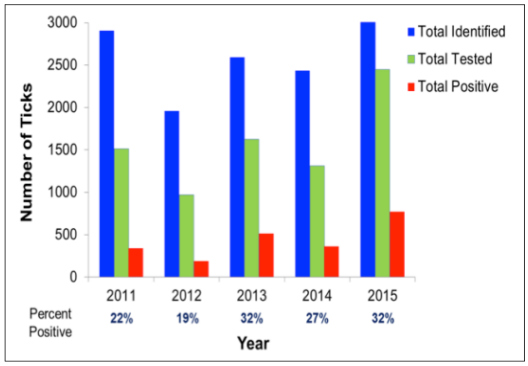
using human Lyme cases, number of identified ticks, number of tested ticks and number of positive ticks as response variable respectively: 1) a basic model without any random effects, 2) model with independent, identically and normally distributed observation-level random effect, 3) model with independent, identically and normally distributed town-specific random effect, 4) model with both observation-level random effect and town-specific random effect, 5) based on Model 3, also includes spatially-temporally correlated random effect, and 6) model with observation-level random effect, town-specific random effect and spatially-temporally correlated random effect. Our results indicate that human Lyme disease cases are highly correlated with the number of identified positive ticks. Moreover, there is strong space and time correlation in the data and towns with more cases are tended to cluster. Additional analyses are being conducted and a manuscript is also being prepared for submission upon completion of the analyses.

F. Discovery of A Novel Human-biting Ixodid Tick Species in Connecticut (Dr. Goudarz Molaei, Dr. John Soghigian, Dr. Gale Ridge, and Dr. Kirby Stafford)

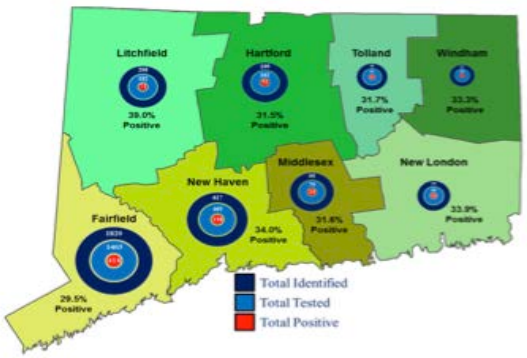
The CAES Tick Testing Laboratory has discovered a novel Ixodid tick species. Morphological, molecular, and phylogenetic characterizations of the specimen are underway in order to prepare a manuscript for submission.

Tick Testing Program for Lyme and Allied Diseases
(Dr. Goudarz Molaei assisted by Tommy Ferri and Magali Bazzano)

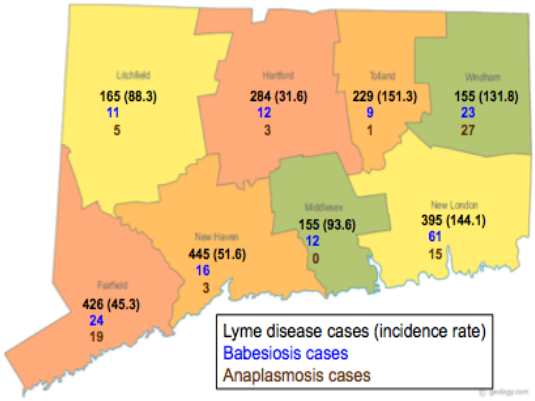
Tick-associated illnesses including Lyme disease (LD) constitute a major threat to human health in Connecticut. In 2014, 96% of confirmed LD cases in the US were reported from 14 states including Connecticut with the 5th highest number of confirmed cases of LD (*n*=1719) and 6th highest incidence (confirmed cases per 100,000 persons) rate of 47.8. The blacklegged tick, *Ixodes scapularis*, is the most important species in transmitting *Borrelia burgdorferi*, *Anaplasma phagocytophillum*, and *Babesia microti*, the causative agents of LD, babesiosis, and anaplasmosis, respectively. The Tick Testing Program at the Connecticut Agricultural Experiment Station was established in 1990 following an earlier outbreak of an unknown illness and hospitalization of a large number of children in Lyme, Connecticut, with arthritic and other symptoms. Each year, an average of 3,000 ticks are submitted for testing. From July 2015 until the end of June 2016, the Tick Testing Laboratory has received 3,566 ticks, representing several species, the majority of which were blacklegged ticks, *Ixodes scapularis*. Of 2,328 ticks tested, 654 (28.1%) were tested positive for LD agent. Infection rates for Anaplasmosis and Babesiosis agents were 4.4% (*n*=102) and 8.2% (*n*=190), respectively.



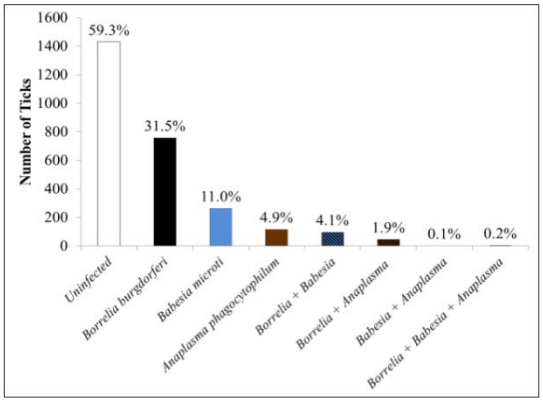
Number and percentage of *Ixodes scapularis* ticks tested for infection with *Borrelia burgdorferi* Connecticut, 2010-2015



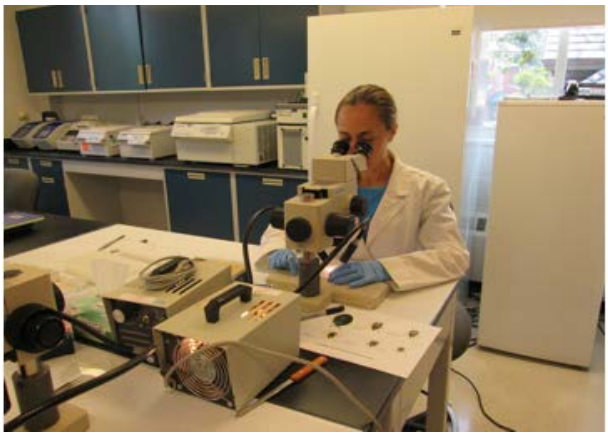
Tick testing Result by county in Connecticut, 2015



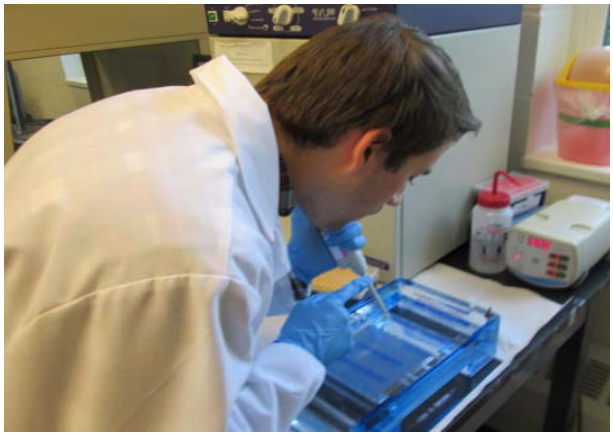
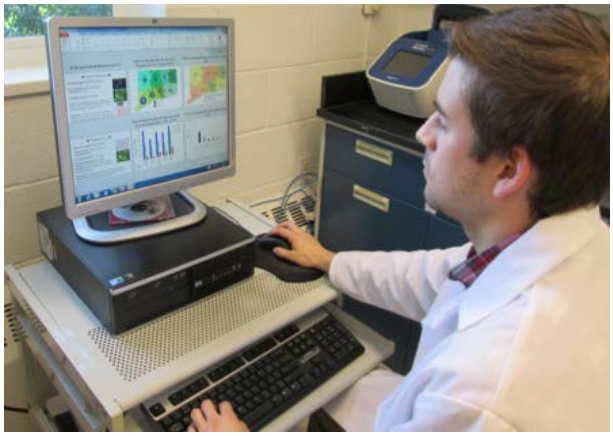
Tick-associated disease cases in Connecticut residents, 2015



Tick Testing Results and Coinfection Rate, 2015





Invasive Aquatic Plant Program
(Mr. Gregory Bugbee and Ms. Jennifer Fanzutti)

We are quantifying the locations of invasive aquatic plants in Connecticut's lakes and ponds, determining their effects on native plant communities, establishing baseline data to track their spread and providing information that is critical for management strategies.

A. Surveillance and Monitoring

Since 2004, the Connecticut Agricultural Experiment Station Invasive Aquatic Plant Program (CAES IAPP) has completed aquatic vegetation surveys of 227 Connecticut lakes and ponds (Figure 1). A total of 44 waterbodies have been resurveyed at least five years later to determine how invasive plants are changing the quality of lakes over time. In fiscal year 2015-2016, Greg Bugbee and Jennifer Fanzutti (Figure 2) mapped native and invasive aquatic vegetation in eight new and six previously surveyed water bodies (Table 1). In addition, Lake Candlewood, Connecticut's largest lake, was surveyed for the ninth consecutive year to determine the effects of alternate year deep and shallow winter drawdown on Eurasian watermilfoil (*Myriophyllum spicatum*), minor naiad (*Najas minor*), and curlyleaf pondweed (*Potamogeton crispus*). Lakes Lillinonah, Zoar and Squantz Pond were also surveyed to track changes in the population of invasive species. We established transects in each waterbody, using global positioning systems to quantify changes in native and invasive aquatic species abundance and distribution.

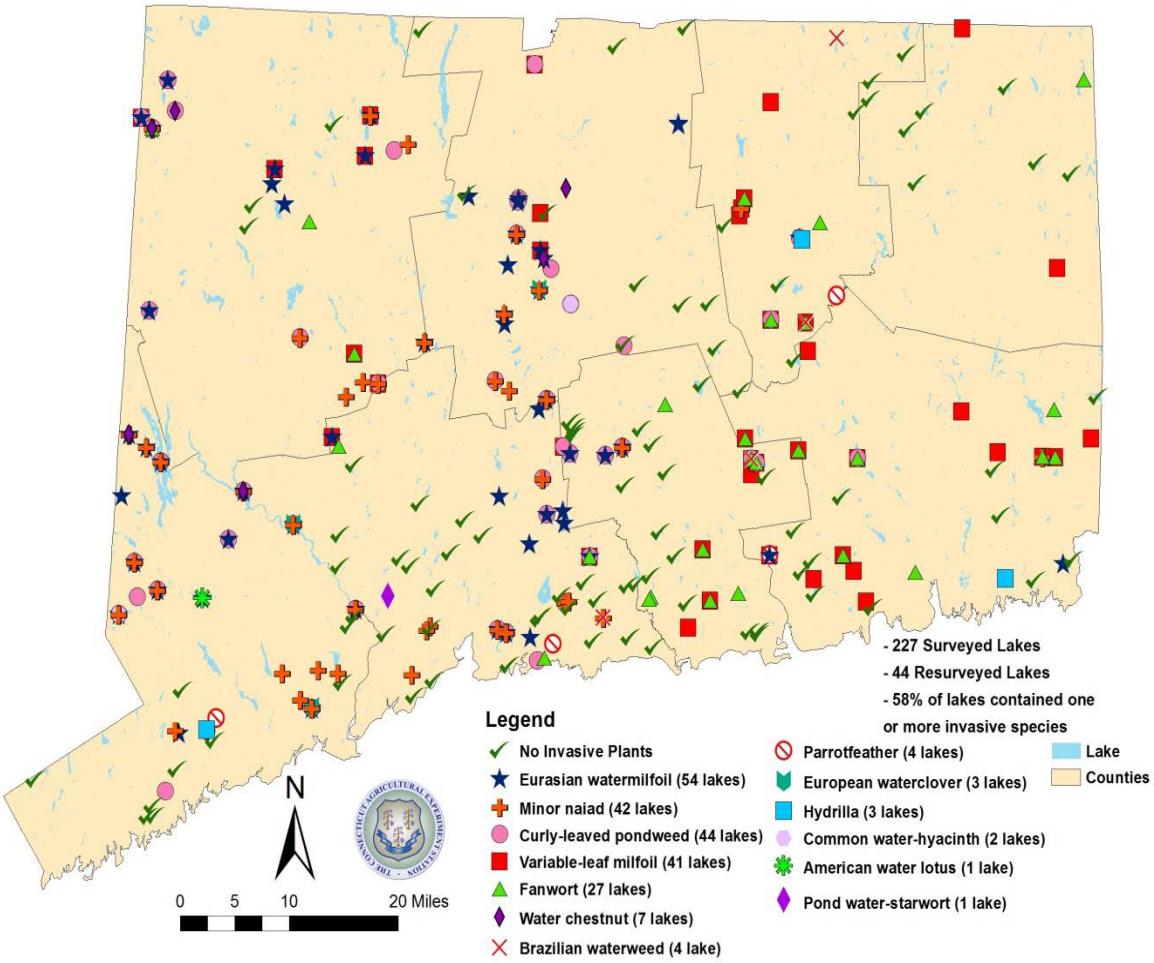


Figure 1. Locations of invasive plants in Connecticut's lakes and ponds as found in CAES IAPP surveys from 2004-2015.

We collected water samples and analyzed them for pH, temperature, dissolved oxygen, clarity, alkalinity, conductivity, and phosphorus. This data, along with watershed information, is being used to investigate the factors that influence the susceptibility of waterbodies to certain invasive species. We archive dry specimens of all plant species in the CAES herbarium for future reference. We designed our Invasive Aquatic Plant Program to utilize the latest digital technology to rapidly and comprehensively report our findings to the public. Lake survey maps and other data are published online within days of their completion (http://www.ct.gov/caes/IAPP).

Nearly 60 percent of the waterbodies contained one or more invasive plant species and some lakes contained as many as four invasive species (Figure 1). The most common invasive plants are Eurasian watermilfoil, variable watermilfoil (*Myriophyllum heterophyllum)*, minor naiad, curly leaf pondweed, and fanwort *(Cabomba caroliniana*). Less common invasive plants are water hyacinth (*Eichhornia crassipes*), water shamrock (*Marsilea quadrifolia*), hydrilla (*Hydrilla verticillata*), and water chestnut (*Trapa natans*). Our 2009 survey of Fence Rock Lake, in Guilford, discovered Connecticut's first infestation of Brazilian waterweed (*Egeria densa*) and our resurveys in 2010, 2011, 2012, and 2013 found the population expanding (Figure 3). We have since found Brazilian waterweed in Lower Moodus

Reservoir (East Haddam), Staffordville Reservoir (Stafford Springs), and Mono Pond (Coventry). We are working with the local lake associations and the CT DEEP to develop and test novel control strategies.

Figure 2. Jennifer Fanzutti assessing the aquatic Plant community in Moodus Reservoir.

B. Control Technology

The goal of this objective is 1) to research novel means of control that minimize herbicide usage and protects native vegetation and 2) to investigate non-chemical management options such as winter water level drawdown.

Table 1. Lakes and ponds surveyed by CAES IAPP in fiscal year 2015-2016 (* = resurvey).

Lake	Town	Acres
Black Pond*	Meriden	76
Candlewood*	Danbury	5064
Dodge Pond*	East Lyme	30
Filley Pond	Bloomfield	1.2
Gardner Lake*	Bozrah	527
Gorton Pond*	East Lyme	52
Lillinonah*	Bridgewater	1547
MDC Reservoir 1	West Hartford	27
MDC Reservoir 2	West Hartford	40
MDC Reservoir 5	West Hartford	22
MDC Reservoir 6	West Hartford	135
Merriman Pond*	Watertown	36
Mudge Pond	Sharon	211
Norwich Pond*	Lyme	29
Private Pond	Woodbridge	1.6
Rak Pond	Middletown	2
Squantz Pond*	New Fairfield	266
Uncas Lake*	Lyme	69
Zoar*	Southbury	920

1. Herbicides. Novel methods of chemical control with herbicides can rapidly remove invasive plants and begin to restore native plant communities to aquatic ecosystems.

Bashan Lake – East Haddam, CT - We are in the 15th year of research involving the use of spot applications of the herbicide 2,4-D to control variable watermilfoil in Bashan Lake. We have largely restored the lake to preinfestation conditions. Our resurvey of Bashan Lake in 2014 found an approximate 99 percent reduction in variable watermilfoil and an increase in the number of desirable native species from 12 to 19. In the fall of 2014, the water level in the lake was lowered 18 feet for dam repairs, with the prospect for the refilling to take two years. A survey of Bashan Lake in 2015 found a few sparse patches of variable watermilfoil. With support from the Bashan Lake Association, CAES IAPP performed a targeted herbicide application in late September. We continue to monitor the aquatic vegetation as the lake refills with special concern regarding new shoreline infestations of common reed (*Phragmites australius*).

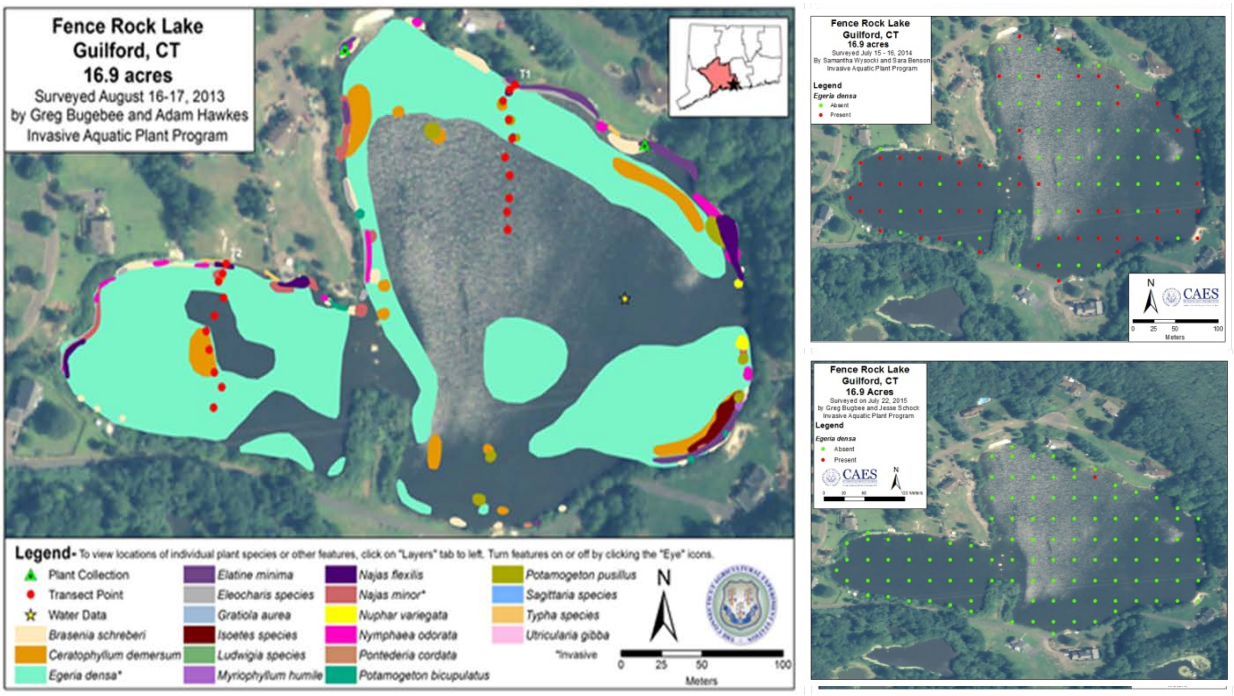


Figure 3. Brazilian waterweed in Fence Rock Lake in 2013 (top left), pretreatment 2014 (top right), and post treatment 2015 (bottom right).

Fence Rock Lake - Guilford, CT - CAES IAPP discovered Brazilian waterweed in Fence Rock Lake in 2009 and has since documented its yearly expansion (Figure 3). Because this plant is the first documented case of large scale invasion of this plant in CT and no information is available on its control, we arranged for testing the herbicide diquat (6,7-dihydrodipyrido (1,2-a:2',1'-c) pyrazinediium dibromide) in the summer of 2014. The herbicide was applied by bottom injection to the shoreline areas of the lake in July. A pre-treatment survey on over 100 georeferenced points in July 2014 (Figure 3, top right) found 59 points were occupied by Brazilian waterweed. A post-treatment survey, one year later, found only one point with the plant. Another treatment was performed in late July 2015. We will resurvey in July 2016 to determine if the plant has been eliminated.

2. Winter water level drawdown.

Candlewood Lake - Brookfield, New Fairfield, New Milford, Sherman, CT. Lake Candlewood's aquatic plant community is dominated by Eurasian watermilfoil. Winter water level drawdown is used to manage the watermilfoil. Using state-of-the-art global positioning systems, we have documented the success of the drawdowns each year since 2007. The winter drawdown protocol consists of alternate year shallow (1m) and deep (3m) water level reductions. Drawdown timing and duration varies depending on the hydrogenerating needs of FirstLight Power Resources. These variables and inconsistencies in winter weather result in differences in milfoil control. The coverage of

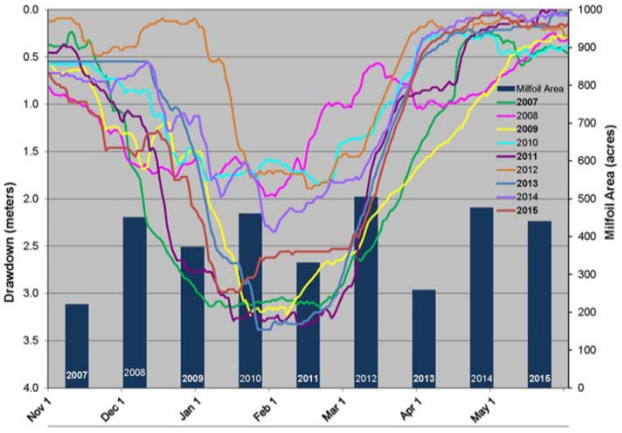


Figure 4. Comparison of drawdown depth and duration on the acreage of Eurasian watermilfoil in Candlewood Lake.

milfoil shows a negative relationship to drawdown depth and duration (Figure 4). Our yearly report to The Federal Energy Regulatory Commission, FirstLight Power Resources, CT DEEP, Candlewood Lake Authority and other stakeholders provide data that is crucial for making decisions on future drawdown practices for Connecticut's largest lake.

3. Benthic Barriers.

Lake Quonnipaug - Guilford, CT. Benthic barriers are blankets designed to be placed over nuisance vegetation in lakes and ponds. They provide an alternative to herbicides and are thought to control vegetation by blocking the light aquatic plants need to grow. Benthic barriers are not new; they are typically placed over weed beds early in the growing season and removed in the fall. Recently, marketers of benthic barriers have claimed that their products need only be placed over weeds for a few weeks and then moved to another location or removed. To test this practice, we collaborated with the town of Guilford to place twenty one 50' X 20' benthic barriers at Lake Quonnipaug's public beach (Figure 5). The beach has had an increasing problem with Eurasian watermilfoil and fanwort. We placed the benthic barriers in early April and removed them prior to the opening of the beach on Memorial Day weekend. With the exception of some vegetation that grew where the barriers were inadequately overlapped, the covered areas were free of nuisance plants and remained that way through June. Further tests are needed to determine more information on why these barriers provide impressive weed control even when they are used for short periods of time.

Figure 5. Installation of benthic barrier at Lake Quonnipaug, Guilford.

C. Outreach - We strive to disseminate all information from our program to the public in a timely fashion and educate stakeholders in the identification, prevention, and management of invasive aquatic species. We make every effort to engage citizens, lake associations, and other stakeholders. CAES scientists have organized several workshops (Figure 6) on the identification of invasive aquatic plants. We also gave presentations to professional organizations such as the North American Lake Management Society and the Connecticut Conference on Natural Resources, numerous lake associations, town meetings, and student groups such as the Connecticut Envirothon. We have made all our information freely and readily available via our website. Included are all our digitized interactive lake maps, our complete herbarium, and publications (http://www.ct.gov/caes/IAPP).

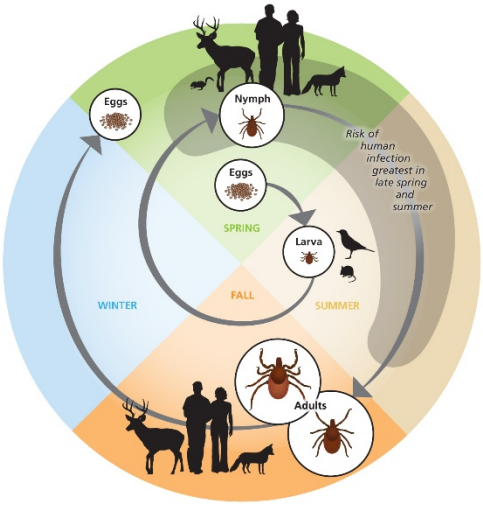
Figure 6. Jennifer Fanzutti teaching a CAES IAPP aquatic plant workshop.

Our invasive aquatic plant control and outreach efforts have resulted in the protection of lakes and provided scientifically proven methods for use by others. Our workshops (Figure 6) have trained

hundreds of citizens to recognize and report new infestations in order to prevent future problems and the associated control expenditures.

Virus-Vector Interactions

A. Deer Tick Virus Population Dynamics during Infection of *Ixodes Scapularis* Ticks (Dr. Doug Brackney, Dr. Phil Armstrong, Dr. John Anderson, Ms. Angela Bransfield)



Deer tick virus (DTV) is an emerging tick-borne virus, which can cause encephalitis and has caused numerous human cases in New England over the last couple of years. DTV is maintained in nature in a transmission cycle between deer ticks (*Ixodes scapularis*; primary vector of Lyme disease) and small woodland rodents, most likely white-footed mice. However, deer tick nymphs and adults can transmit the virus to larger mammals such as humans. Because little is relatively known about this virus, we here at CAES are conducting experiments to investigate the ecological forces allowing the virus to emerge, adapt, and persist within New England transmission cycles. Previous studies indicate that DTV is a variant of another tick-borne virus, Powassan virus, which is maintained between woodchucks and *Ixodes cookei* ticks. This divergence occurred thousands of years ago when Powassan virus became fixed in the new transmission cycle between *Ix. scapularis* ticks and white-footed mice resulting in the emergence of DTV. The evolutionary forces allowing this transmission shift are unknown. Therefore, we are examining how DTV populations evolve during infection of deer ticks in order to gain a better understanding of the evolutionary potential of this virus and viruses like it. These studies are currently underway with results expected in the next couple of months. Image from discovermagazine.com.

B. Identifying West Nile Virus Receptors in the Mosquito Gut (Dr. Doug Brackney, Mr. Mike Misencik)

The emergence and re-emergence of arthropod-borne viruses (arboviruses) over the last 40 years constitutes a continued and significant public health threat. For example, West Nile virus (WNV) was introduced into North America in 1999 and has since been responsible for 41,762 human cases and 1,765 deaths. Currently, there are no vaccines or therapeutics for the majority of these viruses. Further, while traditional mosquito abatement programs have had some success in limiting the transmission of arboviruses, concerns about public and environmental safety, the development of insecticide resistance, cost, and political instability have greatly limited their application. Therefore, the development of novel strategies to curb their transmission is greatly needed. To this end, novel vaccine strategies targeting the vector, not the pathogen, are being considered. While traditional vaccines are designed to elicit protective immunity against a specific pathogen, anti-vector vaccines aim to disrupt critical events within vectors that are important for life or pathogen transmission. The initial events mediating the interaction between arboviruses and the mosquito midgut are poorly defined. To date, no midgut receptors have been identified and the involvement of mosquito midgut carbohydrates during viral infection has not been investigated. Establishing the mechanisms by which viruses are able to bind to and infect midgut epithelial cells will greatly contribute to our understanding of this critical event and may lead to the development of novel control strategies. To address these deficiencies in knowledge we are

characterizing the luminal midgut proteome and determining the importance of midgut carbohydrates during the initial stages of WNV infection of the mosquito.

C. The Role of Autophagy during Arthropod-borne Virus Infection of Mosquitoes (Dr. Doug Brackney and Ms. Maria Correa)

Autophagy can be induced in metazoans by developmental stimuli or in response to various types of stress such as starvation, hypoxia, or microbial infection. During normal growth conditions, autophagy maintains cellular homeostasis by degrading unwanted or damaged organelles and protein aggregates. In times of cellular stress, autophagy catabolizes these cellular components, generating a pool of energy and macromolecules that maintain essential cellular processes until normal growth conditions return. Because this is a highly complex process requiring the reorganization of intracellular membranes and numerous signaling pathways, perturbations in normal activity, at any of these stages, can drastically affect the outcome of autophagic events. Not surprisingly, many viruses either directly modulate or indirectly alter many of these pathways and/or processes important in regulating autophagy. To date, our understanding of virus-host autophagy interactions has been limited to mammalian systems, yet arthropod-borne viruses (arboviruses) require both a vertebrate host and invertebrate vector for maintenance in nature. It is currently unknown if or how the autophagy pathway of vectors interacts with viruses. Our contribution here is expected to result in a detailed understanding of these events. The significance of these studies is that they will contribute to our understanding of virus-vector interactions. This is important because identifying cellular components/pathways essential to virus replication has the potential to be exploited for the development of novel control strategies.

Environmental Microbiology

A. Effects of Sudden Vegetation Dieback on Soil Microbial Ecology and Greenhouse Gas Emissions (Dr. Blaire Steven and Dr. Wade Elmer)

Recently, cases of sudden vegetation dieback (SVD) have been observed across coastal wetlands of the northeastern U.S.A. The development of SVD appears as a sudden die-off of the local plants, often occurring in as little as one season. Because SVD also kills the propagative rhizomes of the dominant plants (generally *Spartina alterniflora*), the sites often remain devoid of plants for several years. The causes of SVD have yet to be discovered, but the loss of plants can have dramatic consequences on wetland ecosystems (Figure 1). Coastal wetlands are among the most productive ecosystems on Earth, fixing an equivalent amount of carbon per area as tropical rain forests. This productivity is supported by the photosynthesis done by wetland plants. When the plants die, this carbon is no longer fixed from the atmosphere and SVD sites have the potential to switch from net sinks of carbon from the atmosphere to net sources. The release of carbon is due to soil microorganisms that recycle the material produced by the plants, which ultimately ends up as CO_2. We are monitoring cases of SVD throughout Connecticut and Rhode Island. As part of this assessment we are measuring soil gas fluxes to determine the extent that SVD affects sediment carbon cycling as well as characterizing how the soil microbial communities respond to SVD.

Our preliminary data indicates that SVD significantly alters the composition of the microbial communities (Figure 1A). We have also found that specific bacterial groups, namely bacteria in the phylum Bacteroidetes, are significantly less abundant in SVD sites (Figure 1B). These bacteria are known to be associated with the breakdown of plant-derived carbon. Their reduction in the SVD sites suggests that carbon cycling differs between SVD affected and healthy soils. In this regard, SVD offers a unique opportunity to develop metabolic models of how carbon is processed in wetlands. Taking a

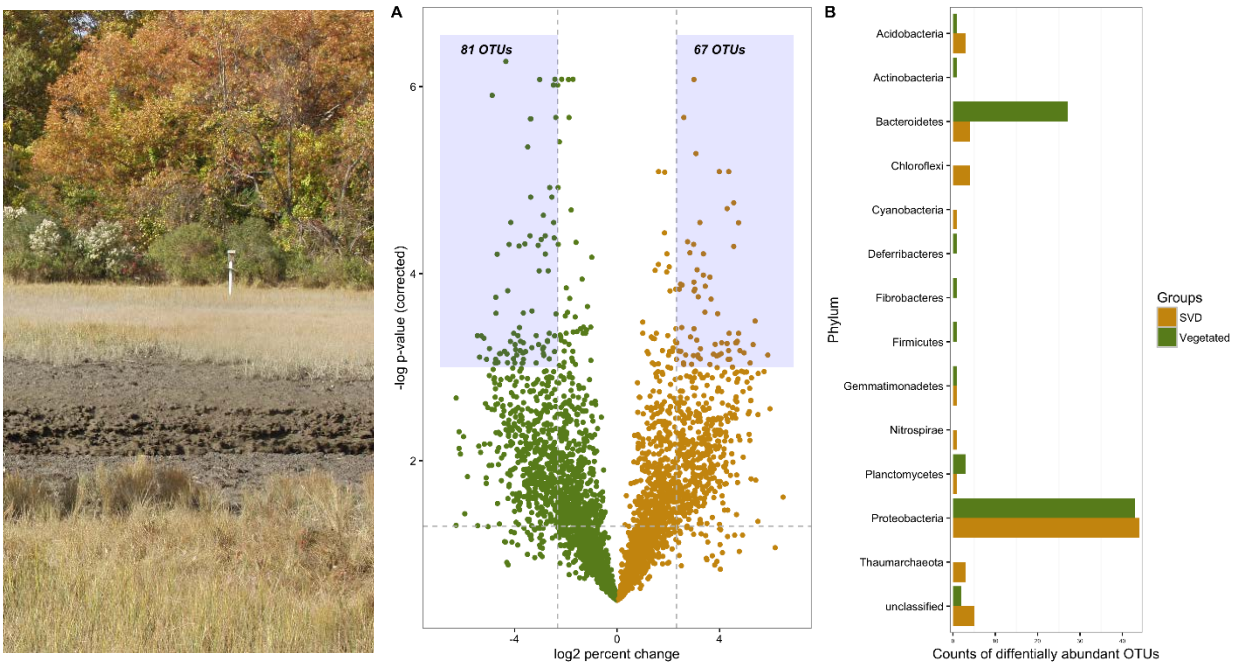


Figure 1. SVD affected site in Hammonasset Beach State Park, CT. A). Bacterial species and their abundance in vegetated and SVD affected sediments. The species within the blue boxes show significantly different abundances between the vegetated and SVD affected sites. B). Groups of bacteria altered in response to SVD.

microbial view of SVD will hopefully provide insight into the causes and consequences of SVD as well as generating data to better represent wetlands in global climate change models.

B. Mapping the arboreal microbiome and determining the metabolic pathway for in-tree methane production (Dr. Blaire Steven)

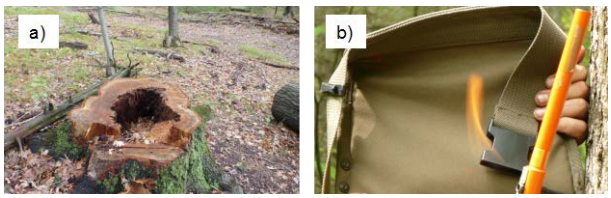


Figure 2. (a) Heart rot revealed after felling a timber tree, (b) microflaring of trunk methane released from an upland oak during tree coring. (Photo courtesy of Kris Covey, Yale University)

Recent work has established that trees and downed wood produce methane, an important climate forcing gas. The scale of the resulting fluxes from this source are as of yet, not resolved. Forest climate offsets are projected to become a $20 billion market. To date, observations suggest that methane emissions from living trees vary with stand age, species, and in the case of woody debris—decay class, indicating emissions can be managed alongside carbon as part of a more holistic climate mitigation effort.

Heartwood is non-living tissue that accumulates as trees age (Figure 2). Heartwood disease promotes decay and, with it, methane production, but it has been overlooked in atmospheric budgets when considering whether living trees are a significant global methane source. Assuming even conservative published estimates, methane production could lead to a ~20% reduction in the overall climate benefit of carbon sequestration in forests. As heartwood decay and methane production is driven by internal microorganisms, including archaea, bacteria, and fungi, a microbial view of living wood methane production will shed light on the controls of methane production in trees.

C. Characterizing the apple flower microbiome for developing potential biological controls for fire blight (Dr. Blaire Steven and Dr. Quan Zeng)

Figure 3. The presentation of fire blight affected apple trees at Lockwood Farm in Hamden, CT.

Fire blight, caused by the bacterial pathogen *Erwinia amylovora*, is one of the most devastating diseases of apples and pears (Figure 3). Despite the tremendous damage posed by fire blight, the control options for organic growers are extremely limited. Further, the removal of antibiotics from the list of organic control options by the National Organic Standards Board in 2014, put organic growers at significant risk for control failures.

As the pathogens enter the plant through open flowers, we are characterizing and screening the natural microbiome of apple blossoms to identify potential natural biocontrol agents that could be employed in organic agriculture. Work to date has focused on optimizing methods to generate apple blossom bacterial culture collections, screening isolates for antagonistic activity against *E. amylovora*, and developing methods for the metagenomics of the apple blossom microbiome. Future work will hopefully translate these methods into developing a viable biocontrol strategy for fire blight in Connecticut.

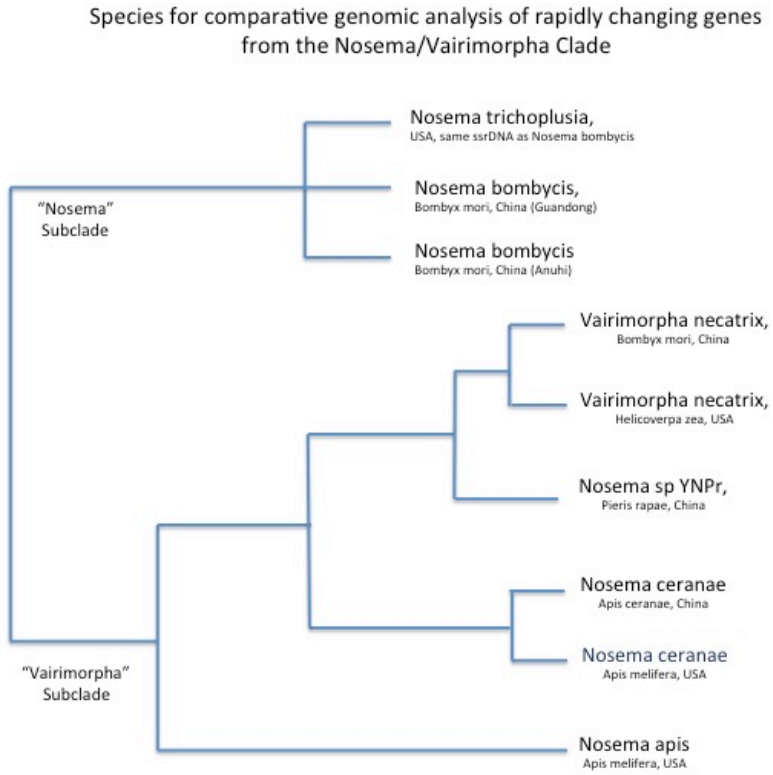
D. Mosquito Microbiota: An Ecological Based Approach for Paratransgenesis Systems in Mosquitoes (Dr. Doug Brackney, Dr. Blaire Steven)

The presence of host associated microbiota (the collection of bacteria living on or in animals) is a commonality shared among all animals including mosquitoes. Because of their importance in mediating mosquito development and their ability to influence disease transmission, there is considerable interest in understanding these relationships. It is currently known that the mosquito microbiome is composed of ~50-200 bacterial species and that this community is temporally dynamic with large shifts in community composition between different life stages. This suggests that mosquito microbiomes, in their natural state, are composed of complex and dynamic communities. However, while informative, these studies have been descriptive and have failed to empirically test the ecological mechanisms mediating microbial colonization, development, stability, or transmission. Despite these knowledge gaps, efforts to utilize this host-microbiome relationship for the purposes of controlling mosquito-borne diseases have already been tested. This approach, known as paratransgenesis, utilizes symbiotic microbes to express anti-pathogen effector molecules within the mosquito. Mosquito paratransgenesis attempts thus far have focused on employing a single paratransgenic strain. A key condition impacting the success of mosquito paratransgenesis is the assurance that paratransgenic strains are resilient to replacement by competing environmental strains. Studies in mice suggest that low complexity microbiomes are unstable, easily invaded, and quickly replaced by environmental competitors. However, it remains unknown if mosquito based paratransgenic mono-cultures will remain stable in the presence of competing environmental bacteria and conversely, whether complex paratransgenic communities are more resilient to invasion and replacement. Another important consideration when assessing the feasibility of mosquito paratransgenesis is the likelihood that such approaches can be introduced and propagated amongst natural populations. Current literature suggests that mosquito microbiomes, at least in part, can be transmitted transovum and that members of this community can colonize emerging larvae. The implications of these findings are profound and may provide a drive mechanism by which paratransgenic bacteria can be transmitted trans-generationally. However, the implications of these findings have not been examined in the context of paratransgenic communities. Furthermore, the transmission efficiency or stability of these

communities has not been assessed. Filling these fundamental gaps in knowledge will be critical if we are to fully harness the potential of novel paratransgenic countermeasures. Our goal is to better understand the ecology of the microbiome within vector mosquitoes. The objectives of this proposal is to define the stochasticity of microbial colonization, the stability of microbial populations over the life of the mosquito (including transovum transmission), and to test the predictions of a community ecology based approach on the development of paratransgenic strategies.

Evolutionary Biology of the Microsporidia
(Dr. Charles Vossbrinck)

We have begun genomic analysis of the obligate intracellular microsporidial parasite *Vairimorpha necatrix* from the Corn Earworm. This tiny single-celled organism belongs in a Phylum of its own and has potential for use in Biological Control. We hope, in the upcoming year, to compare it to another isolate of the same species obtained in China from the Silkworm. By comparing the same species from different hosts from different continents we hope to get a glimpse at how this parasite can switch hosts on the genomic level.

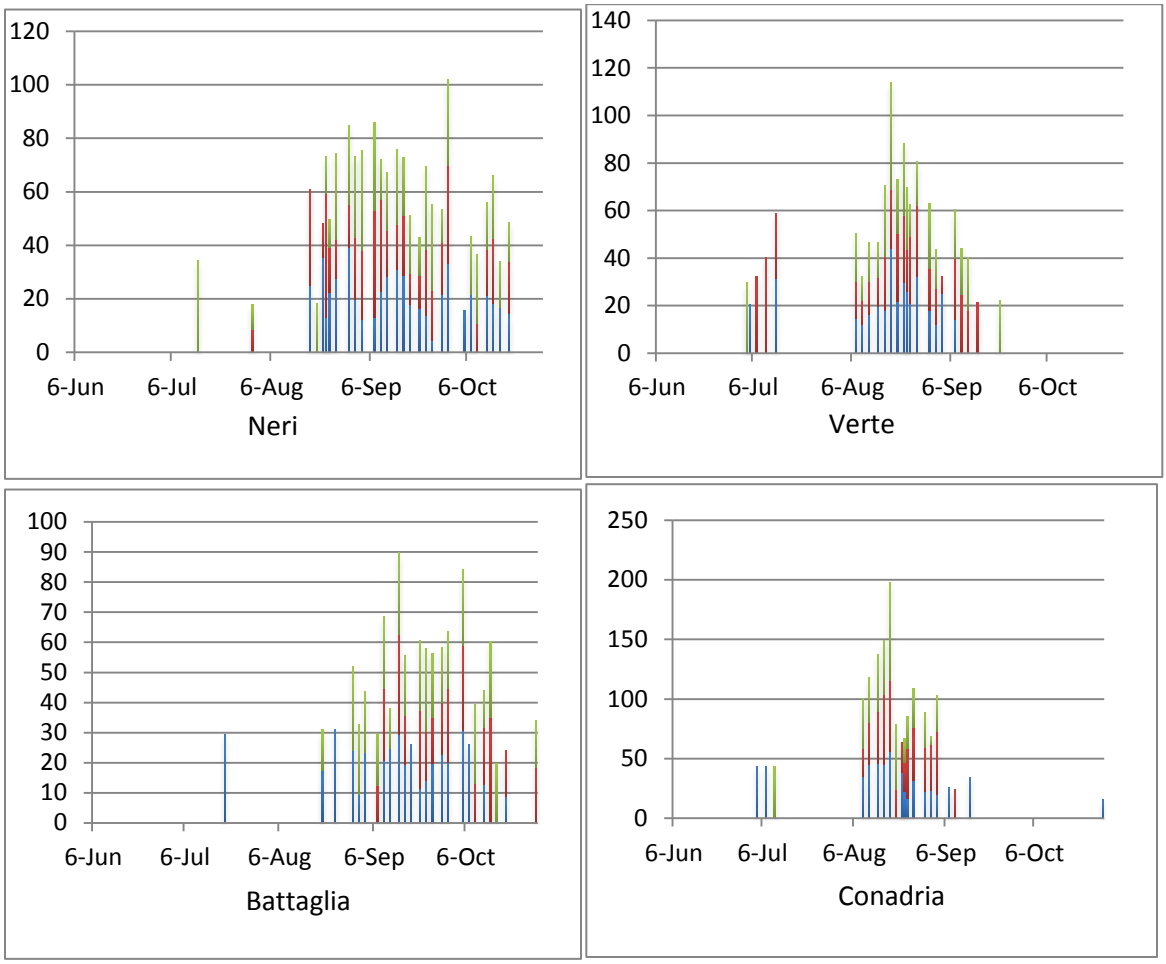


Closely related microsporidial species showing *Vairimorpha necatrix* from China and the USA.

Growth and Production of Figs in Connecticut
(Dr. Charles Vossbrinck)

Yield measurement for the fig testing program is in its third year. Six varieties are being tested for numbers, weight, and date of ripening. So far, one variety (Melanzana) requires pollination for its main crop and has been eliminated from the study. One variety in our study (Conadria) shows early ripening, high yields, and disease resistance. Figs show promise as a new crop in Connecticut. Because figs are on

the border of freeze tolerance for this area (Zone 6), figs as a crop will depend on the use of supplemental heat in the winter and the future effects of warming on the Connecticut climate.



Production numbers for 4 varieties of figs being tested at Lockwood Farm. Colors refer to different varieties.

Neri Figs (dark brebas on the old wood and developing figs) in July.

Conadria figs almost ready to pick in July

Battaglia figs will ripen.

SERVICE ACTIVITIES

Soil Testing (Mr. Gregory Bugbee)

Testing soil samples for fertility and suggesting methods for growing better plants are a continuing service for citizens of Connecticut. At the laboratory in New Haven, Gregory Bugbee tested 6,935 samples (a 27% increase from 2014-2015) and answered approximately 1,600 related inquiries.

The soil testing services and recommendations made by the Connecticut Agricultural Experiment Station reduce unnecessary fertilizer treatments to lawns and nursery stock throughout the state. This provides direct economic and environmental benefit to the suburban community by reducing nitrogen runoff into soil and water.

Connecticut's landscape is a quilt of forests, farms, towns, and cities. Scientists in the Department of Forestry and Horticulture are studying the factors that influence both forest and farm productivity, including how trees respond to novel pests and a changing climate, innovative forest management practices, the effect of the growing deer population on natural and managed landscapes, and novel specialty crops.

Emerald ash borer and drought interaction in Fraxinus tree defense responses

Recent climatic predictions suggest that drought episodes will become more frequent, increasing the possibility of invasive insects becoming established due to the decreased defense responses of drought-stressed trees. Drs. Rutledge and Arango-Velez are studying the effect of drought stress in the establishment of emerald ash borer and the new naïve host fringetrees. The first part of this study "Larval survival and growth of emerald ash borer (Coleoptera: Buprestidae) on white ash and white fringetree saplings under well-watered and water-deficit conditions" was published in the journal *Environmental Entomology*. A short summary of the research and some of the physiological results are presented here.

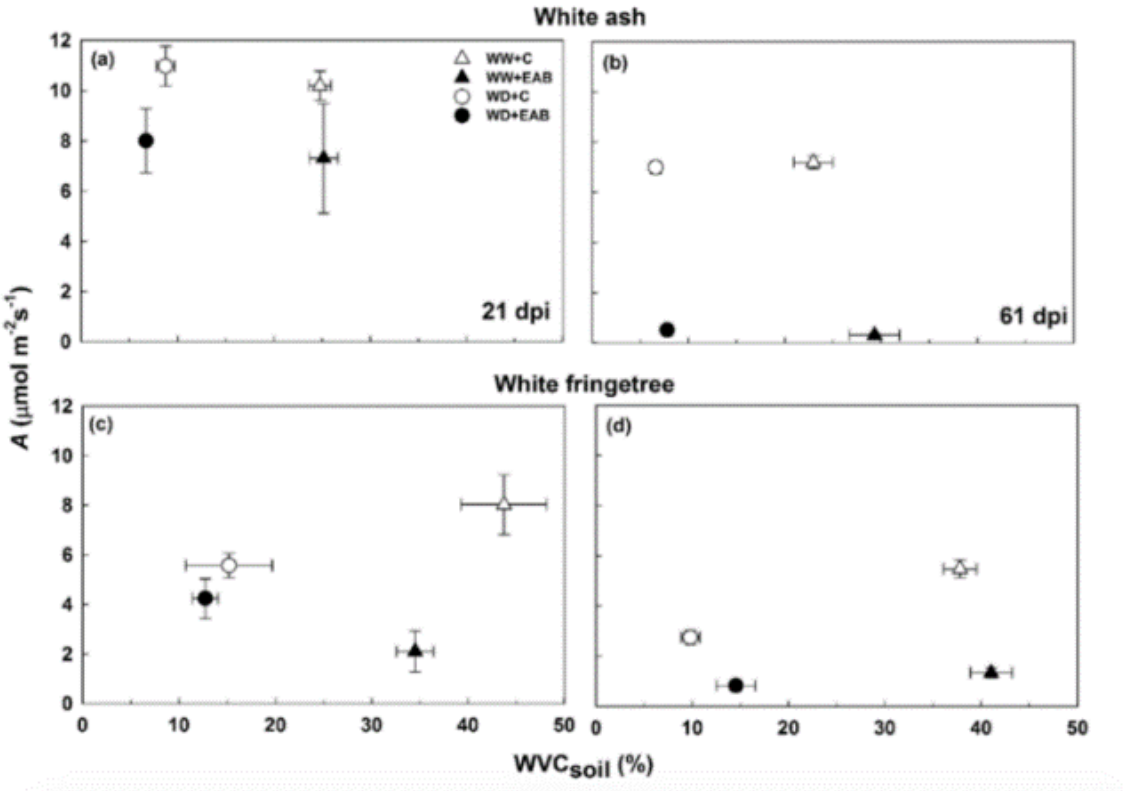


Figure 1. Photosynthesis response to drought and emerald ash borer on seedlings of white ash (top panel) and white fringetrees (bottom panel). Triangles denote well-watered conditions and circles water-deficit conditions for both control (open symbols) and infested.

Figure 2. EAB Larvae development in white ash and fringetree saplings under well-watered (left) and water-deficit (right) conditions after 61 days postinfestation.

Emerald ash borer (*Agrilus planipennis* Fairmaire) was recently found on a novel host in North America, white fringetree (*Chionanthus virginicus* L.) (Oleaceae). In this study, we artificially infested 4-year-old, naïve white fringetree and white ash (*Fraxinus americana* L.) saplings under well-watered and water-deficit conditions with emerald ash borer (EAB) eggs. We used physiological and phenotypical approaches to investigate both plant response to emerald ash borer and insect development at 21, 36, and 61 days postinfestation. Photosynthesis was reduced in both tree species by larval feeding, but not by water deficits (Figure 1). Emerald ash borer larvae established and survived successfully on white ash. Both establishment and survival were lower on white fringetree than on white ash. Larvae were larger, and had reached higher instars at all three time points on white ash than on white fringetrees (Figure 2). Larvae grew faster in white ash under water-deficit conditions; however, water-deficit conditions negatively impacted survival of larvae at 61 days postinfestation in white fringetrees, although head size did not differ among surviving larvae. White ash showed higher callus formation in well-watered trees, but no impact on larval survival was observed. In white fringetree, callus formation was not affected by water treatment, and was inversely related to larval survival. The higher rate of mortality and slow growth rate of larvae in white fringetree as compared to white ash suggest that populations of emerald ash borer may be sustained by white fringetree, but may grow more slowly than in white ash.

Does mycorrhizae and/or biochar decrease salt toxicity in urban trees?

Dr. Arango is conducting research that focuses on developing better practices for maintaining and preserving common urban trees growing under salinity and ultimately drought stress due to soil salt accumulation. Most of the current knowledge on plant adaptation mechanisms has been acquired through studies of herbaceous annuals or short-lived perennials; but much less is known for trees, especially in urban settings. Understanding the physiological adaptive traits to salinity and drought is of particular importance for urban tree management and tree planting under predicted scenarios of climate change. It is expected that arborists, tree wardens, and the general public will benefit from the proposed study by having a better understanding of how to implement practices that improve the health of stressed trees. This will result in a positive economic return for municipalities and landowners by reducing the loss of trees due to salt.

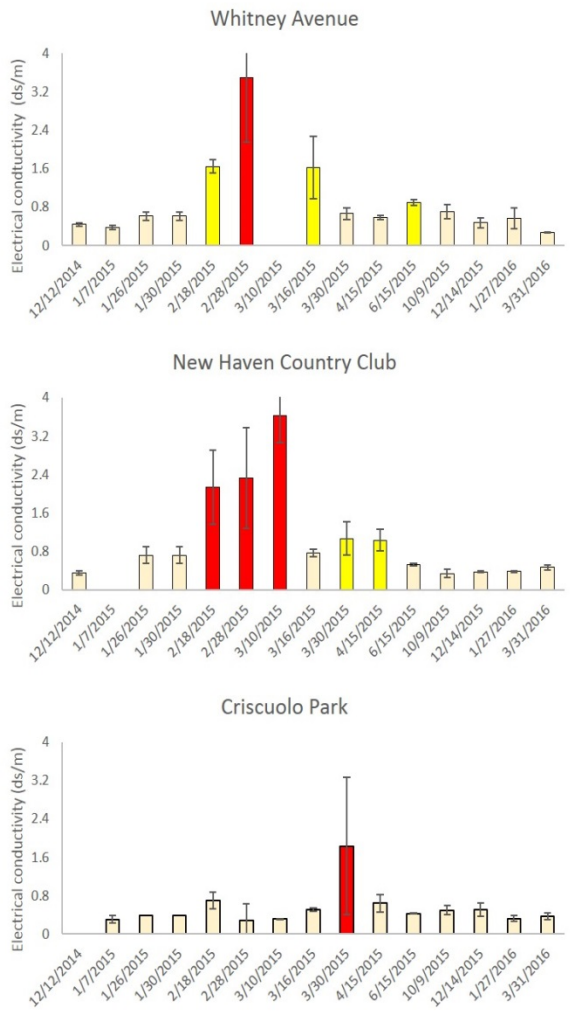


Figure 3. Soil electrical conductivity. Toxicity levels are denoted in colors, from light yellows (low), yellow (medium) to red (highly-toxic).

The field study was established in December 2014 in three different areas: strip adjacent to high automobile traffic (Whitney Avenue and Sachem Street), near a park and residential area (New Haven Country Club at Hartford Turnpike), and near a parking lot (Criscuolo Park at James Street). We found that deicing toxic salt levels accumulated mostly during winter and early spring in Whitney Avenue and New Haven Country Club during 2015 (Figure 3). Based on these results, Drs. Adriana Arango-Velez and Blaire Steven, with the help of intern Scott Hultgren, are studying the effect of salt concentration in the soil microbiota community associated with urban sugar maples.

In addition, Drs. Arango-Velez and Wade Elmer, with the collaboration of Mr. Joseph Barsky, are evaluating the adaptive traits (phenotypic plasticity) of trees for succeeding under salinity conditions. Physiological thresholds of tree responses from salt toxicity and water stress in sugar maples will be quantified by analyses of stem hydraulics, wood anatomy, and biochemical signals. In the beginning of spring 2015, sugar maple saplings were planted in a greenhouse at CAES where biochar and/or mycorrhizae treatments were applied and will be maintained through summer 2016 (Figure 4). Physiological analyses will be conducted under both salinity and drought conditions, and the effectiveness of applying biochar and mycorrhizas for salt detoxification capacity will be evaluated.

Figure 4. Sugar maple saplings growing under semi-controlled conditions. Biochar and/or mycorrhizae treatments were applied.

Southern Pine Beetle Expanding into New England

Healthy pitch pine forest in Lyme.

Southern pine beetle (SPB) presence has been confirmed in Connecticut and surrounding states, possibly due to milder winters and warmer summers. SPB outbreaks have caused direct economic losses of over $1.5 billion and widespread ecological changes across the south. Because SPB can attack eastern white pine in addition to hard pines, there is the potential of widespread disruption of eastern white pine forests of inland southern New England and pitch pine forests in coastal Massachusetts and Rhode Island. Forest management practices to identify and minimize SPB effects are therefore crucial for forest conservation and maintenance of species habitat. Eastern white pine is the second most common species in southern New England and accounts for 11% of all timber. Eastern white pine and pitch pine are associated with hardwoods that are valuable for the forest industry and wildlife habitat. In addition, these pines provide important ecological services and are now considered likely to be susceptible to attack by southern pine beetle and its pathogenic fungi.

Based on the results obtained in 2015, where anatomical differences were observed in the different pine species attacked by SPB and its pathogenic fungus (Figure 5), a study using mature eastern white pine was initiated to assess the histochemical responses to the pathogenic fungus associated to SPB. Analyses are underway and will be presented next year.

Figure 5. Southern pine beetle associated fungal study in eastern white pine. **A**. Field harvest. **B**. Resin accumulation in eastern white pine. **C**. Fungal development in phloem of inoculated trees. **D**. Traumatic resins in white pine.

Forest Management

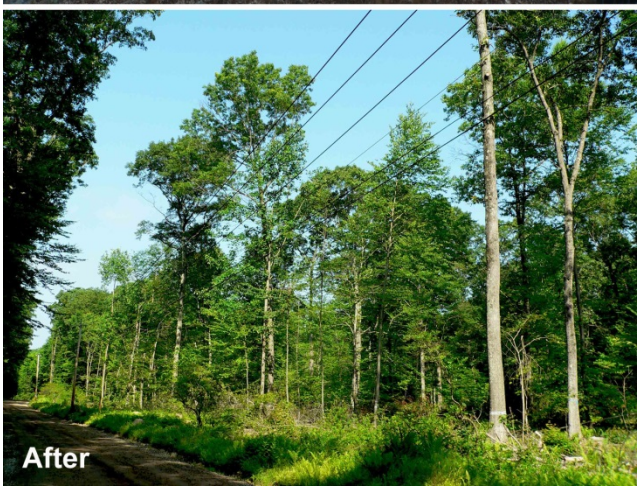
The value of the forest to Connecticut is much more than the timber and other forest products. First and foremost, forests protect watersheds, aquifers, and groundwater supplies that provide the bulk of our clean drinking water. Trees also provide air pollution control, acting as giant filters to remove dust, particulates, and some airborne chemicals. In addition, trees cool our environment in the summer by recycling water and reflecting sunlight. Forests contribute to the character of Connecticut and add to our enjoyment throughout the year.

The current epoch, described by many as the Anthropocene, finds human-mediated disturbance regimes creating novel plant community species complexes across significant swathes of the landscape. These new regimes include disturbance intervals that range from seasonally mowed hayfields to forests harvested every several decades, historically high local deer populations, nearly complete suppression of wildfire, and invasions by non-native plants. In addition, exotic insects and diseases have devastated some native species in our region including the American chestnut, eastern hemlock, elms, and soon, ashes.

Roadside Forest Management

Less appreciated are the distinctive environmental conditions associated with roadside forests. These long, linear edge forests form a unique, hitherto unseen ecotone. The higher wind speeds associated with edge forests are amplified by vehicular traffic, especially along highways with heavy truck traffic. Salt spray during the winter months can negatively impact sensitive evergreen species. While sodium chloride salt has been linked to sugar maple decline, calcium and magnesium chloride salts may have the opposite effect. Lastly, the periodic pruning of branches over utility wires or those extending into the traffic safety zone, along with removal of saplings and shrubs in those zones, precludes development of the characteristic soft edge that develops following a natural microburst or forest harvest.

There are an estimated 7,600 miles of Connecticut roads that transverse forested landscapes. If we assume that the influence of a road extends 100 feet into the surrounding forest, then approximately 5% of our forests, or 92,000+ acres, can be considered roadside forests. The benefits of roadside trees are numerous and roadside forests, in part, define Connecticut's sense of place. However, these benefits must be balanced against the potential societal costs of



losing power and communication along with road obstruction during severe weather.

Although the expanse of roads and utility corridors through forested areas is enormous, proactive management has been minimal. Historically, management of roadside forests has largely been limited to utility pruning of branches within specified distances of lines, and occasional hazard tree removal. Few, if any, resources have been invested on management of the surrounding forest. The 100 feet of forest immediately adjacent to utility lines and roads has traditionally been excluded from management activities, both by utility tree crews and by the managers of adjacent woodlands due to the understandable liability concern from accidently dropping a tree on a power line or the road.

Dr. Jeffrey S. Ward, with the assistance J.P. Barsky, is part of a private/public/NGO partnership "Stormwise" that is characterizing and developing management protocols for roadside forests. This partnership includes the private sector (Eversource Energy, United Illuminating, Connecticut Water Company), public and quasi-public entities (UConn, CAES, CT DEEP Forestry, CT DOT, South Central CT Regional Water Authority, Town of Manchester, NRCS), and NGO's (Audubon CT, CT Forest & Park Association, White Memorial Foundation). Our goal is develop forest management protocols that will lead to responsibly managed, ecologically healthy, and aesthetically pleasing roadside forests.

To characterize roadside forests, Dr. Ward and colleagues at UConn are completing the establishment of ten 1.6 ha (4.0 ac) demonstration areas located throughout the state. At each area, all trees with diameters greater than 12.7 cm (5 in) have been mapped and detailed information has been collected on their size, health, and factors that could predispose them to fail such as decay or lean. To examine the shrub stratum, all woody plants taller than 120 cm (4 ft) have been tallied by species and size on smaller subplots that are 10 and 30 m (33 and 99 ft) distant from utility lines. Vegetation shorter than 120 cm, including herbaceous guilds and invasives, have been assessed by measuring percent cover. These permanent plots will be periodically examined to monitor the dynamics of roadside plant communities both with and without Stormwise management.

Relative to trees, Stormwise vegetation management ideas are based in three very basic concepts:

1. Trees with room or space to grow are healthier trees.
2. Tree branches and twigs will grow and develop toward the sunlight.
3. Trees with the freedom to move in the wind will become more wind-firm.

Our vision is to preserve the aesthetic benefits of forested roadsides while reducing damage during future severe storms and increasing habitat diversity. Immediately adjacent to utility and road corridors, trees are pruned using ANSI A300 and at-risk trees are removed. To the interior, crop tree management is used to develop trees with wind-firm, open-grown characteristics along with subcanopies of short stature trees, native shrubs, and herbs. This is achieved by promoting the growth of open-grown trees with crowns that are wide rather than tall, such as those in open fields. Species with decurrent growth (*Acer*, *Fagus*, *Quercus*) will be favored, while those with excurrent growth (*Betula*, *Liriodendron*, *Pinus*, *Populus*) will be selectively removed.

Ten study areas have been established along 5 km of roadside forests. Lessons learned on tree selection and coordination from implementation at the areas are being incorporated into treatment recommendations at other locations. Results of treatments and monitoring will be used to inform communities and stakeholders about the management of roadside forests.

Impact: The storms in 2011 were estimated to have caused Connecticut more than $3 billion in economic losses. CGS Sec 16-234a(4) recognized our work by designating the Right Tree-Right Place lists as the state standard of trees and shrubs compatible with utility infrastructure. Replacing urban/suburban roadside trees as they die with shorter Right Tree-Right Place species will impose no additional costs to property owners and towns. Recognizing the importance of our work for their forest management programs, Connecticut Water Company, the Town of Manchester, White Memorial Foundation, CT DEEP, and CT DOT have provided land and personnel assistance to establish the demonstration areas.

Precommercial Crop Tree Release

An underappreciated component of precommercial crop tree release (PCTR) is the inevitable partial release of non-crop trees. While the response of fully released crop trees is increasingly understood, few studies have examined the response of non-crop trees. The effects of precommercial crop tree release at canopy closure on upper canopy persistence, mortality, and diameter growth over 25 years were examined on seven study areas established in Connecticut in 1988. Each area had nine 8 m x 8 m plots for each of two treatments: PCTR and unmanaged controls. The equivalent of 156 crop trees per hectare were completely released by cutting all stems with adjacent crowns. This resulted in the inadvertent partial release on two or more sides of 480 upper canopy, non-crop trees per hectare. Diameters and crown classes of all stems (DBH > 2 cm) were measured annually. For those stems in the upper canopy at when treated, partial release increased the proportion of oaks, but not maples or birches, which persisted in the upper canopy. Partial release increased the proportion of intermediate oaks that ascended into the upper canopy and reduced mortality. Partial release increased 25-year diameter growth of oaks. However, releasing upper canopy, sapling oaks on only one side did not increase upper canopy persistence or diameter growth. PCTR increased the proportion of oaks among the largest 300 trees per hectare twenty-five years after treatment. Where predicted oak densities are below management goals, precommercial crop tree release should be considered as a tool to increase survival and growth of quality oak saplings.

Impact: The increased diameter growth provided by precommercial crop tree release should optimize potential stand value and result in at least a 4% real rate of return by decreasing the time needed to reach minimal diameter of grade or veneer sawtimber.

Cut Oak Stump Resprout Study

When cut down, many tree species put root energy reserves into forming new sprouts from latent buds on the stump. In the past, these stump resprouts are an integral part of a regenerating forest. However, in Connecticut, it is not known how many of these resprouts successfully reach the upper canopy largely due to overbrowsing by white-tailed deer. As a result, Drs. Scott Williams and Jeffrey Ward, in collaboration with the Wildlife Division of the Connecticut Department of Energy and Environmental Protection and the South Central Connecticut Regional Water Authority, selected five sites throughout the state (Bozrah, Burlington, Guilford, Litchfield, and Madison) where timber management has recently occurred. Three of the five sites were recently clearcut for New England cottontail (*Sylvilagus transitionalis*) habitat, a fourth was part of a timber sale, and the fifth is part of a forest stand rehabilitation project. A total of 187 oak stumps were identified, measured, and numbered. We used 6' fence to individually enclose half of the stumps, effectively isolating them from browsing deer. Additionally, half of those stumps fenced from deer have three 8" x 12" holes cut into the fence at ground level to permit cottontail rabbit access to resprouts. In spring 2014, an additional 10 resprouting stumps were fenced at each location except for Guilford to improve sample size as only about half of monitored stumps actually produced sprouts. We will be able to determine the impact browsing deer have on limiting regeneration of oak resprouts and will be able to determine what impact rabbits are having as well after several growing seasons.

While still too early to differentiate impacts to oak regeneration by rabbits and deer, some differences are evident in those stumps that were fenced and those that were not. Two years after fences were erected, there were 104 stumps (56%) that had viable sprouts. Stumps that were not fenced averaged more resprouts/stump (13) than did fenced stumps (9). However, the average height of resprouts inside fences (92") was nearly double those that were not fenced (60"). Effectively, rabbits and deer will continue to browse available resprouts and keep them suppressed while fenced resprouts will continue to grow and have the potential to rejoin the forest canopy and eventually produce hard mast that will benefit native wildlife populations.

Impact: Oak is a valuable commodity for both the timber industry as well as a source of hard mast for native wildlife species. Protecting new oak stump sprouts with portable cages could be a viable alternative to area-wide fencing for maintaining oak as a significant component of forests in areas with high deer abundance.

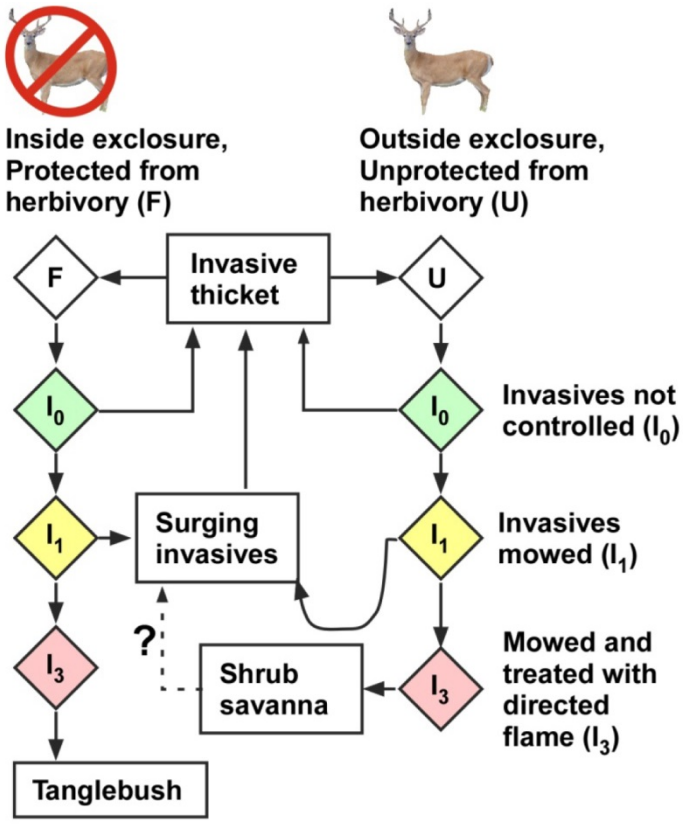
Deer Herbivory Exclosure Study

One method to study the impact of deer on natural ecosystems is to compare growth rates and species diversity of vegetation protected from white-tailed deer (*Odocoileus virginianus*) herbivory to unprotected plots. Drs. Scott Williams and Jeffrey Ward are collecting vegetation data within sixteen deer exclosures and sixteen adjacent control plots throughout the state. Deer exclosures prevent deer from accessing vegetation within. Growth rates and species diversity of enclosed vegetation are compared with that of an adjacent control plot, where deer have access to vegetation. The project is a collaborative effort with The Nature Conservancy to maintain and sample twelve deer exclosures (and

adjacent control plots), at Burnham Brook Preserve in East Haddam, the Bingham Easement in Salem, and Devil's Den Preserve in Weston. We are also including four of our own exclosures on South Central Connecticut Regional Water Authority property in North Branford. Additionally, in collaboration with the Connecticut Department of Energy and Environmental Protection and the Metropolitan District Commission, four more fences were erected this spring at the MDC's Barkhamsted Reservoir property (see photo). Plots have been sampled for herbaceous species cover in spring of 2006-2016. Late summer sampling was conducted from 2005-2015 and included all woody and herbaceous plants. Preliminary data analyses indicate that herbaceous cover within exclosures is greater than control plots. Density of tree seedlings at least two feet tall is twice as high within exclosures compared to control plots. All locations will be resampled for both woody and herbaceous vegetation in late summer 2016. Results from this study will reveal plant species composition and growth rates in the absence of browsing deer.

Left to right: CAES Technician Michael Short, DEEP Wildlife Division Seasonal Employees Josh Tracy and Molly Tasmer, CAES Technician Megan Linske, CAES Associate Scientist Dr. Scott Williams, and DEEP Wildlife Division Biologist Michael Gregonis. Photo by Andrew Hubbard, MDC Forester.

Impact: Overabundant herds of white-tailed deer negatively affect forest regeneration by repeated herbivory. This in turn will negatively affect the future of the timber industry and other wildlife populations in Connecticut. The Nature Conservancy in Connecticut uses these data to scientifically justify and document the results of their deer management program by educating their constituency on the negative impacts of overabundant white-tailed deer on the very forest flora and fauna they are charged with protecting. The Nature Conservancy also uses these data as a benchmark with which to monitor and compare noticeable browse damage on other properties which may require deer reduction. The Metropolitan District Commission will use these data to monitor similar impacts by overabundant deer but as it relates to water quality in terms of minimizing erosion and siltation into surface drinking water bodies.



Interaction of Deer Browse Impacts and Barberry Infestations

While both invasive species and cervid herbivory are recognized as locally important drivers of plant community dynamics, few studies have examined whether their effects on plant community structure and dynamics are synergistic, additive, or antagonistic. Beginning in 2007, Drs. Jeffrey Ward and Scott Williams began a study examining the interaction of invasive shrubs and cervid herbivory, primarily Japanese barberry (*Berberis thunbergii* de Candolle) and white-tailed deer (*Odocoileus virginianus* Zimmermann) respectively, on development of herbaceous and shrub layers. At three locations, invasive shrubs were either treated three times (I_3, initial mechanical cutting in March followed by directed flame of new ramets with propane torches in July and October), once (I_1, single mechanical cutting in March), or were not treated (I_0). After the initial mechanical cutting, half of each treatment area was protected from deer herbivory with a 2.3 m polyethylene fence (F-fenced, U-unprotected) resulting in six treatment combinations I_3F, I_3U, I_1F, I_1U, I_0F, and I_0U. Within each of the six treatment combinations, percent coverage estimates for all shrub, vine, and herbaceous species were completed at ten 4 m^2 sample points in early summer from 2007-2013. Species were combined into nine guilds for analysis: annuals/biennials, short perennial forbs, tall perennial forbs, ferns, graminoids, native woody shrubs, invasive shrubs, native woody vines, and invasive woody vines.

Repeated measures analysis found no significant invasive control-browse exclusion interaction in changes of cover over the 6-year period for any guild, indicating no synergistic effects. However, changes in cover were influenced by invasive control for short perennial forbs, invasive shrubs, and native vines; by browse exclusion for graminoids and annual/biennials; and by both invasive control and browse exclusion (i.e., effects were additive) for invasive vines and native shrubs. Using volume as an alternative metric, invasive control-herbivory exclusion interactions were noted for invasive vines, native shrubs, tall perennial forbs, and graminoids. For the first three guilds, volumes were greater only with both invasive shrub control and herbivory exclusion. Graminoid cover was also greatest where invasive shrubs were controlled, but in contrast, outside of the exclosures.

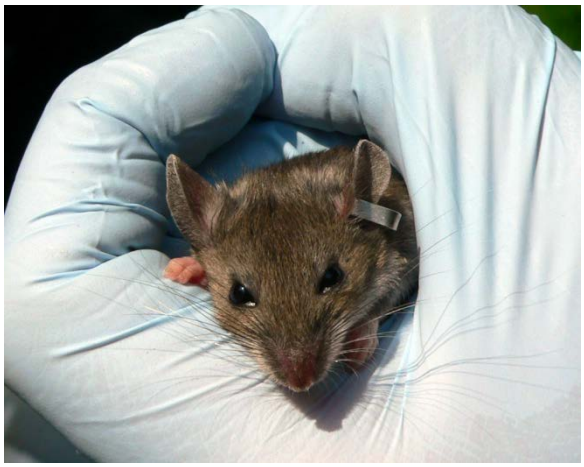
Our results suggest that deer at high densities function as keystone herbivores that create underutilized growing space by intensively browsing susceptible species, especially native shrubs. Invasive shrubs initially establish as passengers in degraded systems. The invasive shrubs were able to become the predominant species because while they are browsed, they are able to continue to grow. Once invasive shrubs have formed well-established thickets, they function as backseat drivers because the recalcitrant thickets quickly recover from a disturbance that kills all aboveground tissues – regardless of whether herbivore pressure is high or absent. These recalcitrant thickets severely limit growth of shorter stature species by capturing most of the available light, and as other studies have shown, by altering soil biota

and chemistry. Until the introduction of effective biological controls, it is likely that invasive shrubs will continue to dominate sites where they are established and spread across the landscape.

Impact: Both the invasive shrub Japanese barberry and native white-tailed deer can have detrimental impacts on Connecticut's native forested ecosystems. Information on invasive control and growth characteristics has been provided to media outlets (WNPR, WFSB-3, Landscape Architecture magazine, CT Post, The Daily Voice, Brainerd Communications), numerous associations (CT, NY, VT, MA), 10 government agencies (CT, VT, WI, NC), 8 towns, and 9 private companies/utilities. Restoration of native communities was important for 83% of land trusts that implemented invasive control programs on at least 925 acres in Connecticut since 2010.

Japanese Barberry Infestations Serve as a Refuge for Blacklegged Ticks

In many Connecticut forests with an overabundance of white-tailed deer (*Odocoileus virginianus*), Japanese barberry (*Berberis thunbergii*) has become the dominant understory shrub. This exotic invasive provides habitat favorable to blacklegged tick (*Ixodes scapularis*) and white-footed mouse (*Peromyscus leucopus*) survival. To determine mouse and larval tick abundances at six replicate sites, Drs. Scott Williams and Jeffrey Ward have been trapping mice since 2007 in unmanipulated dense barberry infestations, areas where barberry was controlled, and areas where barberry was minimal or absent. The number of feeding larval ticks/mouse was recorded. Adult and nymphal ticks were sampled along permanent draglines within each treatment area, retained, and were tested for the presence of *Borrelia burgdorferi*, the causal agent of Lyme disease in humans and pets.



To date, there have been 2,322 white-footed mice captures. The number of captured mice did not differ between treatments. However, the average number of feeding larval ticks per mouse was highest on mice captured in dense barberry (6.0 larvae/mouse). Adult tick densities in dense barberry (237/acre) were higher than in both controlled barberry (120/acre) and no barberry (69/acre) areas. Ticks sampled from full barberry infestations and controlled barberry areas had similar infection prevalence with *B. burgdorferi*, 54 and 50%, respectively. Adult tick infection prevalence with *B. burgdorferi* varied widely between treatments and study areas, but was lowest in areas where barberry was absent and generally lower where barberry was controlled. This in concert with the overall reduction in the adult tick cohort in areas where barberry was controlled resulted in 108 *B. burgdorferi*-infected ticks/acre in dense barberry, 55/acre where barberry was controlled, and 30/acre where barberry was absent.

Results indicate that managing Japanese barberry will have a positive effect on public health by reducing the number of *B. burgdorferi*-infected blacklegged ticks that can develop into motile life stages that commonly feed on humans. Mouse trapping and tick sampling efforts will continue for several more years to monitor long-term effects of controlling Japanese barberry.

Impact: This research scientifically documented the negative impacts an invasive plant has on human health. Forest managers have used it to strengthen their argument for the increased need to control

invasive plants. Applied invasive plant control will also reduce the number of ticks capable of causing Lyme disease in humans and domesticated animals. In the past five years, 69% of land trusts responding to our survey in spring 2015 indicated that they have treated barberry on 530 acres and other invasive species on another 800 acres. In addition, various entities in the states of Massachusetts, Michigan, New York, Pennsylvania, Rhode Island, and Vermont have used these results to educate and in part to justify equipment purchase and initiate or reinvigorate invasive plant control programs. Lastly, multiple towns in Connecticut as well as the states of Delaware and Maryland and the Province of British Columbia have used our research linking deer and invasive plants to justify their respective deer management programs.

New Crops Program

Investigation of new crops is essential to provide new opportunities for farmers during a time of changing agriculture in Connecticut. Today, about 11,000 acres on 733 farms in Connecticut are devoted to vegetable production with a cash value of 30.2 million dollars. This compares to 19.1 million dollars from 582 farms in 2002. Seventy-nine percent of these farms are less than 100 acres in size; sixty-three percent are less than 50 acres in size. With numerous small farms, there is a need for growers to find a diversity of high value niche crops. In addition, small farm sizes in Connecticut have resulted in marketing shifts from wholesale contracts with local supermarkets to direct retail sales. Approximately 313 farms offer direct sales through roadside stands and sales rooms, where a variety of fruit, vegetables, nursery stock, and Christmas trees are offered. About 36 of these are open all year. Nearly 20% of these farms offer pick-your-own fruit and vegetables to reduce the cost of harvest labor. These savings are passed on to the consumer.

The development of a network of farmers' markets in Connecticut's major urban centers and densely populated suburbs is an important segment of direct sales of vegetables to consumers. All produce sold at farmers' markets must be "Connecticut Grown." Farm fresh produce is offered at reasonable prices to urbanites who cannot travel to the farms. Niche crops valued by diverse ethnic groups are generally sold at these markets. According to the Connecticut Department of Agriculture, there were 122 farmers' markets in 2015, attended by over 400 farmers compared to 87 markets in 2007, a 40% increase.

As the popularity of farmers' markets in Connecticut have surged, so too has the need for growers to find a diversity of high value niche crops. Consumers used to a wide variety of fruits and vegetables in large supermarkets are seeking a greater diversity of ethnic and specialty crops at farmers' markets and roadside stands. A recent survey of vegetable growers by the Connecticut Agricultural Experiment Station showed that over 70 vegetable crops are currently being grown in Connecticut. The Connecticut Agricultural Experiment Station has been investigating specialty crops to provide new opportunities for Connecticut farmers since 1982. Over 50 fruits and vegetables have been studied resulting in over 50 publications. Results have been, and continue to be, communicated to growers at meetings and farm visits. Some of the crops studied in the New Crops Program include globe artichoke, Belgian endive, radicchio, heirloom tomatoes, sweet potatoes, specialty melons, okra, and tomatillos. Research included cultivar trials and experiments to determine the best cultural methods for growing each specific crop in

Connecticut. Crops that were chosen have a high market value and an existing or expanding market that would readily accommodate these commodities.

Sweet Corn Trials: Among all vegetables grown in Connecticut, sweet corn ranks first in acres grown and cash value. Supersweet corn trials were conducted from 1995 to 1998 at CAES. Of the 22 cultivars evaluated, only 5 remain for sale. Trials including new varieties developed in the last 15 years will provide important information to the over 300 Connecticut farms who grow sweet corn. In 2015, Dr. Maynard evaluated the yield and quality of 5 varieties of sweet corn planted May 1 and June 1 at Windsor and Lockwood Farm. In addition, cool soil percent germination will be determined from the early (May 1) planting.

Impact: Temptation had the greatest germination (98%) at Windsor for the early May 1 planting while Xtra Tender 274A had the greatest germination at Lockwood Farm (75%). Espresso (129 ears/20 ft) had the greatest yields when averaging both plantings at both sites followed by Quickie (102 ears/20 ft). At a retail price of $0.60/ear, there is a potential crop value of $67,431/acre. Cultivar selection can dramatically increase yields and profits for the grower. By growing Espresso instead of Xtra Tender 274A, the grower can produce over 75,000 more ears per acre or over $45,000 more per acre. The long-term benefits include additional revenue for farmers in the spring and early summer, especially those who attend farmers' markets in urban areas.

Kabocha Trials: Kabocha is a generic term for squash in Japan, but in North America, kabocha is a specific type of winter squash. It has a hard, dull, bumpy dark green shell marked with pale, celery green striations. Round with a flattened top, it ranges from one to eight pounds, but generally averages two to three pounds. It has a brilliant yellow-orange flesh with a naturally sweet flavor and texture similar to pumpkin and sweet potato. Kabocha is harvested when immature with dry, bland-tasting, pale yellow flesh. It must be ripened for about 6-12 weeks after it is harvested in order to enhance sweetness and maturity with a bright orange color. Two cultivars of kabocha were included in our winter squash trials in 1997-1998 but there are now over 20 cultivars on the market including both regular and new smaller (1 lb) personal-sized types. In 2015, Dr. Maynard evaluated the yield and quality of eleven cultivars of kabocha squash at Windsor and Lockwood Farm. Included in the trials were 8 short-vined and 3 long-vined varieties as well as 3 personal-sized varieties.

Impact: Averaging both sites, Eclipse (19.2 lb/plant) and Thunder (16.4 lb/plant) had the greatest yields. Cultivar selection can dramatically increase yields and grower profits. By growing Eclipse instead of Space Station, the grower can produce 56,991 more pounds per acre. At a retail price of $0.69/lb, the grower can gross over $39,000 more per acre by growing Eclipse. The long-term benefits of growing kabocha squash include an additional product and revenue for growers who attend farmers' markets or have their own roadside stands. Almost half of all vegetable growers in Connecticut grow winter squash.

Sweet Potato Trials: A 1998 Connecticut Department of Agriculture survey noted that sweet potato is one of the most popular specialty vegetables. In addition, it is very nutritious, with high values of beta carotene (vitamin A) and vitamin C. North Carolina and Louisiana are the leading US producers where they are grown in hilled soil, but we have found that they can easily be grown in Connecticut. Since they have a long growing season and thrive in warm soil, they have always been grown in the Northeast with black plastic mulch. However, black plastic mulch and hilling the soil increases both the labor and the cost per acre of producing the crop. In 2015, Dr. Maynard evaluated the effect of different cultural treatments on the yield and quality of sweet potatoes. There were 4 treatments: black plastic/flat soil, black plastic/hilled soil, no mulch/flat soil, and no mulch/hilled soil.

Sweet potato field

Impact: The greatest yields were from plots amended with black plastic mulch (6.2 lbs/plant) compared to bare soil plots (5.5 lbs/plant). There were no differences in yields between the hilled and flat soil plots. The long-term benefits of growing sweet potatoes include additional revenue for farmers and providing a product that has growing consumer demand. In addition, there may be health benefits for those who consume sweet potatoes. About 43% of vegetable growers in Connecticut grow sweet potatoes.

Okra Trials: Okra is grown for its long pointed seed pods, which are used in gumbos and soups. It is best picked when the pods are young and immature or about 2-4 inches long. It is considered a delicacy in the southern United States particularly when breaded with corn meal and deep-fried. It is in the same family as cotton, hollyhocks, and hibiscus which make it a nice ornamental plant as well. Okra plants are extremely drought resistant which make a popular vegetable in countries with difficult growing conditions. It grows best in hot weather with warm soils so that yields are usually increased when grown with black plastic mulch in the Northeast. In 2015, Dr. Maynard evaluated the yield and quality of ten cultivars of okra at Windsor and Lockwood Farm. In addition, the crop was grown with and without black plastic mulch to determine whether the expected increased yields utilizing the black plastic mulch is enough to offset the added expense of the plastic.

Impact: Averaging both sites, North and South (98 pods/plant) and Jambalaya (85 pods/plant) had the highest yields. Yields from the black plastic amended plots averaged 96% greater when compared to plots with no plastic. Cultivar selection can dramatically increase yields and grower profits. By growing the cultivar North and South (98 pods/plant) instead of the cultivar Cow Horn (56 pods/plant), the grower can produce 42 more pods/plant or almost 305,000 more pods/acre. At a retail price of $2.99/12 pods (6 oz), the grower can gross almost $76,000 more per acre by growing North and South. The long-term benefits of growing okra include an additional product and revenue for growers who attend farmers' markets or have their own roadside stands. About 35% of vegetable growers in Connecticut grow okra.

Pawpaw Trials: Pawpaws are shrubby trees that are native to the temperate woodlands of the eastern United States. The American Indian is credited with spreading pawpaws across the eastern U.S. to eastern Kansas and Texas, and from the Great Lakes almost to the Gulf. They are woodland understory plants that need shade to protect the seedlings but once established prefer full sun. They produce maroon, upside-down flowers which are self-incompatible, requiring cross pollination from another unrelated pawpaw tree. They are not pollinated by bees but by flies and beetles. The pawpaw is the largest edible fruit native to America. Individual fruits weigh 5 to 16 ounces and are 3 to 6 inches in length. The tasty fruit has a smooth, custard texture. In this trial, 4 cultivars of pawpaws were planted in 2002. Since 2013, annual yields were recorded from each tree.

Impact: Thus far, the cultivars Rebecca's Gold and Overleese have averaged the greatest yields (43 and 39 fruit/tree, respectively) with Sunflower producing the largest fruit (6.9 oz/fruit). Pawpaws are an ideal fruit for Connecticut growers who attend farmers' markets or have their own roadside stands as they are very delicate and difficult to ship long distances. The long-term benefits of growing pawpaws include an additional product and revenue for growers.

Sheet Composting of Oak and Maple Leaves

Many municipalities in Connecticut with leaf collection programs in the fall are turning to farmers to dispose of their leaves. However, not all farmers have extra land to set aside for a standard composting operation. Instead, they layer undecomposed leaves on their fields and simply plow the leaves under. This is called sheet composting. Nitrogen deficiency can be a problem in these soils because microorganisms involved in leaf decomposition use nitrogen more efficiently than plants. There is some question whether the differences in the rates of decomposition between oak and maple leaves would lead to differences in plant response when these leaves are used in a sheet composting operation. This is also a situation that confronts many home gardeners who have a predominance of oaks in their backyards.

To help answer this question, Dr. Maynard conducted a sheet composting experiment in which plots were amended with either all oak or all maple leaves. Undecomposed leaves were layered about 6 inches thick in the falls of 1994-2013 and incorporated into the soil by rototilling. In 2015, eggplant was grown with all plots receiving the same amount (1300 lbs/A) of 10-10-10 fertilizer. Yields from plots amended with oak leaves were compared to plots amended with maple leaves and the unamended controls. In 2015, the greatest bean yields were from plots amended with maple leaves (23.4 lbs/10 ft row) followed by plots amended with oak leaves (22.0 lbs/10 ft row) and the unamended control plots (19.8 lbs/10 ft row). Lettuce yields from the plots amended with maple leaves averaged 1.8 lbs/head compared to 1.6 lbs/head from plots amended with oak leaves and 1.5 lbs/head from the unamended control.

Impact: Many Connecticut homeowners are now disposing of their oak and maple leaves in their gardens without worrying about any deleterious effects on yields in their vegetable gardens. Incorporating tree leaves into gardens improves the environment by storing carbon in the soil and reducing the volume of material in the solid waste collection and disposal system.

Sonic and Electrical Resistance Tomography in the Assessment of Internal Decay in Living Northern Hardwoods.

The goal of Dr. Marra's project, funded with a National Science Foundation grant through the EaGER (Early Grants for Exploratory Research) program, is to evaluate the use of sonic and electrical resistance tomography (SoT and ERT, respectively) in the nondestructive assessment of the extent and magnitude of internal decay in living trees. Current assessments of the role that forests play in sequestering atmospheric C assume that trees are solid tapering cylinders of wood, i.e., they do not take into the account the role of internal decay in reducing estimates of sequestered C.

SoT measures differences in the velocity of sound, which correlates to the extent of decay. ERT measures differences in electrical conductivity, which correlates to the amount of water present, and can identify incipient stages of decay. Field work completed at Great Mountain Forest (GMF) in Norfolk, CT the summer of 2014, consisted of tomography performed at three cross-sectional levels (50, 100, and 150 cm above ground) on 20 or more trees of each of the three principal northern hardwood species – American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), and yellow birch (*Betula alleghaniensis*), followed by felling and cutting of stem disks ("cookies") at the tomographic cross-sections. Figure 1 shows the typical location of tomographic cross-sections, and the images taken at these positions.

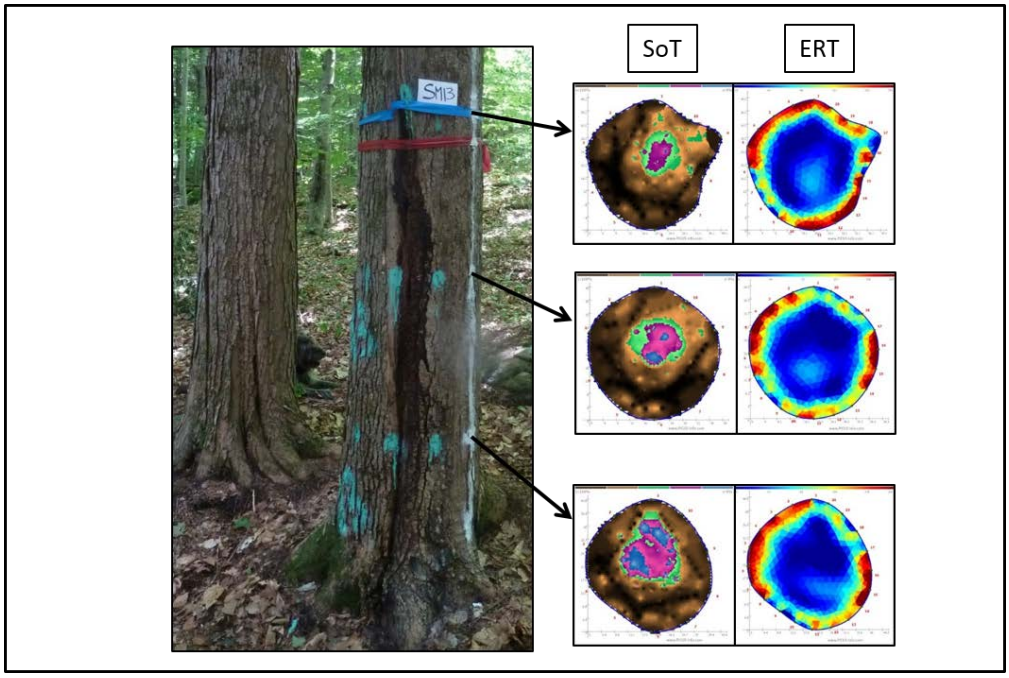


Figure 1. A sugar maple and the associated sonic (SoT) and electrical resistance (ERT) tomographs. In SoT, brown-green-magenta-blue represents decreasing wood densities. In ERT, red-yellow-blue represents decreasing electrical resistance.

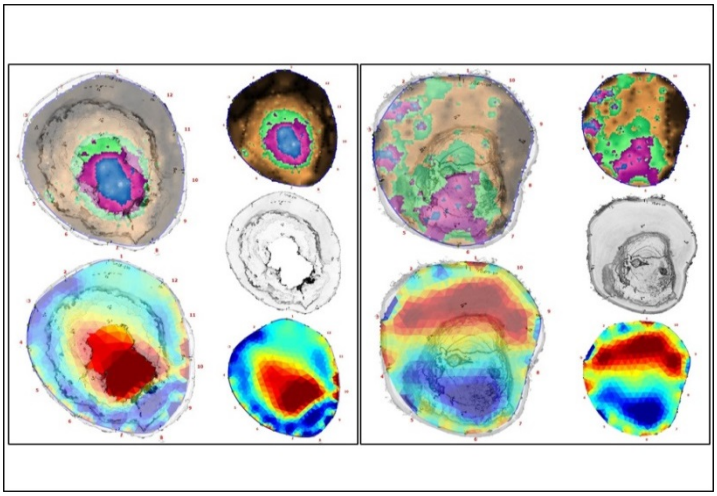


Figure 2. Semi-opaque versions of cookie photographs were transposed over the tomographs, with measuring points aligned, facilitating evaluation of the accuracy and reliability with which tomographs predict the extent and nature of internal decay, including the presence of cavities.

During the winter of 2015, the air-dried cookies were planed, sanded, and photographed, for direct comparison to tomographic images (Figure 2).

Over 500 volumetric samples extracted from cookies, corresponding to tomographic colorimetric categories (brown, green, and magenta; blue could not be sampled) were analyzed for C concentration by Gas Chromatographic Elemental Analysis (GCEA), thus permitting an estimate of C density (concentration by volume). Analyses of these data confirmed the hypothesis that SoT depicts variation in wood density, with samples from areas corresponding to "brown" in sonic tomographs showing the highest densities, and samples from areas corresponding to "green and "magenta" showing progressively decreasing densities. Statistical analyses of these data showed that "green" and "magenta" samples were each significantly lower in C density compared to "brown," but not significantly different from one another; they were therefore pooled together as "non-brown" for subsequent analyses in which these C density metrics are used with volume estimates (as shown in Figure 3) to estimate the amount of C in the tomographically assayed portion of the lower bole.

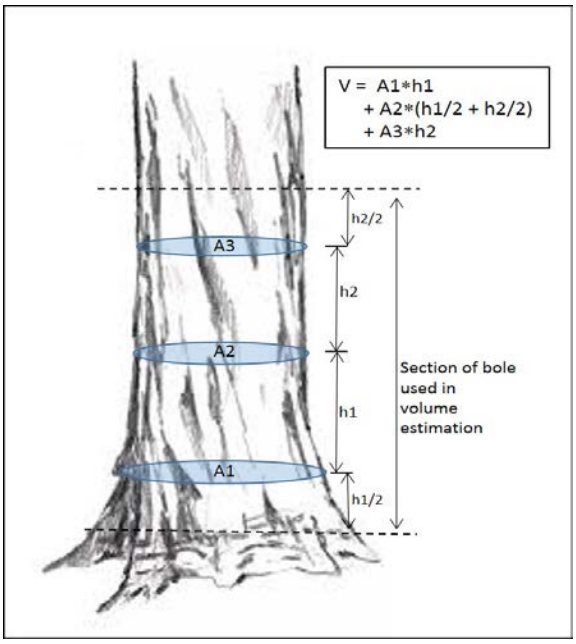


Figure 3. Volume estimates of the lower bole, using surface area data provided by PiCUS software.

Further analyses of SoT and ERT images in conjunction with cookie photographs permitted the conclusion that when used together, SoT and ERT can accurately distinguish among four internal tree conditions, as shown in Table 1 and Figure 4; of most importance in the development of a nondestructive methodology for assessing the internal condition of trees is the high degree of accuracy with which cavities can be distinguished from active decay and sound wood. Furthermore, the tomographic software reports the relative proportion of "brown" to "non-brown" in the cross-section, thus permitting an estimate of the relative volumes of sound wood, actively decaying wood, and cavities.

In order to test the accuracy with which SoT and ERT can nondestructively estimate the amount of C in the tomographically assayed section of a tree, nearly the entire inventory of tree cookies (105) was measured for volume and mass in the spring of 2016. These data are now being analyzed statistically in order to validate and calibrate the methodology. The actual C content of each cookie was estimated by multiplying the cookie mass by C concentration metrics. Cookie volumes are used with tomographic data to indirectly estimate the amount of C in the cookie.

Impact: As forests are increasingly looked upon to sequester and store atmospheric carbon, it is essential that all components of carbon cycling be considered in the carbon balance models that are used to assess and quantify the role of forests in carbon sequestration. The results of this project will constitute an important first step in Dr. Marra's long-term goals of addressing these critical missing components, and contributing data that will be relevant to other ecologists and carbon balance modelers.

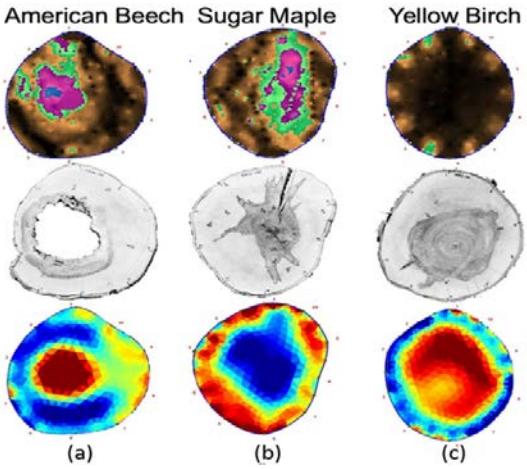


Figure 4. Internal decay interpretation is facilitated by synergistic use of SoT and ERT. A brown SoT region indicates non-decayed wood when the corresponding ERT is red (c), but incipient or active decay when the ERT is blue (d). A non-brown SoT region indicates a cavity when the corresponding ERT region is red (a), but active decay when the ERT is blue (b).

Table 1. Using SoT and ERT to evaluate internal condition.

Category	SoT (density)	ERT (moisture)	Hypothesized Internal Condition
A	Uniform (all brown)	None	No decay
B	Uniform (all brown)	present	Incipient decay
C	Reduced (non-brown)	present	Advanced decay
D	Reduced (non-brown)	none	Cavity

Neonectria Canker caused by *Neonectria ditissima* (prev. *N. galligena*)

Perennial Target Canker (also known as Neonectria canker) continues to be researched by Dr. Marra. This research focuses on the ecology and genetics of the causal agent of perennial target canker, the

fungal pathogen, *Neonectria ditissima*. The goal of this research is to gain a fuller understanding of the life history, evolution, population dynamics, and host-interactions of *N. ditissima*, particularly with respect to its principal hosts, black and yellow birch (*Betula lenta* and *B. alleghaniensis*). Fundamental knowledge of the natural history of *N. ditissima* is lacking, yet is an essential component to effective management strategies. Dr. Marra has developed the field techniques and laboratory tools necessary to the study of this fungus and the disease it causes, and has used these tools and methods to examine the relationship between mating system and genetic structure.

These indirect predictive estimates are then compared statistically to direct estimates of C, which are obtained by multiplying each cookie's mass by empirically determined C concentration (w/w) metrics for each species. In Figure 5, the predicted estimates are plotted on the y-axis, and their corresponding direct estimate on the x-axis. Two important results of this preliminary analysis are that (1) the data are highly correlated, and (2) the slope of the line (=1) indicates that the predicted data are in very strong agreement with the directly estimated data. This is a very strong argument that tomographic data alone (i.e., without destructive sampling) can be used to estimate the amount of C in the assayed portion of the tree. Previously, Dr. Marra developed and used a set of 13 polymorphic microsatellite markers to study mating and genetic differentiation in *N. ditissima* from two nearly adjacent sites at West Rock Ridge State Park in New Haven, CT. This study revealed a paradoxical juxtaposition of high levels of genetic diversity alongside high levels of selfing and biparental inbreeding. The results confirm an earlier hypothesis that *N. ditissima* has a "mixed mating system" (selfing and outcrossing occurring in the same population). In order to test the hypothesis that these observations of selfing are possibly the result of high levels of biparental inbreeding, we continue the process of evaluating putatively self-fertilized sets of progeny using AFLPs. With analysis nearly complete, AFLP data confirm and corroborate conclusions of selfing.

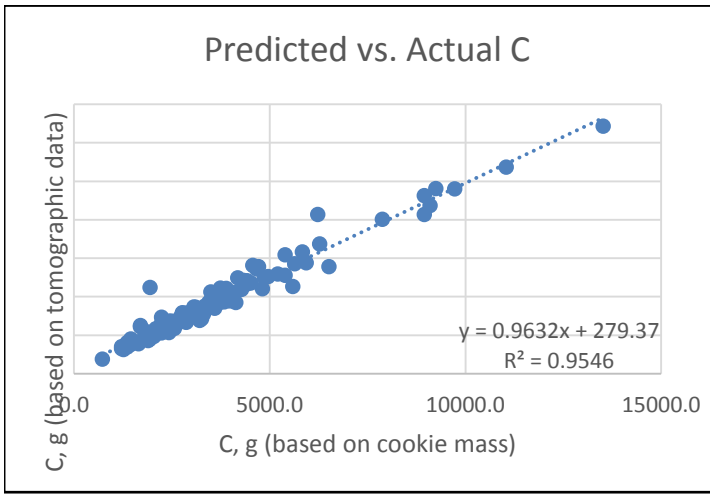


Figure 5. The regression of predicted C estimates onto measured C for each cookie shows the high degree of correlation and agreement between the two datasets

Impact: Due to its increasing abundance in Connecticut, black birch is a tree of growing importance and concern. Although trees infected with Perennial Canker can persist for decades, the extensive scarring caused by the cankers renders them of little value for lumber or veneer. Our efforts to more fully understand the biology and natural history of *N. ditissima* is an important contribution in the fields of mycology and evolutionary biology, and will contribute to the identification and utilization of control strategies. An important result of this research is that they are the first to demonstrate, in a fungus, empirical support for theoretical models that posit the importance of biparental inbreeding to the evolutionary stability of mixed mating.

Boxwood Blight

Building on previous work developing and optimizing realtime PCR and other nucleic acid-based assays for early and accurate detection of the boxwood blight pathogen, *Calonectria pseudonaviculata* (Cps), Dr. Marra, a founding member of the Boxwood Blight Working Group, has for the past two years been focusing on the transcriptomics of fungicide resistance, with the ultimate goal being the development of rapid realtime allelic discrimination assays targeting gene mutations associated with reduced sensitivity to the two principal classes of fungicides—demethylation inhibitors (DMIs) and quinone-outside inhibitors (QoIs)—used in the control of boxwood blight. The original basis of this work was predicated on observations of reduced sensitivity to select DMIs and QoIs reported for a European clade of C.ps. known as G2. However, this clade has since been elevated to separate species status, and named *C. henricotiae* (Ch). The reported fungicide sensitivity differentials were tested in our laboratory using in vitro radial growth assays on solid media amended with the target fungicide at different concentrations. Results confirmed that among the DMIs tested to date, Ch has reduced sensitivity, relative to Cps, to tetraconazole and propiconazole, but not to tebuconazole, and among the QoIs tested, reduced sensitivity to kresoxim-methyl but not pyraclostrobin. Under most circumstances, "cross-resistance"—reduced sensitivity to all fungicides within a class based on identical modes of action within the class—would be expected. However, in the case of these two DMIs and the QoI, we suspect that the mechanisms for reduced sensitivity in Ch are complex, and require further study.

The *CYP51* gene paralogs, *CYP51A* and *CYP51B*, are known in other plant and human fungal pathogens to mediate resistance to DMI fungicides. With the genome sequences of both Cps and Ch available for study, we studied the relationship between *CYP51A* and *CYP51B* gene sequences and differential sensitivity to tetraconazole and propiconazole, and identified an internal stop codon in *CYP51A* in Cps, but not Ch, making *CYP51A* nonfunctional in Cps, and suggesting that the expression of only *CYP51B* in *Cps* may partially explain the increased sensitivity to tetraconazole and propiconazole.

Cps and Ch isolates were grown in the presence and absence of tetraconazole and kresoxim-methyl. RNA extracted from each treatment was sequenced on Illumina high-throughput sequencers with the goal of identifying differentially expressed RNA transcripts that could be associated with differential fungicide sensitivity. However, the comparative analyses have been complicated by the high degree of divergence between the two species.

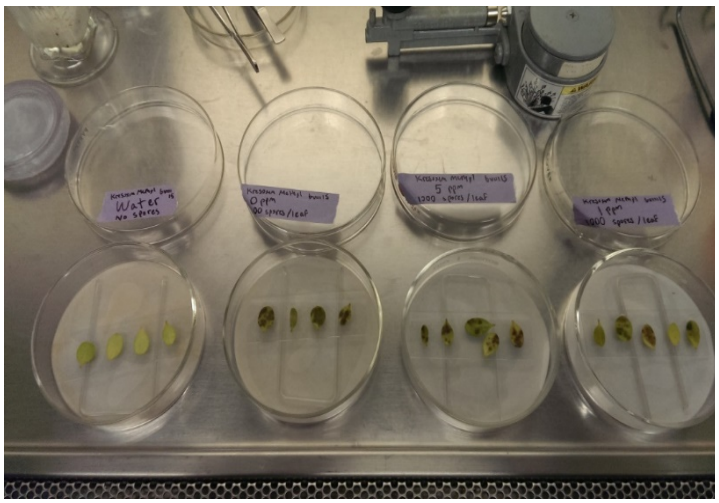


Figure 6. Detached boxwood leaf assays. From left to right: (1) control; (2) 0 ppm (parts per million) kresoxim-methyl; (3) 5 ppm kresoxim-methyl; (4) 1 ppm kresoxim-methyl. Only assays 2, 3, and 4 were inoculated with Cps.

Given the absence of Ch in North America, and the concern in the boxwood industry that fungicide resistance could emerge from Cps, our study turned its attention to identifying the potential for reduced sensitivity to these fungicides in Cps. To do this, Cps has been "passaged" through boxwood leaves in detached leaf assays, wherein leaves treated with each of the target fungicides (the project began with kresoxim-methyl, which became no longer available in the USA, and was therefore replaced by pyraclostrobin), as well as untreated leaves, are inoculated with Cps. Within 2-3 weeks, lesions produce spores, which are then isolated, grown, and used to infect a new round of treated and untreated leaves. The

assumption in this assay is that over the course of multiple generations we will be able to generate resistance to the target fungicides. Figure 6 shows a typical detached leaf assay, with lesions developing on inoculated leaves. We are currently at Generation 9 for tetraconazole and Generation 7 for pyraclostrobin.

Generation 10 of each fungicide assay will be isolated and tested in radial growth (dose response) assays in order to determine if the repeated exposure to fungicide resulted in reduced fungicide sensitivity, relative to the originating "parent" strain. If so, RNA-seq experiments will be conducted similar to that described above, in which the resistant strains will be grown in the presence and absence of fungicide, RNA extracted, and analyzed with comparative transcriptomics for differentially expressed genes.

Impact: Boxwood is an important part of the landscape in the United States and in Connecticut, where it is also a significant part of the wholesale nursery industry. Because of the heavy reliance on fungicides among growers and landscape professionals for the control of boxwood blight, the likelihood of the development of resistance is great. Molecular markers targeting resistance genes will permit the detection of resistance in its incipient stages, thereby informing management strategies and reducing the risk of that resistance becoming established in the population.

Winegrapes in Connecticut

Dr. Ferrandino is continuing the project, "Coordinated wine grape variety evaluations in the eastern USA," which was initiated by Dr. Nail in 2008. Thirty-two different winegrape varieties are planted at Lockwood Farm (Hamden, CT) and the Valley Laboratory (Windsor, CT) (Figure 7). These plantings are evaluated for plant vigor, fruit yield and chemistry, and relative susceptibility to disease. The intent of this project is to provide a coordinated approach to the evaluation and dissemination of knowledge gained by cooperator evaluation of existing and newly released wine grape varieties in the eastern USA. The coordination is fostered by cooperator involvement in the SDA/CSREES project, "NE-1020, Multi-state evaluation of winegrape varieties and clones" (http://www.ngwi.org/). Over the past 7 years, more than 60% of the tender vinifera cultivars (Merlot, Cabernet Sauvignon, Syrah, and Dornfelder) have died due to sub-zero temperatures in January before adequate protective snow cover was established. For this reason, more cold hardy cultivars have been planted (Frontenac, Marquette, Saint Croix, Corot Noir, Chambourcin, Vidal, and La Crescent). These cultivars are also planted at the Valley Laboratory (Windsor, CT) and Griswold Research Center (Griswold, CT). The performance of these cultivars at these three locations will provide information on the effect of climate variation on growth, yield, and disease susceptibility.

Figure 7. Vineyard at Lockwood Farm in Hamden, CT.

Impact: Growers are informed as to the relative merits of winegrape cultivars before planting. The planting of a vineyard requires a large investment ($3,000/acre) with no expected return for at least 3 years. Thus, the choice of a suitable cultivar is critical to the eventual success of such an enterprise.

Dr. Ferrandino is continuing his work on 3D Lagrangian Stochastic Simulation for turbulent flows in hedgerow canopies in collaboration with Dr. Donald E. Aylor. These simulations are programmed in Microsoft Visual Studio. The verification of such models requires direct measurement of turbulent wind statistics. 3D-sonic anemometers are deployed in the vineyard to collect this information (Figure 8).

Impact: Improved models of spore dispersal enable better predictions of the spread of disease.

Figure 8. Anemometers measure wind information in a Pinot gris vineyard at Lockwood Farm in Hamden CT.

Dr. Ferrandino has maintained three remote sensing weather stations located on the CAES research farms (Hamden, CT; Windsor, CT; Griswold, CT). In the past year, a number of sensors have proved faulty and had to be replaced, however all sites are operational now. Weather data from the three CAES experimental farms and Gouveia Vineyards are available at: https://www.hobolink.com/s/d0696313715dd96f86b25f3552cc1f47. This link is available on the CAES website. Each weather station measures temperature, relative humidity, sunlight, wind speed and direction, rainfall, leaf wetness, and soil temperature every 15 minutes. The data are sent back to a central location once per hour where it is accessible via the Internet. The resultant data are used to calculate disease risk assessment reports, which are made available to growers via Internet postings and direct Email alerts. On-site weather station data are used to calculate disease risk assessments, which are delivered to the winegrape growers on a weekly basis (Figure 9). Early in the season, disease risk assessments are also used in conjunction with scouting of each vineyard to assess inoculum levels that are critical for primary infections.

Figure 9. Weather station at Newport.

Impact: Growers are alerted when disease risk is high. Early fungicide sprays are more efficacious and may reduce the need for later applications reducing overall use of chemicals.

Dr. Ferrandino is called upon by growers to identify problems found in their fields. Due to drought conditions, in the past 2 years, spider mites have been a problem on winegrapes (Figure 10).

Figure 10. In grapes, the grape blister mite raises small (1/2 inch to ¾ inch) bumps on the top of the leaves. Underneath the webs are in the hollow and look like tufts of white cotton candy. These are sucking insects, like aphids. A small amount usually causes no problems. However, a large infestation can reduce vigor and yield.

Dr. Ferrandino has received an increasing number of samples of winegrape virus diseases. This usually affects the more valuable vinifera cultivars. Major infestations can be spread by sucking insects. The overall effect is stunting and eventual death. The most common virus is leaf roll virus (Figure 11).

Impact: Growers are quickly informed as to the cause of a problem. In this way, appropriate action can be taken.

Figure 11. Grape leaf roll virus on a Merlot vine in 2011 at Lockwood Farm (Hamden, CT). This vine died in 2013.

Purine and Pyrimidine Transport in Plants and Microbes

Dr. Neil Schultes studies the movement of nucleobases (purines and pyrimidines) across biological membranes. Nucleobases are nitrogen-rich compounds that make up DNA and RNA, and are central to the synthesis of many secondary compounds including caffeine and the plant hormones cytokinins. In

plants, nucleobase biochemistry involves numerous cells and subcellular spaces necessitating transport across biological membranes. Membrane bound transporters act as specific gatekeepers that regulate chemical traffic and are often key control points in plant biochemistry.

Nucleobases are moved across hydrophobic membranes by membrane localized proteins called transporters. Each transporter specifically recognizes and moves a narrow and defined set of compounds across biological membranes. The fact that 15 percent of the genes in the genome of the plant *Arabidopsis thaliana* encode for membrane transporters illustrates the importance of substrate transport in plant life. We study transporters that belong to the nucleobase-cation symporter1 (NCS1), nucleobase-ascorbate transporter (NAT), and Aza-guanine (AZG) transporter families. The substrate specificity--which purines and pyrimidines are recognized and transported--and the biochemical and kinetic properties of transport are ascertained. These data are revealed through an experimental technique known as heterologous complementation. In this procedure, the transporter genes are cloned into DNA vectors (plasmids) that are engineered to express in either brewer's yeast (*Saccharomyces cerevisiae*) or in *Escherichia coli*. Once these DNA constructs are introduced and expressed in the alternate host, a series of experiments test the proficiency for uptake or transport of radio-labeled nucleobases. In this manner the metabolite-specific transport profile and associated kinetic parameters for each nucleobase transporter is determined.

For the NCS1 transporters we are performing an evolutionary-function analysis – determining the transport profile of NCS1 transporters across evolutionary space in the plant kingdom. Such an analysis will help determine which amino acids in the NCS1 proteins are key to nucleobase transport function. The metabolite transport profile has been determined for NCS1 transporters from algae (*Chlamydomonas reinhardtii*); moss (*Physcomitrella patens*); gymnosperm (*Picea glauca*); monocots (*Zea mays* and *Setaria viridis*) and dicots (*Nicotiana sylvestris* and *Arabidopsis thaliana*). Our data complements the ongoing research in structure-function and three dimensional structural studies of NCS1 transporters actively pursued in fungal and bacterial systems. During the past year, we have completed experiments for this project.

We are similarly determining the function of Arabidopsis NAT transporters and AZG transporters from *A. thaliana* and *Zea mays*. Our results show that NAT transporters move xanthine and recognize various other nucleobase compounds. Xanthine transport is intimately associated with the synthesis of allantoin in soybeans – the major nitrogen transport molecule throughout the plant.

Our last associated project characterizes four similar nucleobase transporters from the bacterium *Paenibacillus larvae* – the causal agent of American Foul Brood in Honey Bees. Two recent developments render this project worthwhile to pursue. First, a recent report has shown that *P. larvae* spores germinate in media with high concentrations of uric acid. Uric acid is a derivative of purines and is transported by some nucleobase transporters. Second, transporters can act as biosensors to trigger cellular responses. We are investigating if the P. larvae transporters can recognize uric acid. We have completed the biochemical studies for these transporters.

Erwinia amylovora and nucleobase transport

During the past year, we have initiated a new project investigating nucleobase transport in the bacterial plant pathogen *Erwinia amylovora*. *E. amylovora* is the causal agent of fire blight in apples and pears--a devastating disease often resulting in localized and extensive crop losses (Figure 12). Like other bacteria, *E. amylovora* has a panel of nucleobase transporters that import nitrogen-rich purines and pyrimidines from the environment--effectively increasing the growth potential. We are determining the function and biochemical properties of NCS1 and NAT-like transporters from *E. amylovora* through heterologous

complementation studies in *E. coli* as described above. Once this information is known we will investigate the role of nucleobase transport in disease establishment and propagation in the host.

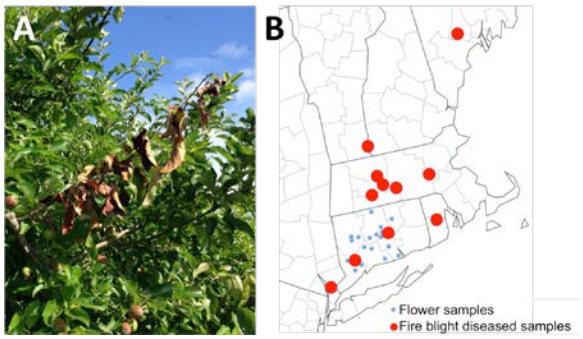


Figure 12. (A). Typical "Shepherd's crook" symptoms of fire blight. (B). Locations of sample collection in 2015.

E. amylovora produces and excretes a nucleobase derivative called 6-thioguanine (6TG). 6TG is known as a toxic analog and has been used as an anti-cancer agent in the past. It is believed that *E. amylovora* uses 6TG to thwart the growth of local microbes on the apple flower at the time of infection – thereby facilitating disease establishment over potential competitors. We are investigating which *E. amylovora* transporters are involved in 6TG movement. In addition to its antimicrobial potential, 6TG may play a role in weakening or killing apple cells at the site of disease establishment. We are determining which apple nucleobase transporters can recognize and move 6TG into cells. During the past year, we have isolated and cloned the *E. amylovora* nucleobase transporter genes into *E. coli* expression vectors. Currently, select apple transporter genes are being isolated.

Impact: A more detailed understanding of nucleobase biochemistry will aid engineering more productive plants. Comprehending how *Erwinia amylovora* utilizes the nucleobase derivative – 6 thio-guanine – in disease establishment will contribute to devising new strategies for fire blight control.

Studies on C_4 photosynthesis

For the past decade, Dr. Schultes along with colleagues in the former Department of Biochemistry & Genetics, have collaborated on projects investigating the biochemistry and physiology of C_4 photosynthesis and photorespiration. The Station has a long and rich history of photosynthesis research. This past year, we finished work investigating the role of the NAD(P)H dehydrogenase complex on the CO_2 concentration dynamics in C_4 photosynthesis in *Zea mays*.

Impact: C_4 photosynthesis is the most efficient way plants convert CO_2 into edible sugars. Understanding the workings of C_4 photosynthesis – particularly at the level of basic science – is essential for designing more productive plants in the future and to meet the needs of an ever-increasing population.

Molecular Fungal Taxonomy

Dr. DeWei Li and Dr. Schultes are collaborating on using DNA sequences from chromosomal ribosomal gene regions to resolve relationships for two different fungal taxonomic groups. We had previously used molecular DNA sequences and morphological characters to describe a new United States isolation of *Olpitrichum sphaerosporum*. We are continuing molecular work to resolve the taxonomic relationships for nineteen species in the *Olpitrichum* and related *Harzia* genera and eleven members for the *Stachybotrys bisbyi* group. The work on these projects is nearing completion.

Impact: Understanding the phylogenetic relationship among fungi in these groups can resolve taxonomic uncertainties.

Monitor and Prevent Streptomycin Resistance in Fire Blight Pathogen Populations in New England

Fire blight, caused by the bacterial pathogen *Erwinia amylovora*, is one of the most serious diseases currently limiting apple and pear production in Connecticut and in the United States. Application of

antibiotic streptomycin during bloom is by far the only management option available that provides a high level of control efficacy. The intensive, long-term use of streptomycin, however, has resulted in the evolution of streptomycin resistance in *E. amylovora*. Since the first report in California in 1971, streptomycin resistance has been commonly detected in *E. amylovora* in most apple producing regions of the United States, including Washington, Oregon, Michigan, and New York, making streptomycin ineffective in these locations. In 2014, severe fire blight outbreaks occurred throughout Connecticut and New England. Growers suspected that the streptomycin resistance may be present in the New England region. Funded by the NE-IPM Center and assisted by Regan Huntley, Dr. Quan Zeng is performing the second year survey of the streptomycin susceptibility in the fire blight pathogen populations in New England. Fire blight pathogen isolates were isolated from infected apple tissues collected from CT, MA, and VT. All the isolates tested are susceptible to streptomycin. The streptomycin resistance gene *strA-strB* was detected in environmental, non-pathogenic bacterial isolates in New England orchards. These results suggest that streptomycin remains an effective management option for fire blight in the New England region, although there is a potential risk of streptomycin resistance development in *E. amylovora* populations in New England orchards in the future, as the *strA-strB* genes may be able to transfer from the non-pathogenic, environmental bacteria into the fire blight pathogen *E. amylovora*. Research findings from this project were highlighted in the April 2016 issue of IPM Insights (http://www.northeastipm.org/about-us/publications/ipm-insights/antibiotic-resistant-fire-blight/).

Impact: Apples and pears are economically important commodities in the United States and Connecticut. According to recent U.S. census data, apples and pears are grown on 142,000 and 24,300 hectares nationally, with cash receipt values exceeding $2.2 billion and $355 million, respectively (USDA-NASS 2008). Annual losses to fire blight and costs of control in the United States are estimated at over $100 million. Results from this research will provide valuable information regarding if streptomycin is still effective in the New England region. Efforts will also be put into preventing and restricting the spread of streptomycin resistance in the *E. amylovora* population through grower education.

Develop antisense antimicrobials for fire blight control

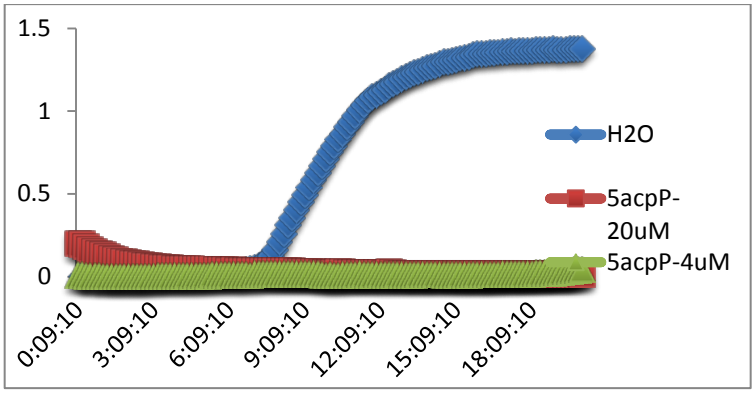


Figure 13. Growth inhibition of *E. amylovora* caused by "5acpP" PNA molecules (at 20uM and 4uM) compared to the water control.

Fire blight is a devastating plant disease, in large part due to the limited amount of control options. Current controls used in fire blight management include antibiotics, copper, and biological controls. However, the emergence of antibiotics resistance, inadequate control efficacy of biological controls, as well as the phytotoxicity caused by copper products limit the use of these options and addresses an urgent need to develop alternative controls that are effective and sustainable. Antisense antimicrobials are short, synthetic nucleic acid oligomer mimics that contain antisense sequences to the translational initiation site of essential genes of a target pathogen. The binding of the antisense compounds to the translational initiation sites of the essential genes leads to the silencing of these genes and cell death. Compared to antibiotics, antisense antimicrobials have an obvious advantage in sustainability, ability to specifically target the pathogens, and to overcome resistance. Funded by USDA-AFRI-Exploratory Research, Dr. Zeng is exploring the possibility of using antisense molecules that target the translational initiation sequence of essential genes of the fire blight pathogens to

inhibit the growth of the fire blight pathogens and to control fire blight. Peptide nucleic acid (PNA) molecules that contain antisense sequences to a total of 8 essential genes were tested for the inhibition of the growth of *E. amylovora*. Among these molecules, anti-*acpP* PNA molecule showed excellent inhibition of the pathogen growth (Figure 13). Detached flower assay also showed that anti-*acpP* PNA was able to significantly limit the growth of *E. amylovora* on apple stigmas at the concentration of 100uM.

Impact: Our research demonstrated the feasibility of using antisense molecules in controlling plant diseases. It not only provides a non-antibiotic management option for fire blight that is urgently needed for the apple and pear industry, but more importantly, it generates valuable data and conditions for the application of this novel technology in management of other important bacterial plant diseases.

Understanding Disease Emergence and Pathogen Evolution of Bacterial Etiolation and Decline of Creeping Bentgrass.

Creeping bentgrass is one of the most commonly used grass species on golf course putting greens in the United States. Since 2009, grass decline with symptoms of wilting, necrosis, and etiolation were consistently observed on creeping bentgrass on many golf courses in the "transition zone" of the United States. Later, the causal agent of this disease was diagnosed as a bacterial pathogen *Acidovorax avenae* subsp. *avenae* (*Aaa*) and the disease was named bacterial etiolation and decline (BED). However, how this disease emerged and spread to different parts of the U.S. is unknown. Dr. Zeng, in collaboration with Dr. Paul Giordano and Dr. Nathaniel Mitkowski, obtained the first collection of the turfgrass pathogenic *Aaa* strains from diseased creeping bent grass from 14 states in the U.S. Draft genomes of 14 turfgrass *Aaa* strains, one maize *Aaa* strain, and one orchid *Acidovorax* strain were sequenced, assembled, and annotated. Our results suggested that the 2009-2011 outbreak of BED was caused by a genetically diverse group of pathogens belonging to two divergent phylogroups. Putative virulence factors of the turfgrass pathogens were identified. Interestingly, we demonstrated that despite that the fact that turfgrass pathogens belong to two distinct lineages, both of these lineages contain a conserved type III secretion system pathogenicity island (Figure 14). Further evolutionary analysis revealed that high levels of recombination occurred between the turfgrass *Aaa* isolates, which is likely to be the cause of the formation of the conserved T3SS structure among the turfgrass *Aaa*.

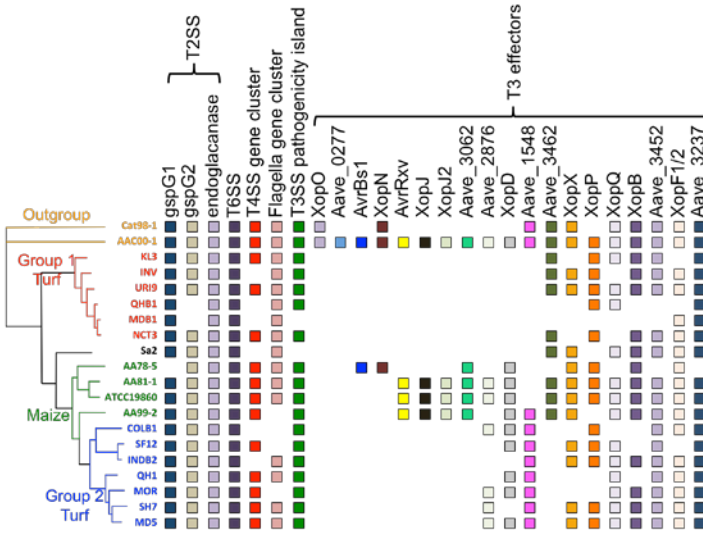


Figure 14. The phylogeny of the turfgrass pathogens (left) and virulence factors identified in these pathogens by comparative genomics.

Impact: The golf industry is an important component of the economy in the United States and Connecticut. The total size of Connecticut's golf economy was estimated at $638 million in 2008. Understanding the disease emergence of bacterial etiolation and decline will help restrict the spread of this important disease on golf courses and develop effective detection and management options.

Understanding of the pathogen evolution and disease emergence will also provide valuable information for future disease mitigation.

Investigating the role of the *Xanthomonas* effector AvrRxo1 as a toxin-antitoxin system.

This project has discovered that *Xanthomonas* pathogens, including those causing bacterial spot of tomato and pepper in Connecticut, secrete a previously unknown type of protein toxin that can alter central metabolism in bacteria, fungi, and plants. This year's work demonstrated that the toxin is a completely new type of toxin that directly modifies an important component of universal central metabolism, and demonstrated that this modification is important for suppressing pathogen defense responses in plants.

Impact: This finding greatly expands our understanding of the ways in which bacteria can directly harm both plant and human hosts. This family of toxic proteins targets rapidly growing cells, and has been investigated toward harnessing its antibacterial and antifungal potential. The discovery of a new type of bacterial toxin will help us find new strategies to fight disease, and the toxin may also have uses in biomedical and synthetic biology research.

The contribution of toxin-antitoxin systems to bacterial plant disease.

A project to identify the roles of numerous different toxin-antitoxin systems in bacterial plant disease was continued this year. Thousands of toxin-antitoxin systems were analyzed for their distribution in plant pathogen genomes, their potential ability to be secreted into the environment and into plants, and to identify candidates for those of strong importance to agriculture.

Impact: In addition to being virulence factors, toxin-antitoxin systems are thought to play a major role in bacterial survival of antibiotics and survival in the host, making it difficult to eradicate disease in an area. Discovering which ones are important will tell us which ones to target for disease control strategies.

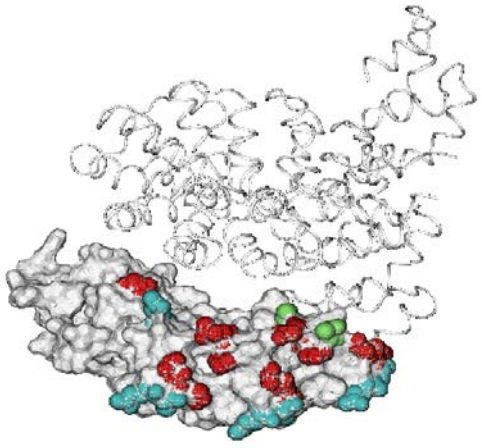


Figure 15. Structural model of the *Xanthomonas* secreted protein that activates a resistance gene found in both tomato and rice. The protein segment that triggers resistance is filled in, and the red, green, and blue indicates surface portions that might be key in activating the resistance gene.

Identification of a novel *Xanthomonas* disease resistance mechanism shared by rice and tomato.

A project was initiated to map the genetic location of a new type of resistance gene in rice that is triggered by a type of protein found in diverse bacteria. The location of the gene was identified, yielding a handful of promising gene candidates. This year, the gene candidates were cloned and sequenced, and their ability to bind to pathogen proteins is being tested. Additional funding has been sought to identify the specific gene.

Impact: This is the first effective genetic resistance against a pathogen that causes at least $1 billion in annual yield loss in West African rice, and has been labeled a security threat to US rice. The resistance gene is a novel type of resistance found in both monocot and dicot plants, and it is triggered by a protein found in 60% of *Xanthomonas* and many *Ralstonia* plant pathogens (Figure 15). Once the specific gene is identified,

it could be harnessed for resistance against a wide variety of crop diseases.

Sudden Vegetation Dieback

Sudden vegetation dieback (SVD) is the loss of vegetation, predominantly impacting *Spartina alterniflora* (SA) along the intertidal creeks that feed into Connecticut's Long Island Sound (Figure 16). *Fusarium palustre* is a recently described species that is pathogenic on SA, but is not solely responsible for SVD. Herbivory from the purple marsh crab, *Sesarma reticulatum*, is also severe in marshes and hinders recovery from SVD.

Figure 16. Sudden vegetation dieback at a Branford salt marsh.

Ms. Magali Bazzano**,** a master's candidate at the University of New Haven, and Dr. Elmer sampled two marshes, one with SVD and one without SVD. *S. alterniflora* plants were systematically sampled at 5 m distance from the creek bank and assayed for Dimethylsulfonio-propionate (DMSP). DMSP has been proposed as a putative physiological indicator of health in *S. alterniflora*. An ordinary kriging on ArcGIS 10.1 was used to make spatial predictions of DMSP concentrations at the two marshes.

Kriging is based on Tobler's first law of geography that states that "everything is related to everything else, but near things are more related than distant things." The kriging prediction map corresponding to SVD sites suggests that the highest concentration of DMSP is located in the northern section of the study area away from the coast (Figure 17, left). The Kriging map corresponding to the healthy site showed a general trend of DMSP concentration increasing inward with distance, away from the creek banks (Figure 17, right). Given that SVD is less severe in the areas with higher DMSP, it suggests an association between marsh health and DMSP.

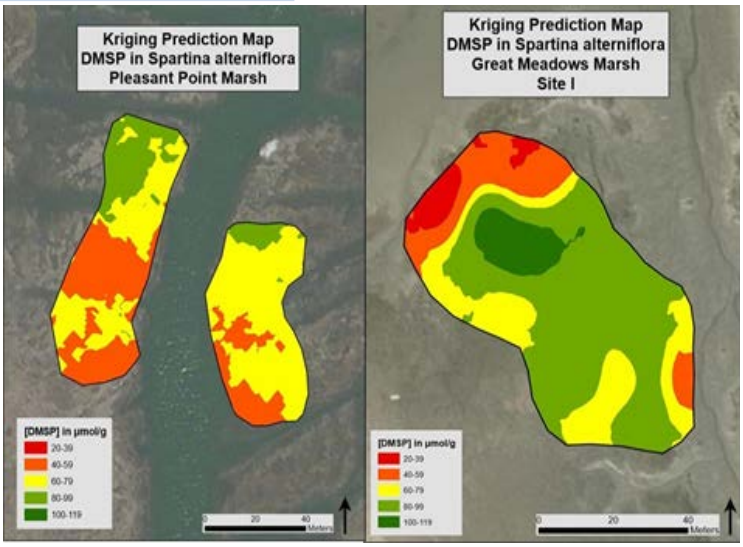


Figure 17. Kriging map that predicts levels of DMSP in *Spartina alterniflora* plants in a dieback site (left) and a site with no dieback (right).

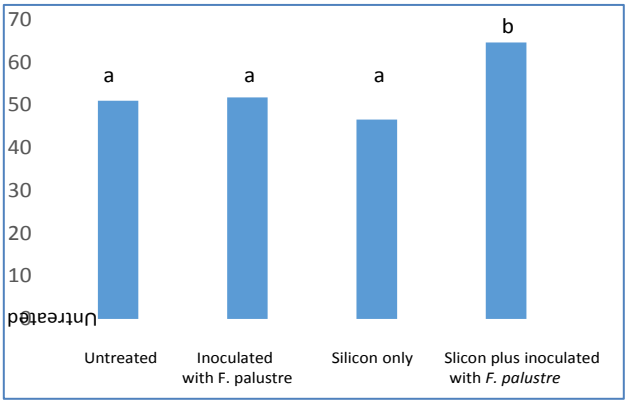


Figure 18. DMSP levels following exposure to silicon and *Fusarium palustre.*

To further test the effects of SVD on DMSP, Ms. Bazzano and Dr. Elmer exposed *S. alterniflora* plants in the greenhouse to silicon nutrition (to boost vigor) and to *F. palustre* inoculation. Inoculated plants exposed to silicon had higher levels of DMSP than any other combination. DMSP may be induced in plants nourished with silicon (Figure 18).

Impact: Understanding the physiology of *S. alterniflora* and how it is affected by the pathogen may reveal knowledge gaps where scientists could manipulate the host via nutrition to reduce damage from SVD. Furthermore, if the physiological conditions can be understood better, we may be able to predict what marshes may be threatened in the future by dieback. Discovering how nutrition can manipulate the resistance and survival of *S. alterniflora* may provide alternative methods for restoring our marshes.

Studies with Nanoparticles for Root Disease Management

Nanoparticles (NP) are defined as any material at the nanoscale (<100 nm). Dr. Elmer and Dr. White have demonstrated that NP of Cu, applied foliarly, will enhance the growth of vegetables when grown in disease-infested soils. The growth and yield of eggplants grown in soil infested with *Verticillium dahliae* were increased an average of 34% over the untreated control, respectively. Another study with watermelon found that foliar applied NP of CuO were more effective in increasing growth and delay in onset of Fusarium wilt caused by *F. oxysporum* f. sp. *niveum* than NP of Zn or Mn (Figure 19). Field studies revealed that NP of CuO were superior to other forms of Cu increasing yield of watermelon (Figure 20).

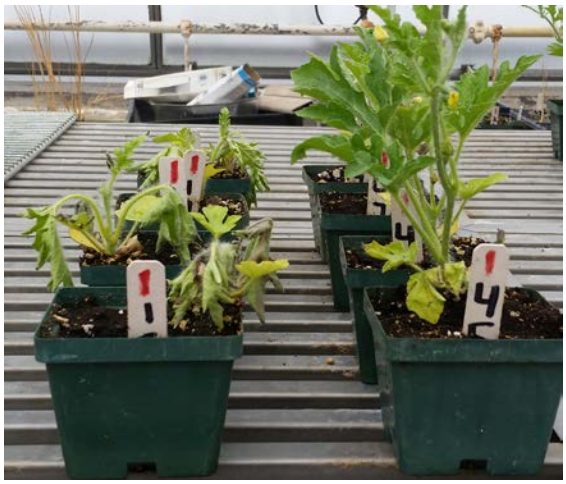


Figure 19. Effect of NP of CuO on watermelon seedlings inoculated with *Fusarium oxysporum* f. sp. *nivuem* (right) versus plants not treated (left).

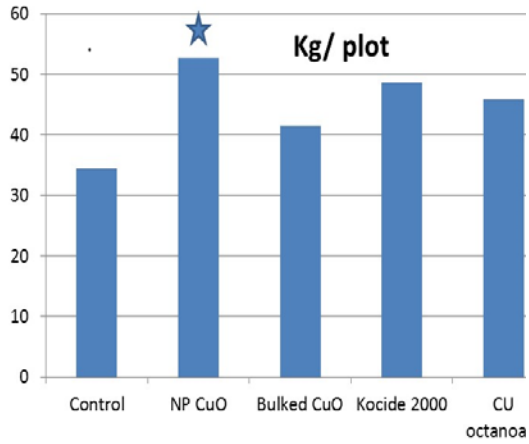


Figure 20. Comparison of NP of CuO to other copper products on watermelon for yield.

Impact: These studies show benefits of the use of NP in plant disease management. Information on how NP micronutrients might affect root pathogens is new and novel. NP might be an alternative to pesticides.

Disease Survey

Dr. Yonghao Li, assisted by Ms. Lindsay Patrick, diagnosed a wide range of fungal, bacterial, viral, nematode, and abiotic diseases on trees, shrubs, flowers, lawn grasses, fruits, and vegetables during the past year. The drought stress during the growing season in 2015 and abnormally warm temperatures in January followed by extreme cold temperatures in February of 2016 caused severe physical injuries on fruit and ornamental trees and shrubs. Many fungal and bacterial diseases were favored by wet weather conditions in the spring of 2016.

Herbaceous and Woody Ornamentals:

The severe epidemic of Volutella blight resulted in significant dieback of pachysandra in the spring of 2016, which can possibly be contributed to drought stress during the growing season in 2015. Phoma blight was prevalent on vinca. Severe damages caused by Alternaria blight of marigold was found in a flower farm. Root rot diseases caused by *Pythium* spp. or *Thielaviopsis* spp. were found on many annual and perennial flowers, such as calibrachoa, coleus, gerbera daisy, salvia, phlox, poinsettia, and begonia.

Damage caused by Fusarium wilt was found on potted chrysanthemum in a garden center. Cool and wet spring weather conditions contributed to the epidemic of Botrytis blight on tulips. Powdery mildew was a common disease on rudbeckia, peony, begonia, beebalm, and phlox. Many fungal leaf spot diseases were prevalent on perennials such as Septoria leaf spot of rudbeckia, Heterosporium leaf spot of iris, anthracnose of hosta, and Cladosporium leaf spot of peony. Bacterial leaf spot was observed on zinnia, geranium, and poinsettia. Impatiens necrotic spot virus and tobacco spotted wilt virus were problematic on some bedding crops in greenhouses, such as African violet, gloxinia, petunia, and pepper.

Frost damage on magnolia blossoms.

Browning of needles and dieback of white pine.

Fluctuating winter temperatures resulted in severe injury on a variety of trees and shrubs such as magnolia, sycamore, oak, cherry, peach, rose, boxwood, Andromeda, and hydrangea. Epidemics of Alternaria leaf spot resulted in severe early defoliation of privet in the spring of 2016. Golden canker caused by *Cryptodiaporthe corni* was found on pagoda dogwood. Besides boxwood blight, Volutella canker and Macrophoma leaf spot were major diseases that caused severe dieback of boxwood in landscapes. Fungal leaf spot of mountain laurel remained a major problem that reduced plant aesthetics and caused significant defoliation. *Gymnosporangium* rust diseases were found on apple, pear, quince, serviceberry, hawthorn, and cedar. An epidemic of an unidentified fungal needle cast of eastern white

pine was observed in July 2015. Widespread shedding of needles and dieback of eastern white pine was found in the spring of 2016, which might be attributed to drought stress and mild winter temperatures. Many cases of Canavirgella needle-cast of eastern white pine were found. Besides Rhizosphaera needle cast, an increased incidence of Stigmina needle cast was noticed on spruce. Seiridium canker was found on Leyland cypress. Botryosphaeria and Phomopsis cankers were found on crabapple, rhododendron, juniper, and maple.

Volutella blight of pachysandra

Alternaria leaf spot of privet

Vegetables:

Bacterial leaf spot was detected in greenhouse-grown basil seedlings. Xanthomonas bacterial leaf spot was observed on tomato and pepper plants in the early summer. Bacterial black rot was prevalent on cabbage and cauliflower. Powdery mildew remained a major disease problem on cucurbits. Anthracnose, Fusarium wilt, and bacterial angular spot were common problems on cucumber. Botrytis blight, Penicillium bulb rot, and white rot were found on garlic. Powdery mildew and Ascochyta blight were detected on snap peas. Root-knot nematode damages were found on parsnips in a home vegetable garden. On tomatoes, Septoria leaf spot, bacterial leaf spot, Fusarium wilt, leaf mold, and blossom-end rot continued as common diseases. A tomato sample that was collected from a garden center was positive for Begomoviruses in a PCR test. Another tomato sample that was collected in a field was positive for tobacco spotted wilt virus by an Immunostrip test. Stemphylium leaf spot of tomato was found in a home vegetable garden.

Bacterial leaf spot of pepper.

Bacterial leaf spot of basil.

Tree and Small Fruit:

Severe winter damage resulted in significant dieback and failure to set fruit on peach, apple, and cherry. Rust, frogeye leaf spot scab, and fire blight were prevalent on apple and pear trees. Black rot, powdery mildew, anthracnose, and downy mildew were commonly found on grapevines. Leaf curl, scab, and brown rot continued to be major diseases on peach. Rust was frequently detected on fig trees. Blueberry rust was found in a landscape.

Frogeye leaf spot of apple

Leaf curl of peach

Turf:

Powdery mildew of turf grass was found in shady lawn areas in the early spring. Many cases of Pythium blight were found in lawns that were frequently irrigated and over-fertilized. Brown patch, summer patch, red thread, anthracnose, and rust were common diseases of lawn grasses.

Powdery mildew of lawn grass

Red thread of lawn grass

Weeds:

Running bamboo continued to be a topic of increasing public concern because it is difficult to control and has the potential for causing problems between neighbors. Oriental bittersweet, Japanese knotweed, and poison ivy remained significant problems in residential properties. Predominant weeds in turf and gardens were crabgrass, annual blue grass, bittercress, creeping bentgrass, chickweed, clover, foxtail, ground ivy, horsenettle, garlic mustard, mugwort, nightshade, nutsedge, purslane, pigweed, spurge, red sorrel, speedwell, stilt grass, sumac, Virginia creeper, wild garlic, and wild violets.

Impact: Information on the diseases that occur on plants in Connecticut landscapes, greenhouses, vegetable fields, orchards, natural woodlots, and forests each year helps to monitor and assess the impact of these problems on the overall health of plants in the state. This information also assists in detecting new diseases or in identifying potentially important emerging diseases on specific plants, which can then be monitored in the years that follow.

SERVICE ACTIVITIES

Members of the Department of Plant Pathology and Ecology are involved in a wide range of service and public outreach activities. Some of these services involve presentations, publications, displays at meetings and other outreach events, tours of facilities, and interviews, in addition to being conducted in cooperation with other state agencies.

Seed Testing: In Cooperation with the Connecticut Department of Agriculture, Bureau of Regulation and Inspection

Every year, official samples of vegetable, crop, and lawn seeds are collected by inspectors from the Bureau of Regulation and Inspection of the Connecticut Department of Agriculture and submitted to The Connecticut Agricultural Experiment Station, an official seed testing laboratory for Connecticut. In 2016, 250 vegetable, 6 lawn, and 5 crop seed samples were submitted to Dr. Li for testing. Pamela Sletten, with assistance from Lindsay Patrick, performed the germination and purity analyses that are required for compliance with Connecticut Seed Law Regulations and the Federal Seed Act for all seed samples by following strict protocols designated by the Association of Official Seed Analysts. Vegetable seeds are tested for germination. As of the date of this report, tests for 193 of the 250 vegetable seed samples were completed and 15 of the tested seed samples failed label claims for germination. Lawn seeds are tested for both germination and purity. Three lawn seed samples tested met label claims for purity, but the other three samples failed to meet the purity claims. Three of the six lawn seed samples passed the germination claims, but the other three samples failed to meet the germination claims. Crop seeds are also tested for both germination and purity. All five crop seed samples tested passed label claims for purity. One of the five crop seed samples failed the germination claim. A *Station Technical Bulletin* will be written to report the findings of this year's results.

Impact: Results of seed tests conducted by Station staff are reported to the Seed Control Official of the CT Department of Agriculture who has the authority to stop the sale of products that do not meet label claims or contain noxious weeds. In the short term, this program protects state residents from purchasing inferior seed and ensures that seeds comply with the Connecticut Seed Law Regulations and the Federal Seed Act. The long-term benefit of the seed testing program is to minimize the unintentional introduction of noxious weed seeds that could potentially impact crops of economic importance and the state's ecosystem.

Samples for Analytical Chemistry and the Connecticut Department of Consumer Protection

During the year, Dr. Li and Ms. Patrick examined 54 samples from the Connecticut Department of Consumer Protection at the request of the Department of Analytical Chemistry at the Experiment Station.

Citizen Inquiries

Plant Disease Information Office

Dr. Li, assisted by Ms. Patrick, answered 4,794 inquiries about plant health from Connecticut citizens. Although the majority of inquiries were on ornamentals, trees, and shrubs (68%), other categories, such as food crops (14%) and turf grasses (4%), were also well represented. A moderate percentage of inquiries fell into the miscellaneous category (14%), which included identification of various plants and weeds, mushroom identification for health officials, and information about pesticides and their relationships to health and environmental concerns. The majority of inquiries were from Connecticut homeowners (59%), and commercial growers and plant care professionals (33%). Eight percent of inquiries were from

cooperative extension, health, news, agricultural personnel, and other. A further breakdown of inquiries showed that 32% of the questions came in by phone, 17% came in by mail, 12% came as email, and 38% were brought in person. The number of physical samples handled by the PDIO (51%) continued to exceed the number of phone calls and emails (49%). Over 1,145 letters and email messages with attached files of fact sheets were sent from the PDIO. Many citizens opted to download fact sheets posted on the CAES website in lieu of letters, since this gave them instant access to the information of concern.

VALLEY LABORATORY

Scientists at the Valley Laboratory conduct research on insects, diseases, soil nutrition, mycology, integrated pest management and weeds of concern to commercial agriculture and homeowners in Connecticut. The Valley Laboratory, located in Windsor, was originally established by the Board of Control in 1921 to conduct tobacco research. While research on tobacco continues today, the research mission has expanded to reflect the diverse agriculture present in the State. Scientists and staff also diagnose insect and plant health problems, test soils for fertility, conduct outreach to growers and homeowners by speaking to professional and community groups, host informational meetings, and assist students.

The Valley Laboratory, Windsor.

Activities on the Farm

There were a total of 47 experimental plots at the Windsor research farm during the past year. Four Windsor-based scientists had 24 of these plots; five New Haven-based scientists were using 13 plots. The remaining plots were maintained by the Farm Manager as rotation crops or for seed collection. Valley Laboratory scientists also conducted experiments in many plots off site, such as in growers' fields, the Lockwood and Griswold farms and in State forests. Valley Laboratory Farm Manager James Preste kept the farm and equipment ready and in excellent shape. He expertly maintained the many field plots and addressed the specific needs of each scientist. He and his summer research assistants did an outstanding job maintaining the extensive ornamental garden in cooperation with the Connecticut Nursery and Landscape Association. Mr. Preste and Dr. LaMondia coordinated the Valley Laboratory effort to comply with EPA Worker Protection Standards for Agricultural Pesticides and organized and conducted safety and pesticide training sessions for the staff.

RESEARCH ACTIVITIES

Hemlock Woolly Adelgid Research

Biological control using imported predators of *Adelges tsugae*, the hemlock woolly adelgid (HWA), is a major long-term national strategy for reducing the impact and spread of this damaging and invasive insect which threatens the entire range of eastern and Carolina hemlocks. *Sasajiscymnus tsugae* (Coleoptera:Coccinellidae), originating from Honshu, Japan, discovered and studied at the CAES is one of the first biological control agents released for HWA management in the US and the only major species released in Connecticut. From 1995-2007, >176,000 *S. tsugae* were mass reared and released in 26 state forest and parks, municipal, water company, and private forest sites throughout Connecticut. Encouraging results of hemlock recovery from HWA damage in Connecticut were recorded from 2005-2009 in >75% of sites with *S. tsugae* releases. The overall goals of this project are to integrate established and new approaches, into (1) an overall current assessment of the health of forest hemlocks in

Connecticut, 30 years after the arrival of HWA, (2) to improve the understanding of the role of climate and biological control of HWA with the introduced adelgid predator, *S. tsugae.*

Impacts:

- Initial revisits to visually assess Connecticut's *S. tsugae* release sites 10-20 years post release show that the majority of eastern hemlocks are alive and generally exhibiting excellent recovery and crown conditions in spring 2016, in spite of concurrent attacks from other pests such as elongate hemlock scale and secondary hemlock borer attacks. This is critical as hemlocks are key to the ecology of many species of wildlife, fish and birds, are important for watershed protection and popular for recreational landscaping.
- The warmest winter on record occurred in 2016 but assessments showed that a brief cold snap of extreme subzero temperatures in February 2016 was sufficient to kill 97% of HWA statewide. This has enhanced hemlock recovery as this is the third successive winter in Connecticut which has significantly reduced HWA populations.
- HWA infestations throughout Connecticut are currently at the lowest levels in 16 years, due to the heavy winter kill, except for protected pockets and some urban areas, coastal and eastern forests which had more snow cover.
- Analyses of the 16-year dataset of HWA winter mortality in CT has enabled predictions on subsequent HWA levels and management options following reduced HWA populations using biological control augmentations are under current evaluation.
- *S. tsugae* remains the only biological control agent for HWA that can be reliably reared on a large scale yearly and is thus available commercially. This species is a very important option for public and private stakeholders who do not want to use chemicals for controlling HWA. Current evaluations are underway to quantify and document its predation under hot, humid summer conditions.

Hemlock health in early spring 2016 at some northern *S. tsugae* release sites.

Salmon River, East Hampton

Bigelow Hollow State Park, Union

Natchaug State Forest, Eastford

Mashamoquet Brook State Park, Pomfret

Implementation of Biological Control of Mile-a-Minute Weed in Connecticut

Mile-a-minute weed, *Persicaria perfoliata*, (MAM) originates from Asia, was first discovered in the eastern U.S. in the 1930s, and is classified as a serious invasive weed in Connecticut. Infestations are found in 14 eastern states from North Carolina to Ohio and the first record of MAM in Connecticut was in Greenwich in 1997, later confirmed in 2000. To date in Connecticut, 43 towns have confirmed reports of MAM, though some have only limited reports of a few plants which have since been removed. This rapidly growing prickly and prolific vine is annual in its northern range but quickly forms dense thickets which overwhelm and displace native vegetation and reduces plant diversity. An introduced weevil, *Rhinoncomimus latipes* (Coleoptera: Curculionidae), imported from central China, has been successfully reared and released for biological control of this invasive species in the Mid-Atlantic and southern New England states. Releases of *R. latipes* began in 2009 in Connecticut, and over 47,000 weevils have been released in 21 towns as of early summer 2016, with new releases in 2016 in the towns of Groton and Milford. Survival of weevils after the most severe winter for 2015 has been recorded in many sites, and again in 2016 despite a brief but lethal cold snap in February 2016. This project has documented the continued successful establishment and spread of this phytophagous species in southern New England.

This project is a collaboration between the CAES and the University of Connecticut and is funded by USDA APHIS PPQ, in cooperation with the New Jersey Department of Agriculture Phillip Alampi Beneficial Insect Laboratory. This project involves many volunteers and cooperators from the private sector working together with other state, town, and federal officials in a team effort to implement MAM biological control to limit spread of MAM. In collaboration with Donna Ellis from the University of Connecticut, >47,000 weevils have been released to date in 21 towns from 2009-2016. Weevils have been released to control MAM in North Haven, Greenwich, Newtown, New Milford, and Bridgewater (2009), Stamford, Westport, and Fairfield (2010) and Sprague and Norwalk (2011), Wilton, Middlefield (2012) and Roxbury, Stonington, Stratford, Ridgefield, Woodbury (2013), Southington (2014), Wallingford, Glastonbury, Southbury (2015); Groton and Milford (2016). Further releases are being implemented in more towns in 2016. Dr. Cheah and Donna Ellis have participated in the releases and monitoring of all the release sites since 2009. GIS mapping and scouting for MAM and weevil abundance, distribution, and spread in the state is being conducted. Weevils have been established at all previous release sites, survived 7 diverse Connecticut winters, severe spring and summer flooding, droughts and reproduced with multiple generations. Dispersal of weevils has also been recorded at least 18 miles from the nearest release site even across long stretches of water to offshore islands.

Impacts:

- Weevils have overwintered successfully again in Connecticut following a lethal cold winter snap in 2016. This marks the 7th year of successful weevil overwintering and establishment.
- Dispersal and natural spread of weevils from their original release sites have been observed in several towns and offshore islands in Westport, Greenwich, and Milford. Establishment and spread of the weevils has also occurred in the majority of release sites in a variety of different habitats on the mainland.
- Weevils released to control mile-a-minute weed in the western and eastern portions of the state are dispersing widely, and starting to impact and reduce local populations of MAM at several release sites.
- Establishment of *R. latipes* for mile-a-minute weed would provide a natural control to limit spread and range expansion of a prolific invasive weed, and reduce the need for chemical control, especially in watershed areas, in utility rights-of-way, agricultural lands, bird refuges, etc. 2016 is the second successive year in which there has been no report of new town infestations, despite intensive surveys in infested and non-infested adjoining towns.

Charles Island Bird Sanctuary, Silver Sands State Park, Milford.

U.S. Navy Groton Submarine Base: marsh restoration project
Releases of weevils to date in June 2016 have been in Groton and Milford.

Augmentative Biological Control of Elongate Hemlock Scale

Elongate hemlock scale, *Fiorinia externa* (EHS), an exotic scale present in Connecticut since the 1960s, has recently rapidly expanded its range and population densities to seriously damaging levels on forest and landscape hemlocks over much of Connecticut in the past 5 years. Forest stands in northern and

western Connecticut with heavy elongate hemlock scale infestations have shown thinning crowns and declining health, leading to pre-emptive hemlock salvage in forest management. Recently, the native species, *Abgrallaspis ithacae*, or the hemlock scale, is increasingly found in southwestern and central parts of Connecticut on forest hemlocks while it has also been seriously damaging Christmas tree plantations for at least the past 3 years. As EHS and hemlock scale also infests other conifers, especially firs, which are the most popular species for Christmas trees, the industry is impacted and mostly resorts to chemical control for management of scale outbreaks. There is no effective natural enemy of EHS in North America. However, the twice-stabbed lady beetle, *Chilocorus stigma*, is a native and widespread omnivorous scale predator. There have been no attempts to mass-rear *C. stigma* and it is not available commercially. The goal of the project is to develop optimal laboratory methods to mass-rear suitable scale cultures and *C. stigma* for potential augmentative and safe biological control releases in EHS-affected stands. Significant progress was made in 2015-2016, in the development of the laboratory mass-rearing system for *C. stigma*.

Impacts:

- Earlier research at the Valley Laboratory had developed a successful way for maintaining a laboratory colony of Florida red scale, *Chrysomphalus aonidum* (FRS), on butternut squash and using that system to attempt rearing of *C. stigma.*

- Methods to augment the scale colony were improved in 2015-2016 using a rain-down technique to infest more butternut squash on a larger scale. Success with this amplification has facilitated *C. stigma* rearing trials on a larger scale. Expanding into available laboratory space at the CAES Griswold Farm, with Farm Manager Robert Durgy's help, has been critical to improving this operation in 2015-2016.

- There has been significant progress toward an operational mass-rearing system for *C. stigma*.

Chilocorus stigma adult, larva, and pupae reared on Florida red scale on butternut squash.

Infested and clean butternut squash storage at the Griswold Farm.

EHS Status and Impact on Connecticut's Hemlocks

Surveys in 2014-2015 showed that eastern hemlocks continued to decline in certain regions, especially in northwestern Connecticut, due to heavy EHS infestations, in either single or joint infestations with HWA. But as HWA levels have been significantly depressed due to 3 cold winters, the decline is mostly due to EHS buildup. Thinning crowns and increased incidences of hemlock borer, a native secondary pest that attacks stressed trees, has been observed in marginal sites. Large areas of hemlock have been salvaged on watershed lands due to rapid decline in hemlock health and value. In 2014 and 2015, elongate hemlock scale winter survival was much higher than for hemlock woolly adelgid. In 2014, mean winter mortality of EHS was 54.8% in northern sites and 34% in southern sites but with high variability. In 2015, there was greater mortality. Scale mortality ranged from 52% along the coast to 66-73% in the interior and northern regions. With cyclic natural hemlock needle drop and winter mortality from 2 years, EHS levels have now decreased in previously heavily infested stands and these interactions with HWA and hemlock health are being investigated.

Impact: Currently there is no effective non-chemical control of elongate hemlock scale and the range is expanding northward into Maine. Development of novel mass-rearing procedures for *C. stigma*, a safe, omnivorous, climatically-adapted native predator of EHS, would allow implementation into new areas, augment local forest populations and also provide a method of biological control for many scale pests in plantations and orchards and reduce pesticide usage.

Avian Dispersal of Hemlock Woolly Adelgid

This is an undergraduate research project by Nicholas Russo, from the University of Connecticut, in collaboration with Dr. Morgan Tingley, Department of Ecology and Evolutionary Biology, University of Connecticut and Dr. Cheah. The major field site in 2015 was the hemlock plot at the Valley Laboratory research farm where Nick investigated the potential dispersal of HWA crawlers onto stationary preserved bird mounts and the relationship between crawler dispersal and the phenology of HWA hatch from late spring into summer in 2015. Positive relationships were found between crawler transfer to mounts and crawler hatching peaks and avian spring migration patterns. Nick Russo is currently into the second year of his project where he is conducting mist netting to investigate crawler dispersal on live birds at the Valley Laboratory hemlock plot and two other forest plots.



Nick Russo demonstrating stages in his experiment to detect HWA crawler dispersal onto preserved bird mounts at the Valley Laboratory Farm in Spring 2015.

Impact: This research describes the possible mechanisms which may contribute to the long-distance dispersal of HWA northward with bird migration

Insect Management

Neonicotinoid insecticides have been implicated as having the potential to be injurious to pollinators, because they are systemic and can be transported within plants to nectar or pollen. The U.S. EPA has established that 25 parts per billion (ppb) in nectar and 100 ppb in pollen may be thresholds for sublethal effects on honey bee health – the concentrations of concern to other pollinators is not as well studied. In order to interpret whether there is risk to pollinators from plants grown in Connecticut nurseries, a team consisting of Drs. Kimberly Stoner, Brian Eitzer, and Richard Cowles measured concentrations of imidacloprid found in rhododendron nectar and pollen. *Rhododendron* spp. proved to be an excellent model plant for assessing residues, because one-gram quantities of nectar or pollen (the quantity required for sensitive residue analyses) could be collected. Although these plants had been planted into potting media in which imidacloprid had been incorporated, and eventually also were treated with foliar sprays of this insecticide, the residues in nectar (about 10 ppb) and pollen (about 14 ppb) were not great enough to justify concern for honey bee health. An additional effort is underway (Cowles and Eitzer) to better understand the relationships between factors associated with the application of these insecticides (active ingredient, dosage, application method, and interval before bloom) in influencing the resulting residues found in nectar (milkweed) and pollen (sunflower). These plant species were chosen based on their abundant production of nectar or pollen. At normal nursery application rates, the concentrations found in pollen decline rapidly following a foliar spray. By two weeks after spraying, the residues would not be of concern to honey bees. In contrast to foliar sprays, soil drenches at medium and high rates result in residues in pollen that would be of concern to pollinator health. These data will be of great value to establish best management practices for nursery growers, and to assure the public that these insecticides can be used in ways that are not likely to influence pollinator health.


Honey bee on a sugar puff rhododendron.

Since discovering spotted wing drosophila (SWD) in Connecticut in 2011, Dr. Cowles has focused on developing low environmental impact and IPM-compatible approaches for managing this pest. A field test of behavioral approaches to manage SWD through mass trapping demonstrated no observable saturation in trap catches as trap density increased, signifying that mass trapping is impractical. These results will be valuable for redirecting research into more productive ways to use behavioral manipulation with this pest, such as through the use of baited sprays.

Dr. Cowles established a planting of firs in Brooklyn, CT at a site with high naturally occurring incidence of Phytophthora root rot. This experiment is investigating soil acidification as a method to prevent infection of roots by *Phytophthora* spp., which are known to be much less tolerant of acid soils than are the fir tree hosts. The soil acidification (with pelletized sulfur) is part of a factorial experimental design investigating host species (comparing Fraser firs with Canaan firs, which are highly vs. much less susceptible to infection), use of phosphites, and use of insecticides (imidacloprid and thiamethoxam) known to elicit the systemic acquired resistance (SAR) pathways as phosphites, with a negative control. Evaluation of tree health in the same year as planting demonstrated highly significant treatment effects from application of sulfur, which benefitted both species of fir, and the phosphite root dip, which specifically benefitted Fraser firs. The root dips with the insecticides provided no significant improvement in tree health.

Impacts: Dr. Cowles' research has assisted fruit extension specialists through New England. The use of baits and traps designed by Dr. Cowles has provided timely monitoring information to fruit growers, enabling them to protect their fruit from damage.

- Growers in New England had early warning of SWD activity from extension personnel using effective monitoring methods.
- Growers have adopted the use of sucrose with their sprays to more effectively manage SWD.

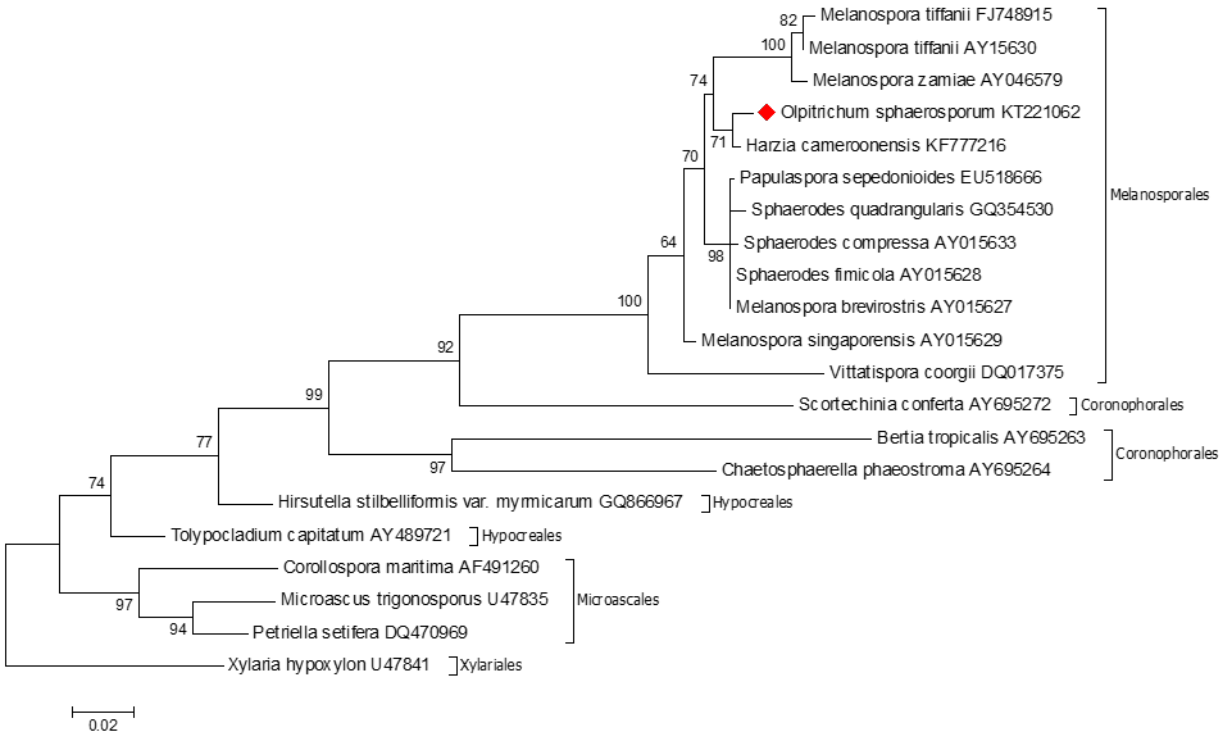
Mycology Research

Dr. DeWei Li conducts research on indoor molds of human health concern, fungal succession on water-damaged building materials, and infiltration of mushroom spores from outdoors into residences.

Toxic Indoor Mold - *Stachybotrys* and *Memnoniella* Biosystematics

Systematic study of *Stachybotrys* led us to conclude that *S. elegans* is a species complex, which may include three species. At present, DNA sequencing work is underway for differentiating these species. At the same time *Olpitrichum sphaerosporum*, a dimorphic hyphomycete isolated from the foliage of *Juniperus chinensis* in CT, constitutes the first report of this species in the United States. Phylogenetic analyses using large subunit rRNA (LSU) and internal transcribed spacer (ITS) sequence data showed that *O. sphaerosporum* belong to the *Ceratostomataceae, Melanosporales*.

Impact: The study in the past year has clarified two issues: *Stachybotrys elegans* is a species complex and more work is ongoing to delineate them so that the definition of *S. elegans* is redefined. In the past the placement of *Olpitrichum sphaerosporum* and its genus was uncertain. The phylogenetic studies using DNA sequence data clearly place this genus and its members into the *Ceratostomataceae*, *Melanosporales*.



Maximum likelihood analysis, with bootstrap values indicated, of *Olpitrichum sphaerosporum* and related species, based on LSU sequence data (1000 bootstrap replicates). Accession numbers of the sequences are included with the species names. *Xylaria hypoxylon* AY327477 is included as the outgroup. The scale bar indicates the number of expected changes per site.

Global Diversity of the *Auricularia auricula-judae* Complex

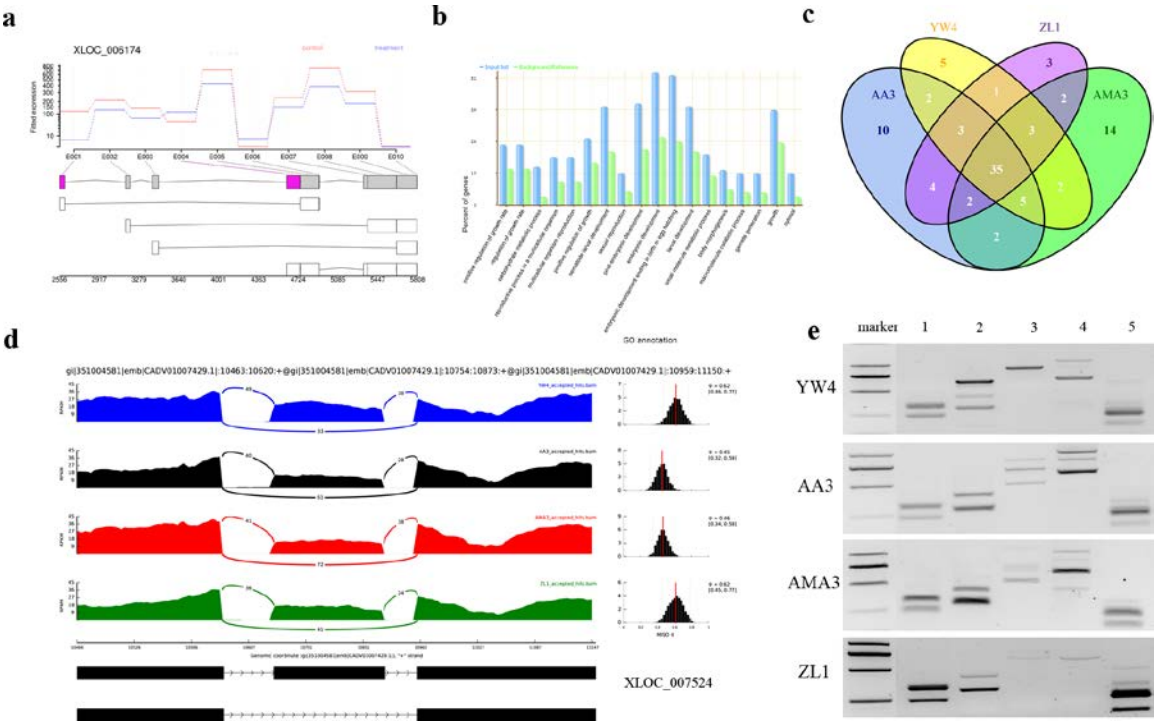
Auricularia auricula-judae was previously considered a single species, but recent studies showed that it is a species complex. This study is to delineate this species complex. Fifty samples of *A. auricula-judae* sensu lato from Asia, Europe, and North America were studied and analyzed using morphological and molecular phylogenetic methods. ITS, LSU, and rpb2 sequences were used for phylogenetic analyses. The results indicated that seven species are in the complex, including three new species: *Auricularia angiospermarum*, *A. minutissima*, and *A. tibetica*. The type specimen of *Auricularia angiospermarum* was collected from the Valley Laboratory of CAES.

***Impact**:* The fungi in the *Auricularia auricula-judae* complex are all edible. Some of them are the economically important, cultivated *Auricularia* mushrooms. Two species are cultivated, but have been treated as a single species: *A. auricula-judae*. The study clarified that *Auricularia heimuer* is the most extensively cultivated species of *Auricularia. Auricularia villosula* is also cultivated, but has been called by the mushroom production industry *A. heimuer* due to confusion in taxonomy. The size of basidiospores and the presence or absence of medulla are important characters for differentiating the species within the complex, and ITS sequence data is a sensitive marker to discriminate species. The results of this study are important not only to mycologists from taxonomic aspects and species definition, but also to the mushroom cultivation industry, which will understand what they are producing.

Basidiomata of *Auricularia angiospermarum* (holotype). Bars: (a–b) 2 cm. (This type specimen was collected from a log cut down from a forest management demonstration plot at CAES Valley Laboratory).

Pine wood nematode *Bursaphelenchus xylophilus* study

This is a collaborative study on pine wood nematode (PWN) with Nanjing Forestry University in China. The study is conducted in several different aspects from pathogenicity, population genetics, ecology, adaptation, management, and detection, etc. Two forms of pine wood nematodes are present in the native region of PWN, i.e., with strong virulence and weak virulence. However, the molecular differences between the two forms remain little known. This study focused on their molecular variations. Transcriptome and genome sequences of three strongly virulent strains and one weakly virulent strain were analyzed. Results showed that 238 transcripts and 84 exons showed notable changes between the two virulent forms. In addition, a small number of exon-skipping events in *B. xylophilus* were found. At the same time, 117 SNPs were identified as potential genetic markers in distinguishing the two forms. Four of them were further proved to have undergone allele specific expressions and possibly interrupted the target site of evolutionary conserved *B. xylophilus* miR-47.



Exon-skipping events and differentially expressed exons found in *B. xylophilus*. (a) Visualization of differentially expressed exons in Bx-eng-1 gene (highlighted in red). (b) GO enrichment results of differentially expressed exons (P-value<0.05). (c) Venndiagram showing the predicted exon-skipping events. (d) Sashimi plot of exon-skipping event in XLOC_007524. (e) Experimental validation of exon-skipping events using PCR amplification. (lane 1 indicated exon-skipping events found in XLOC_002568, lane 2: XLOC_007524, lane 3: XLOC_002051, lane 4: XLOC_001151, lane 5: XLOC_000101)

***Impact**: Bursaphelenchus xylophilus* is native to North America and the causative agent of pine wilt disease, which has spread to Asia and Europe decimating pine forests and causing huge economic losses in many countries. It is a very important quarantine pest. In these countries, people are desperate to find ways to contain this nematode and to save their pine forests. The results of this study could help researchers to better diagnose nematode species with different virulence and facilitate the control of pine wilt disease.

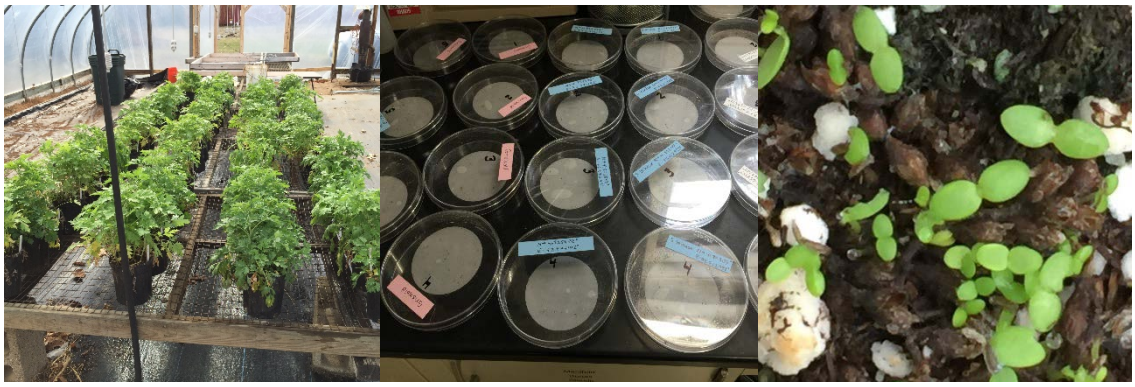
Weed Science

Invasive Plant Management Trials

In Connecticut, hundreds of non-native plants occur in various managed and natural ecosystems. One of these non-native invasive plants is mugwort (*Artemisia vulgaris* L.), which was introduced in North America more than 400 years ago as a medicinal herb. Dense monotypic stands of mugwort are commonly found along roadsides, floodplains and riparian areas, pasture and rangeland, rights-of-way, and in various agronomic, turf, and landscape settings. Mugwort is also considered as one of the 10 most troublesome weeds in the US nursery industry where it strongly interferes with the growth of ornamental plants. Mugwort's rapid spread is attributed to its extensive underground rhizome system and resistance to chemical and cultural control tactics. Current mugwort management relies mainly on herbicides since there are few nonchemical options available for control. Dr. Aulakh has initiated field trials to evaluate low rates of herbicides, mowing frequencies, nitrogen fertilization, and overseeding as an integrated approach to manage mugwort infestations. It is hypothesized that: 1) nitrogen fertilization will influence

the efficacy of herbicides and will improve the competitive ability of crop plants against mugwort, 2) overseeding desirable plant species will help achieve and maintain high levels of mugwort control, and prevent reinvasion by filling in areas thinned from mugwort competition, 3) lower rates of selected herbicides will help in complete eradication of mugwort plants and rhizomes.

Dr. Aulakh has established a field experiment at Lockwood Farm in Hamden to evaluate mugwort (*Artemisia vulgaris*) response to herbicides and mowing regimes under enhanced levels of soil nitrogen. Additional sites are being established for testing herbicide rates, mowing frequencies, and overseeding as an integrated approach toward mugwort management. Dr. Aulakh is conducting lab studies to test mugwort's response to flooding regimes and mulching following herbicide treatments. The scientific literature also lacks information on mugwort's potential for reproduction from seed; it has been widely believed that no viable mugwort seeds are produced in the USA. Seed germination trials are being conducted to see if mugwort populations in different parts of Connecticut can produce viable seeds.



Mugwort's herbicide response and percent seed germination lab trials at the Valley Lab, Windsor, CT.

Ornamental Nursery Trials

Herbicides are a critical input to raise weed-free, high quality ornamental plants. Ornamental plants as well as weeds vary in their tolerance to herbicides. In Connecticut, nurserymen are growing a vast variety of ornamental plants and there are always new species or varieties for which information is needed on their tolerance to herbicides effective against commonly encountered nursery weeds. Dr. Aulakh has initiated field experiments to screen new herbicides (SP 1770, OHP 052908, F6875 4SC, BAS 659H G, indaziflam, flumioxazin, and Westar) for ornamental plant safety and weed control efficacy. These studies will help to develop safe use practices for these new products and compare their weed control efficacy with the commonly used pre-emergence herbicides.

Ornamental plant safety trials at the Valley Lab, Windsor.

Christmas Tree Weed Management Trials: Christmas tree tolerance to herbicides depends on many variables that encompass tree species, growth stage, herbicide chemistry, application rate, and timing (dormant or actively growing), and method of application (directed or over-the-top). Experiments are underway to screen new pre-emergence herbicides such as indaziflam, flumioxazin, Westar, and their combinations, at full rates applied once or with two split applications spaced a month apart, for Christmas tree safety and weed control efficacy.

In Connecticut, Christmas tree plantations, a major shift in vegetation is happening toward perennial and biennial weeds or annual weed species, which are naturally tolerant to currently available herbicides. Examples include: Asian day flower, brambles, cinquefoil, evening primrose, field bindweed, hedge bindweed, horsenettle, horsetail, mugwort, whorled yellow loosestrife, wild violets, wild carrot, and woody vines such as Virginia creeper, poison ivy, black swallow wort, and Oriental bittersweet. In order to meet these new weed challenges, Dr. Aulakh has designed experiments to test conventional and new post herbicides for their weed control efficacy and safety on Christmas tree species and age groups.

Christmas tree weed management research sites at Brooklyn and Shelton, CT.

Impact: Research on integrating cover crops and crop rotation for weed control in organic systems will benefit the organic producers in Connecticut. Further research is needed to validate results and make information available to the growers and other stakeholders.

Organic Production Systems

Weed management is one of the greatest challenges in organic production systems as chemical herbicides are not allowed in order to meet the organic production standards. Considering this, there is a great need to integrate non-chemical weed management strategies such as tillage, cover crops, crop rotations, and competitive crops, etc. for managing weeds on organic farms. Dr. Aulakh has established a field research trial to evaluate fall cover crops and crop rotation for weed management in organic production systems.

Research trial on cover crops for weed suppression, Valley Lab, Windsor, CT.

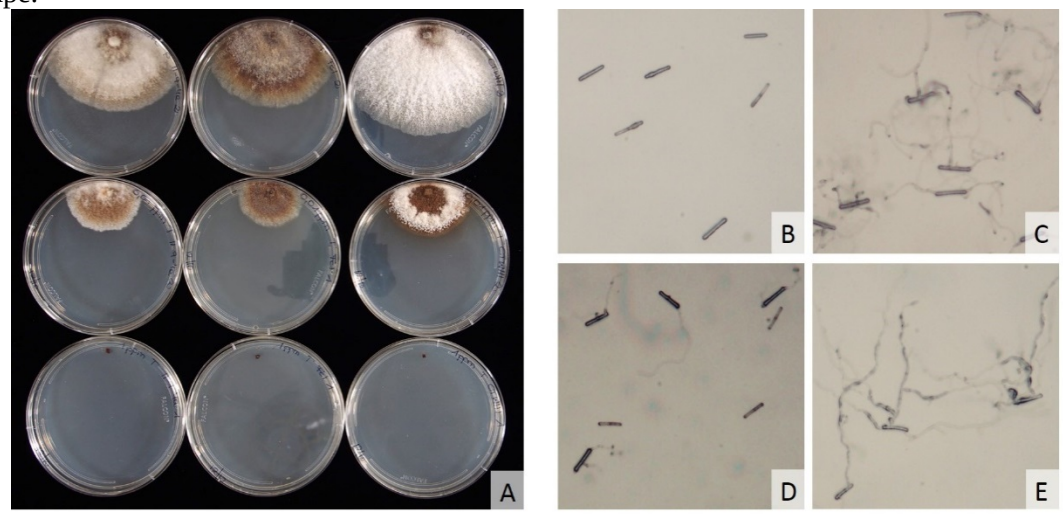
Plant Disease Research

Boxwood Blight

Boxwood blight is a new, introduced disease in Connecticut. The impact of the disease has been very high; boxwood plant losses have been estimated at over $5.5 million in Connecticut since October 2011. In addition, the concern about boxwood has resulted in reduced or lost orders for other plants, resulting in a multiplier effect on economic losses. Drs. James LaMondia and Katja Maurer have conducted research to determine fungicide efficacy in vitro and in plant systems. *Calonectria pseudonaviculata* (*Cps*) causes leaf spot and stem lesions resulting in defoliation and dieback of boxwood.

Assess Potential for Development of Fungicide Resistance in *C. pseudonaviculata*

One aim of the boxwood blight research program is to assess the potential for development of fungicide resistance (insensitivity) in *Cps*. The development of resistance is common and observed for many pathogens and crops. Therefore, Drs. James LaMondia and Katja Maurer conducted tests to evaluate the fungicide sensitivity of three different pathogenic isolates (a sensitive wild type; an isolate of the sensitive wild type selected for ability to grow on up to 250 µg a.i./ml pyraclostrobin; and a recent isolate from a Connecticut landscape) on mycelial growth and conidial germination using in vitro assays. Four strobilurin fungicides (pyraclostrobin, azoxystrobin, trifloxystrobin, and kresoxim-methyl) and five demethylation inhibitor (DMI) fungicides (propiconazole, tebuconazole, triflumizole, myclobutanil, and tetraconazole) were analyzed. The concentration that suppressed fungal growth by 85% (effective dose EC_{85}) was determined. In general, DMIs showed a stronger inhibition effect on *Cp*. radial growth rate than the strobilurin fungicides. Only pyraclostrobin and kresoxim-methyl had an inhibition effect on mycelial growth and conidial germination of the sensitive and CT isolate within the use rate. The selected and the CT isolates exhibited reduced sensitivity to strobilurin but not DMI fungicides compared to the wild type strain. This study demonstrates that reduced fungicide sensitivity in *Cps* can be selected for in vitro and that reduced strobilurin sensitivity can also occur naturally in pathogenic isolates in the landscape.



A: In vitro assay to determine the radial growth of the three isolates on fungicide amended media. B - E: Conidial germination: (B) Non-germinated conidia of the sensitive wild type on pyraclostrobin amended media; (C) Germination of the sensitive wild type spores on unamended media; (D) Partly germination for the CT isolate on pyraclostrobin amended media; (E) Germination of the CT isolate on unamended media.

Impact: Boxwood is a very important ornamental plant in the Connecticut landscape and, in general, in the United States. Boxwood has a significant share of the wholesale value of ornamental plants. Current losses amount to an estimated $5.5 million in CT alone.

- Because of the high application of fungicides to control boxwood blight, the likelihood of the development of resistance is high.
- The knowledge of fungicide insensitivity is important to develop an effective spray program and to avoid fungicide resistances.
- Multiple fungicide active ingredients from different mode-of-action groups in mixture and rotational usage may slow selection for fungicide insensitivity.

Boxwood Blight Resistance

At CAES-Windsor, we have conducted two evaluations of differential susceptibility in boxwood cultivars using 40 boxwood lines as rooted cuttings from the Long Island Horticultural Research and Extension Center originally obtained from the National Boxwood Collection. We evaluated disease susceptibility as whole plants and as detached leaves. *Buxus sinica aemulans*, *B. sempervirens* 'Scupi', *B. harlandii*, and *B. microphylla* var. *japonica* 'Jim Stauffer' were the least susceptible, and averaged 1 lesion per plant or less, whereas *B. sempervirens* 'Suffruticosa' averaged over 50 lesions. Detached leaf assays did not result in significant differences, although reduced sporulation was observed on the less susceptible lines. Detached leaf assays may not be the most effective means to rank cultivar susceptibility compared to entire plants. These plants have different growth habits and therefore different microclimates, so there may be additional factors that impact disease susceptibility or tolerance. Our preliminary results indicate that leaf age is also important in relation to disease susceptibility and that spores inoculated to the underside of leaves are much more likely to cause infection than spores inoculated to the top surfaces. Conidia of the pathogen can infect leaves directly or can grow through leaf stomates to infect.

Boxwood Blight Fungicide Efficacy

Orkestra Intrinsic™ fungicide is a new broad-spectrum active ingredient under development by BASF. Dr. LaMondia conducted trials on three- to four-year-old 'Green Velvet' boxwood plants in no. 1 containers. The fungicide applications were applied as a foliar spray to runoff on 8 May, 29 May, and 19 Jun 2015 in the outdoor container nursery production area. Plants were inoculated with 4.3×10^5 conidia per plant on 11 May, 2.6×10^5 on 13 May, 1.3×10^5 on 1 Jun, 1×10^6 on 3 Jun, and 2.4×10^5 conidia per plant on 22 Jun. Plants were moved back to the nursery area after 4 d. Disease was assessed by counting numbers of dropped leaves and typical boxwood blight lesions on newly produced leaves, older mature leaves and stems on 9 and 10 Jul. The experiment was repeated. For both experiments, most of the infection observed in boxwood leaves occurred late in the experiment in newly produced young leaves. Immature leaves are more susceptible to infection than mature boxwood leaves. Early infection likely resulted in diseased dropped leaves. Stem infection and numbers of dropped leaves were similar in the two experiments. For both experiments, all treatments reduced infection significantly compared to the untreated controls, and the fungicides and the different rates of BAS 70306F were not significantly different from each other. Disease control averaged over all fungicides resulted in good control for stem lesions in experiment 1 and stem and leaf lesions in experiment 2. No symptoms of phytotoxicity were observed on the fungicide-treated plants.

Previous fungicide work has yielded promising results with several registered products preventing severe development of boxwood blight. Experiments are being conducted at CAES-Windsor to investigate curative activity, the length of residual activity, and fungicide programs. In addition, because growers are asking questions regarding the length of efficacy and reapplication intervals, we are investigating curative activity and the length of residual efficacy of specific fungicides. Selected efficacious fungicides were evaluated for post-infection activity. In vitro, *Cps* exposed to $\geq$ 5 ppm DMI fungicides in agar did not resume growth when transferred to non-amended media, suggesting the potential for curative activity. A detached leaf assay was used to evaluate 0, 3, 30, or 300 ppm propiconazole, tebuconazole, or kresoxim-methyl on disease when applied 24 h before or 24, 48, or 72 h after inoculation (curatively) with 100

conidia per leaf. All fungicides were effective from 3 to 300 ppm when applied preventatively. Propiconazole reduced disease incidence at 30 or 300 ppm at 24 h applied curatively and prevented sporulation at 30 or 300 ppm up to 96 h. Tebuconazole and kresoxim-methyl did not reduce disease when applied curatively; tebuconazole but not kresoxim-methyl prevented sporulation at 30 or 300 ppm up to 96 h. Propiconazole applied curatively at 30 or 300 ppm reduced diseased leaf area; 300 ppm resulted in 2, 18, or 51% of leaf area diseased at 24, 48, or 96 h compared to 90% for untreated leaves. Green Velvet boxwood plants were treated with propiconazole, thiophanate-methyl, pyraclostrobin, kresoxim-methyl, or water alone 48 h after inoculation with *Cps*. Disease development was reduced after curative application of propiconazole only. The number of *Cps* re-isolations from symptomatic tissue was also reduced for propiconazole.

Impact: The identification of fungicide application programs with curative activity as well as activity against spore germination and vegetative growth of the boxwood blight pathogen will lead to the development of effective management strategies.

Tobacco Disease Research

The Connecticut Agricultural Experiment Station Valley Laboratory was established in 1921 as the Tobacco Substation, to combat tobacco problems and diseases such as wildfire, a devastating disease caused by a bacterial plant pathogen. Wildfire was eventually eliminated by the development of plant resistance to this pathogen. Ever since, tobacco breeding to incorporate genetic plant resistance to plant pathogens has been used to successfully manage diseases. Plant resistance to major pathogens is the most economical, environmentally responsible, and often most effective way to control plant diseases. The development of plant resistance to Tobacco Mosaic Virus (TMV) in the 1950s, to ozone damage (weather fleck) in the 1960s, black shank in the 1970s, and Fusarium wilt in the 1980s and early 1990s effectively controlled serious diseases which each threatened to seriously impact or even wipe out cigar wrapper tobacco production in the Connecticut River Valley. There are currently a number of pathogens that threaten the crop. Dr. LaMondia conducts an ongoing breeding program to develop resistance to: *Fusarium oxysporum* (causing Fusarium wilt); *Globodera tabacum* (the tobacco cyst nematode); tobacco mosaic virus, and *Peronospora tabacina* (blue mold) for both shade and broadleaf types. Recently, a male-sterile F1 hybrid 'B2' highly resistant to Fusarium wilt, TMV, and the TCN and with moderate resistance to blue mold and black root rot was released and licensed. Black shank, caused by *Phytophthora nicotianae*, has re-emerged as a serious pathogen in Connecticut and we are working to develop a hybrid line with significant resistance to the pathogen. Our first candidate line, B3, was evaluated under field conditions in 2014 and 2015 and, while resistant, was found to be lacking in wrapper leaf quality. Additional crosses are now being made. Black root rot, caused by the fungus *Thielaviopsis basicola*, has been damaging and increasing in impact in recent years with cool, wet springs. We obtained three sources of dark wrapper tobacco with high levels of black root rot resistance from cooperating scientists in Kentucky. A back-cross program is being used to transfer resistance to CT broadleaf, and resistant plants are being selected for broadleaf characteristics. Inbreds have been developed and have been used to develop hybrid lines with resistance to multiple pathogens. Two of these lines are being evaluated under commercial conditions. Breeding for resistance to Potato Virus Y (PVY) has been a high priority; however, the burley tobacco cultivar (TN-86), which is the commercial source of resistance to Potato Virus Y (PVY), has been evaluated and found not to be resistant to the new PVY strains that occur in potato, tobacco, and other solanaceous crops. No source of resistance to the new strains is currently known, so this objective has been put on hold.

Impacts: The development of a male-sterile hybrid broadleaf cigar wrapper tobacco with resistance to most of the major pathogens, including Fusarium wilt, TMV, the TCN, and blue mold, will allow sustainable production with reduced disease and much reduced pesticide inputs. B2 has been released as

a new cultivar and licensed to a local company. Proceeds will support further research on plant resistance. Adding resistance to black root rot will further reduce plant losses to disease.

Tobacco Cyst Nematode Management

Trap crops are being developed for nonchemical control of cyst nematodes. A solanaceous weed, sticky nightshade (*Solanum sisymbriifolium*) is being evaluated to control potato cyst nematodes *Globodera pallida*. Because of the difficulties in working with this regulated pathogen in the United States, Dr. LaMondia is cooperating with scientists from Idaho to conduct experiments with the closely related tobacco cyst nematode *G. tabacum* as a model system. The influence of broadleaf cigar wrapper tobacco (*Nicotiana tabacum*), eastern black nightshade (*Solanum ptychanthum*), and sticky nightshade (*Solanum sisymbriifolium*) on egg hatch and subsequent development of the tobacco cyst nematode, *Globodera tabacum*, was investigated. Root diffusates were prepared from 2 g of root of four-week-old plants soaked in 100 ml of distilled water for 2.5 hours, filtered and frozen. *Solanum ptychanthum* root diffusates stimulated juvenile hatching from eggs in cysts over 4 weeks more than root diffusates of *S. sisymbriifolium* or *N. tabacum*. Tobacco increased hatch by four times compared to water alone. *S. sisymbriifolium* stimulated twice and *S. ptychanthum* three times the hatch of that for *N. tabacum*. *G. tabacum* juveniles were observed in stained roots of both *N. tabacum* and *S. sisymbriifolium* and development to adult females occurred within four weeks in tobacco but not *S. sisymbriifolium*. Cysts were extracted from roots and soil in pots that had been planted to *N. tabacum* or *S. sisymbriifolium* for 12 weeks and cysts crushed to count encysted juveniles. Final population densities were 324 *G. tabacum* J2 per 100 cm^3 soil for tobacco and 4.5 *G. tabacum* J2 per 100 cm^3 soil for *S. sisymbriifolium*. Sticky nightshade, *Solanum sisymbriifolium*, stimulates tobacco cyst nematode hatch better than tobacco but unlike eastern black nightshade, does not allow significant reproduction in roots, indicating that it may be an effective trap crop for management of *G. tabacum*. In addition, *G. tabacum* may be useful as a substitute model for the quarantined pathogen *Globodera pallida* for trap cropping with *S. sisymbriifolium* under field conditions.

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Tobacco Black Shank Management

Black shank, caused by *Phytophthora nicotianae*, is a re-emerging disease in Connecticut. Experiments were conducted in 2015, in cooperation with Altadis Tobacco, in a field that experienced losses to black shank in previous years. Broadleaf cigar wrapper tobacco cultivar C9 was transplanted by the grower. Fungicides were applied at transplanting and a second layby application was applied at the last cultivation. Treatments consisted of Ridomil, Revus, Presidio, and an experimental fungicide under development. No disease was observed on 26 June, symptomatic plants were observed and counted on 23 July and 14 August 2014. No further disease occurred after that point. Numbers of black-shank affected plants were numerically higher in untreated control plots than in all fungicide-treated plots but differences were not significant. Incidence in the untreated control average about 20% symptomatic plants. There were no significant differences between fungicide treatments, indicating that all fungicides tested had similar efficacy. There was no indication that mefenoxam-resistance was present. Disease control averaged over all fungicides was quite good, about 85% control or better. No phytotoxicity was observed in broadleaf cigar wrapper tobacco for any of the fungicides evaluated. No blue mold occurred in the plots or even on the farm in 2015, so the effect of fungicides on blue mold could not be determined.

Blue Mold Management in Tobacco

Blue mild, caused by *Peronospora tabacina*, is a very damaging leaf spot pathogen that ruins crops being grown as cigar wrapper. Dr. LaMondia evaluated fungicide efficacy in an established shade tent at the

Valley Laboratory. Fungicide sprays were applied at two-week intervals. Three leaves per plant were picked and evaluated for blue mold symptoms on 10, 17, and 24 Aug, and on 1 and 8 Sep for a total of 15 leaves per plant. Numbers of completely healthy unblemished leaves per plot were counted for each harvest date. Conducive conditions for disease development resulted in severe blue mold in borders and untreated plots by the first pick on 10 Aug. Harvest was stopped after 5 wk (15 leaves) as few healthy leaves remained. All fungicides resulted in increased numbers of unblemished leaves per plant compared to the non-treated control. The untreated control resulted in a 91% yield loss due to blue mold over 5 harvest dates whereas fungicides resulted in a 73-33% yield loss. Presidio fungicide was the most effective control followed by Revus. Forum, Quadris and Manzate were not significantly different from each other. Yield losses were less than 50% in Presidio-treated plots up to three weeks after the last spray, significantly longer than other treatments. No phytotoxicity was evident for any treatment.

Reduced Pesticide Residues in Tobacco

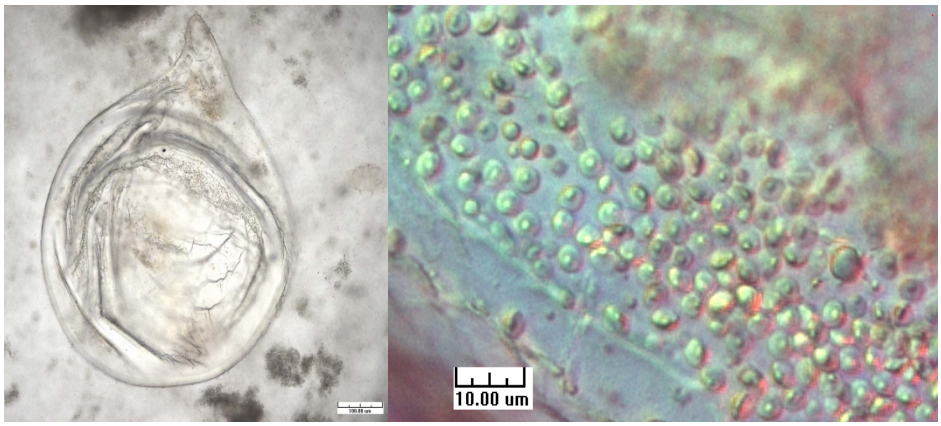
Connecticut shade and broadleaf tobacco types are used to produce some of the highest quality cigar wrappers in the world. Blue mold, caused by *Peronospora tabacina*, is a leaf spot disease that can destroy the crop, valued at up to $50,000,000 per year. Fungicides can help protect the leaves, but growers and cigar makers want to keep residues low. Dr. LaMondia conducted experiments to maximize disease control with reduced levels of fungicide in cured leaves in 2015. The strategy tested investigated the effects of using dimethomorph, mandipropamid, or fluopicolide fungicides early in the season and avoiding or minimizing sprays prior to harvest as opposed to the standard application of the same total amount of fungicide spread out over the season. Leaves were harvested, cured, and fungicide residues determined by Dr. Brian Eitzer of the Department of Analytical Chemistry. Our results indicated that fungicide concentrations were stable in the plant and may have more systemic activity than thought.

Impacts: The development of a more effective spray program that results in reduced fungicide residues in broadleaf cigar wrapper tobacco will increase marketability and reduce human exposure to pesticides.

Root-Knot Nematode Biological Control

Populations of the northern root-knot nematode *Meloidogyne hapla* declined over time in experimental field microplots infested in 1995 and repeatedly inoculated with the nematode. The potential cause of the nematode decline was investigated. *Pasteuria* bacteria endospores were observed on the cuticles of up to 60% of *M. hapla* juveniles recovered from soil in these microplots. Soil was sampled from all microplots, bulked, dried, and lots of 3 kg were each either left as non-treated, microwaved for 4.75 minutes, or autoclaved for 1 hour each on two successive days. Five replicate pots each containing 500 cm^3 of these three soil treatments were inoculated with 2,500 eggs and juveniles of *M. hapla* in 3 ml water. After 5 weeks, plants grown in autoclaved soil had more galls (465) than those grown in untreated soil (203); gall numbers from microwaved soil were intermediate (267) (P=0.04). In another study, hatched juveniles were added to flasks containing 25 cm^3 of soil in 50 ml water and shaken for 7 days. Nematodes were recovered by sugar centrifugation and the number of endospore-free or endospore-encumbered juveniles counted. Autoclaved soil had 8 of 20 juveniles with endospores; microwaved soil had 10 of 20 juveniles with endospores, and non-treated soil had 15 of 20 juveniles with attached endospores. *Meloidogyne hapla* juveniles that were exposed to non-treated soil were added to pots with tomato transplants. After 6 weeks, *Meloidogyne* females that developed within galls were dissected out of roots and examined. Endospore-filled females were observed, indicating that this isolate of *Pasteuria* infected juveniles and produced endospores in *M. hapla.* The association between *Pasteuria* and *M. hapla* appears to contribute to suppression of the nematode in Connecticut soils.

Meloidogyne hapla galls on carrot, endospore-encumbered *M. hapla* infective juvenile.



M. hapla female containing endospores.

Impact: Soils suppressive to nematodes may develop over time and result in effective and economical control of the plant pathogens. We have demonstrated that a successful natural biological control agent can survive and manage root-knot nematodes in Connecticut.

Hops Research

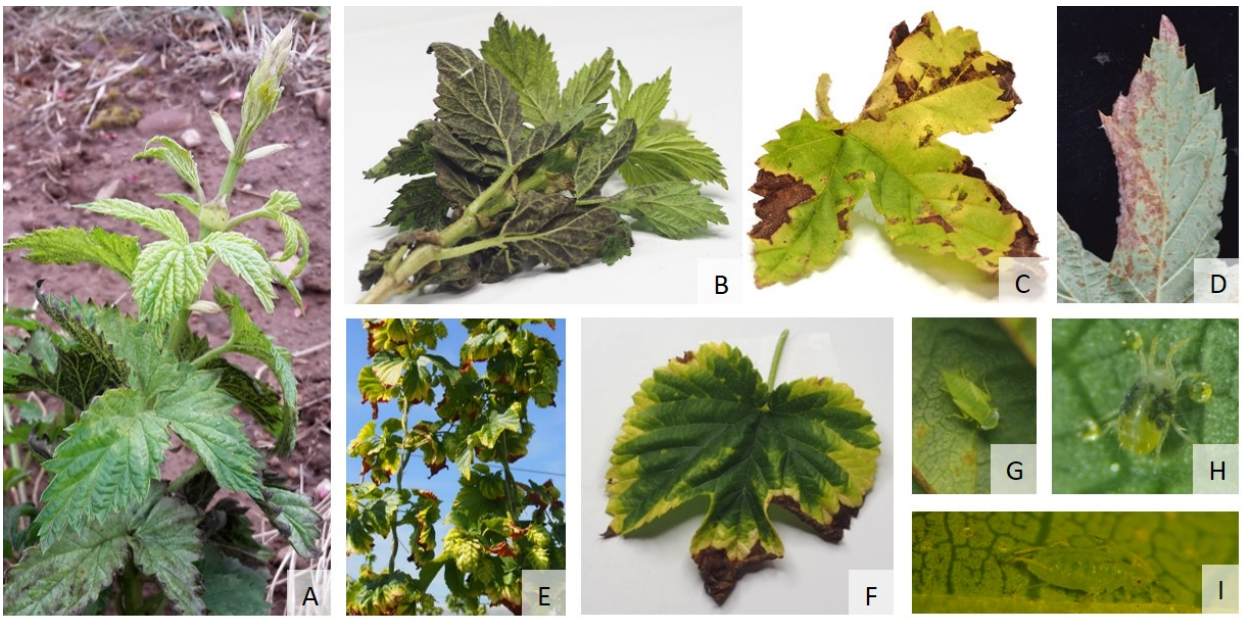
Hop (*Humulus lupulus*) cultivation in the northeastern United States dates back to the first settlers, but disappeared for a century because of disease pressure and the enactment of Prohibition. Subsequently, it was established in the Pacific Northwest, which is nowadays one of the largest production areas worldwide. However, interest in hop production in New England is on the rise again. The popularity of microbreweries, local brewpubs, home brewing, and the growing demand for regional products has increased interest in producing high quality hops on a small scale in New England.

To evaluate the feasibility in CT, the CAES has established two small hop yards with several cultivars (AlphAroma, Cascade, Newport, Perle, Summit) using high and low trellis systems to evaluate yield,

growing characteristics, and susceptibility to diseases in two locations: the Valley Laboratory in Windsor and Lockwood Farm in Hamden. Cascade and Summit are notably suited for CT as well as that the high trellis setup is more reliable except for the semi-dwarf variety Summit. Perle, a German breeding line, had the lowest yield.

A: Hop yard in Windsor; B: Hop yard in Hamden.

The most common diseases and pests are downy mildew, caused by *Pseudoperonospora humuli*, which is the most dreaded disease in New England, aphids, and spider mites. A novel pest, the potato leafhopper, appeared unexpectedly last year and caused serious damage. However, diseases and pests can be controlled by scouting and management measures. The use of pesticides, biological control measures, removing weeds, and stripping lower leaves help to reduce the spread of diseases and pests.



A - B: Basal spikes resulting from downy mildew and black sporulation on the underside of the leaves; C – D: Leaf lesions and sporulation caused by downy mildew; E - F: “hopper burn” = necrosis of the leaves, where the outer edges and tip turn brown, forming a distinctive “V”; G: Potato leafhopper; H: Spider mite; I: Aphid.

In conclusion, our research has demonstrated the general feasibility of hop production in CT. The data concerning hop growth, yield, and disease/pest development have shown that Cascade, a very popular cultivar in the U.S., and Summit, a semi-dwarf variety, seem to be promising varieties for hop cultivation in CT. Ten more varieties were planted at the Valley Laboratory in Windsor and additional plantings were made at Lockwood Farm in Hamden this spring.

Impact: Assessment of different cultivars in low and high trellis production systems in terms of their growth, yield, and disease/pest development will lead to a better understanding of successful hop cultivation in Connecticut.

- Scientists conducted education/outreach at the first meeting and open house at Windsor for growers and brewers, where they presented the results of the hops trials as well as discussed hop production in CT, and the UConn Extension Master Gardener class about growing hops.
- Interest and positive feedback from growers and potential growers is very high.

VALLEY LABORATORY SERVICE ACTIVITIES

Requests for Information

A total of 5,238 inquiries were answered at the Valley Laboratory during the past year. The majority of these queries were answered by Ms. Rose Hiskes (59%) in the inquiry office (61% from the public sector, 32% commercial) or by Dr. LaMondia (20% of inquiries; 92% commercial). About 48% of the information requests to the inquiry office were from the public sector; the remainder was from commercial growers, government, nonprofit, educational, or other (52%). The majority of inquiries answered by Ms. Hiskes concerned insects (26%), diseases (16%), pesticides (12%), and horticulture (10%). Most concerned landscape and nursery (56%), vegetable (9%), and structural entomology (7%). Dr. LaMondia responded to disease (62%), horticulture (23%), insect (5%), fertility (4%), pesticide (4%), weed (1%), and animal (1%) inquiries. These inquiries primarily concerned tobacco (47%), hops (15%), nursery and landscape (14%), vegetables (12%), fruit (10%), golf turf (1%), and Christmas trees (1%). All scientists and many of the staff members at the Valley Laboratory assist growers and homeowners.

Valley Laboratory scientists made 75 presentations to grower, professional, and citizen groups (over 5,800 people), were interviewed 17 times, and made 162 visits to commercial nurseries, greenhouses, farms, forests, and landscapes to diagnose complex problems or conduct research projects. Dr. LaMondia maintained the Connecticut River Valley Blue Mold Web Site to keep growers current with the disease in North America, and management options. This web site was accessed over 24,000 times in the past year. His laboratory conducted 163 nematode diagnostic samples and conducted testing as an APHIS-certified pine wood nematode export testing facility.

Thomas Rathier**,** emeritus soil scientist, continued to visit specific urban sites where community gardens either already existed or were planned by community organizers. At each site, Mr. Rathier made an assessment of the horticultural capabilities of the site as well as the likeliness of heavy metal contamination being found in soils on the site. Samples were taken at each site and analyzed by Mr. Rathier and Mr. Craig Musante (Department of Analytical Chemistry). Mr. Rathier subsequently relayed results to appropriate stakeholders along with suggestions for remediation and/or avoidance of soils whose metal concentrations exceed the Connecticut standards.

Soil testing

A total of 5,273 soil tests were expertly performed by Ms. Diane Riddle during the past year. About 69% were performed for commercial growers and 31% for homeowners. Of the commercial samples submitted, 69% were for landscapers, 7% for tobacco growers, 6% for vegetable growers, 3% for municipalities, 2% for golf course superintendents, 2% for nursery growers, 1% for small fruit, and 1% for Christmas tree growers.

Valley Lab Information Office Insect, Disease and Plant Health Survey

Ms. Rose Hiskes diagnosed a wide range of insect, disease, weeds and plant health problems on herbaceous and woody ornamentals; lawns, fruits and Christmas trees for homeowners, commercial businesses, other government agencies and nonprofits.

Insects

Gypsy moth caterpillar
©CAES, Rose Hiskes

During the spring and summer months, landscape insect pests, such as gypsy moth caterpillars, lace bugs, and white grubs were problems on trees, shrubs, and flowers in the landscape. Gypsy moths resurged in the spring of 2015 as May was very hot and very dry. The fungus, *Entomophaga maimaiga*, which usually kills caterpillars, was not able to proliferate and infect as many caterpillars in the north central part of the state. May of 2016 was not as hot but was dry and so again gypsy moth caterpillars were a problem throughout the eastern and northwest part of the state. There are some indications that the fungus can be watered and therefore activated when there is a lack of rain in April. With a second consecutive year of gypsy moth defoliation, some oak trees may have low carbohydrate reserves and need to be cared for by watering during dry spells. Plans may need to be made for insecticide sprays on these trees next spring. With another warm, dry year, lace bugs are continuing to be a problem on our broadleaf evergreens, especially those planted in sunny spots. White grubs were problems in lawns as well as landscape beds. Larvae are in the soil for nine months of the year feeding on plant roots. When found in vegetable gardens, there are very few effective insecticides available for use. Oriental beetle grubs were found in ornamentals grown in nurseries as well.

Structural insect pests such as bed bugs, carpet beetles, and ants were brought in by homeowners and pest control operators. Bed bugs continue to be problems in private homes, apartments, and communal living facilities, among other places. Fear of not being able to eradicate them can lead to delusory parasitosis, a sensation of being bitten by bugs when none exist. A new ant was brought to the Information office by a pest control operator in October. Scientists from Harvard and UConn identified it as *Pheidole megacephala*, a native of Africa. Thousands of these ants were found in a large structure in central Connecticut feeding on food scraps. This ant has two worker castes: major workers are 3 mm long and minor workers are 2 mm long. A nest was not found. It is believed they may be moving around the world in soils, such as that in large houseplants. It is not known whether they will survive outside in Connecticut.

Pheidole megacephala.
© CAES, Rose Hiskes

Powdery mildew on *Physocarpus*
© CAES, Rose Hiskes

Diseases

In summer 2015, diseases such as rusts, mildews, and needlecasts were found on Connecticut plants. Broom fir rust was found on firs being grown as Christmas trees in northeastern Connecticut. Removal of the alternate host, chickweed, may help in managing the disease.

In spring 2016, powdery mildew was found infecting new growth of *Physocarpus* 'Center Glow'. Larvae of a small white and black lady beetle, identified by Dr. Carole Cheah as *Psyllobora vigintimaculata*, were found feeding on the powdery mildew. It is not known if they provide control.

Larva of *Psyllobora*.
©CAES, Rose Hiskes

Eastern white pines have been having problems for many years. In 2015-2016, we received many reports of early casting of older needles. In the summer of 2015 and spring of 2016, a two-celled fungal spore was recovered from many samples brought to the Windsor office. Wyka and Broder described this as a new family and species, *Septoriodes strobi*. The interaction between diseases and weather will be discussed later.

The stem and bulb (bloat) nematode (*Ditylenchus dipsaci*) is a common plant parasitic nematode with a wide host range that causes severe losses in garlic, onion, and leek. The nematode has biological races with different host ranges and crop damage potential. Symptoms of infection with bloat nematodes include stunting, yellowing, and defoliation. Bulbs may initially have little discoloration if levels of infection are low, but may become darker, shrunken, soft, and light in weight over time as nematodes continue to feed and reproduce in storage. Secondary decays by fungi and bacteria are common. Multiple detections of this nematode from Connecticut over the past year indicate that it is a widespread problem that is very difficult to control.

Bloat nematode symptoms on garlic.

Ditylenchus dipsaci recovered from symptomatic garlic.

The most common and destructive hop disease diagnosed in Connecticut over the last year was downy mildew, caused by *Pseudoperonospora humuli*. This pathogen occurs in most if not all hop plantings, either as leaf lesions or more damaging systemic infection.

Weeds and Herbicides

Many weeds were brought in for identification and management recommendations. Ground ivy and clover in lawns were common problems. These weeds are tough to kill and require multiple applications of triclopyr when weeds are actively growing. Allowing weeds to grow before application so they have a larger surface area for the herbicide to interact with is a good idea. Also, let the herbicide remain on the foliage for as many sunny, rain-free days as possible before mowing again. Fall applications to these perennial weeds are more effective because this is when the plant is moving carbohydrates into the roots for storage through the winter. The herbicide is also then translocated down to better kill the root system.

Herbicide damage to pin oak.
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Misapplication of herbicides was the cause of some of the plant problems brought into this office. In spring, complaints of white grass came in. Clients had applied starter fertilizer with a crabgrass preventer containing mesotrione. Mesotrione disrupts carotenoid synthesis. Carotenoids are the red and yellow pigments found in plants.

Broadleaf herbicides applied to turf caused damage to ornamentals and vegetables. A mixture of 2,4-D, MCPP, and dicamba was applied to turf twice, a month apart, with the result of 100% of leaves on three pin oaks curled and misshapen. A nearby redbud and tomato plants were also injured. Another nearby property had the same two products applied a month apart and resulting drift of the herbicide severely stunted large, potted tomato plants. Many samples from white pines growing in lawns treated with broadleaf herbicides came in with bent and distorted needles.

Plant Health - Weather

Needle browning on white pine.
Nancy Plefka

Winter 2015-2016 was warm late into December with some sudden very cold spells and very little snow. Flower buds and even some vegetative buds and cambium in sensitive plants were killed when air temperatures reached -12°F and wind chills were -33°F on February 14 and 15 at Bradley airport. Many peach and nectarine trees in the northern part of the state had no blooms this spring. Some shrubs bloomed in the fall and only very sparsely in the spring. Azaleas and forsythias bloomed only on the bottom foot of the plant that was protected from the extreme cold temperatures.

Many eastern white pine samples came in from landscapers and homeowners. The warm, dry and then very cold weather played a big part in the decline of those white pines that could not be irrigated. Along with the needlecast fungus and herbicide damage, insects such as pine needle scale, eriophyid mites, and pine bark adelgid were found on the samples. As white pines are seed produced, genetic differences gave some trees resistance to these stresses. Most of these samples still have viable buds and candles were beginning to elongate on those brought in later. With careful irrigation and possibly insecticide sprays many of these trees should survive if they can be watered during the hot, dry spells of the coming summer.

Ornamental cherry tree samples were also brought in in large numbers. Some samples were from Kwanzan cherries, others from the weeping Higan or Yoshino cherry. Although the winter damage happened in February, it is not visible until the plant needs its conducting system those first warm days in the spring. Buds open, leaves expand, and begin transpiring. When the water lost cannot be replaced because of dead xylem, leaves dry, brown, and die. Branches brought in with brown leaves and brown cambium in late April had no fungal pathogens when incubated in a moist chamber. Some of the samples that came in later in the spring did have Phomopsis branch cankers. *Phomopsis* is a weak pathogen and the stress of winter injury gave it the opportunity to grow and cause branch death.

Impacts: Accurate identification of pests of agricultural and human health significance has resulted in economic savings to commercial growers and homeowners, reduced human and environmental exposure to pesticides, and increased human safety.

The Gordon S. Taylor Conference Room

Many agricultural organizations used the conference room at the Valley Laboratory regularly for their meetings. During the past year, 13 different groups used the room on 51 occasions. Our most frequent users were the Connecticut Department of Agriculture, Connecticut Rhododendron Society, Connecticut Invasive Plants Working Group, Connecticut Farmland Trust, Council for Soil & Water Conservation, Connecticut Christmas Tree Growers Association, Connecticut Nursery & Landscape Association, Hops Growers Association, Connecticut Agricultural Information Council, Working Lands Alliance, West Hartford Farmers Market, CT Wine Growers Association, and the CT Agriculture Division of Forestry. Ms. Jane Canepa-Morrison scheduled the meetings and Mr. James Preste and Mr. Isaac Buabeng arranged the furniture and ensured that the room was available after hours.

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