

THE CONNECTICUT AGRICULTURAL
EXPERIMENT STATION

Record of the Year

2014 - 2015



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, 2015 were:

Governor Dannel P. Malloy, President
Terry Jones, Vice President
Paul C. Larson, Secretary
Dr. Theodore G. Andreadis, Director

Commissioner Steven K. Reviczky
Dr. Stephen L. Dellaporta
Ms. Joan Nichols
Dr. Dana Royer
Ms. Patti J. Maroney

The Board of Control met on August 6, 2014, October 22, 2014, January 21, 2015, and April 8, 2015.

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, 2015.

ADMINISTRATION

Dr. Theodore G. Andreadis, Director
Dr. Jason C. White, Vice Director
Michael P. Last, Chief of Services
Dianne F. Albertini
Vickie Bomba-Lewandoski
Joan Ives-Parisi
Lisa L. Kaczinski
Kathryn K. Soleski

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
Dr. Arnab K. Mukherjee
Craig L. Musante
Kitty Prapayotin-Riveros
John F. Ranciato
Dr. Christina S. Robb
Dr. Alia Servin

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
Morgan F. Lowry
Dr. Chris T. Maier
Dr. Gale E. Ridge
Dr. Claire E. Rutledge
Stephen J. Sandrey
Dr. Victoria L. Smith
Dr. Kimberly A. Stoner
Heidi R. Stuber

Peter W. Trenchard
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
Jennifer M. Fanzutti
Saryn L. Kunajukr
Michael J. Misencik
Dr. Goudarz Molaei
Dr. Brij L. Sawhney, Emeritus
John J. Shepard
Dr. Blaire T. Steven
Michael Thomas
Michael Vasil
Dr. Charles R. Vossbrinck
Dr. Feng Xiao

FORESTRY & 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
Eric J. Flores
Brian Hart
Miguel Roman
Ronald A. LaFrazier
Michael A. Scott

PLANT PATHOLOGY & ECOLOGY

Dr. Sharon M. Douglas, Department Head

Michael A. Ammirata
Dr. Sandra L. Anagnostakis, Emeritus
Dr. Donald E. Aylor, Emeritus
Sandra E. Carney
Dr. Wade H. Elmer
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
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. Adriana Arango-Velez



Dr. Arango-Velez is a plant physiologist and ecologist who joined the Department of Forestry & Horticulture as an Assistant Scientist II in September, 2014. She holds a PhD degree in forest biology and management from the University of Alberta. She will focus her research on plant adaptation and response mechanisms to biotic (pests and pathogens) and abiotic (drought and soil toxicity) stresses on crop plants and trees using an integrated multi-disciplinary approach combining techniques in plant ecology, molecular physiology and genomics.

Dr. Douglas Brackney



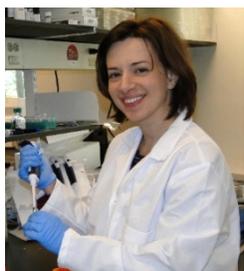
Dr. Brackney is a microbiologist and immunologist who joined the Center for Vector Biology & Zoonotic Diseases and the Department of Environmental Sciences as an Assistant Scientist II in December, 2014. He holds a PhD degree in microbiology, immunology and pathology from Colorado State University. Dr. Brackney will focus his research on elucidating the cellular and molecular mechanisms that allow mosquito and tick borne viruses to develop within their hosts using state-of-the-art techniques such as next-generation sequencing, super resolution microscopy, and high-throughput RNAi screens.

Dr. Blaire Steven



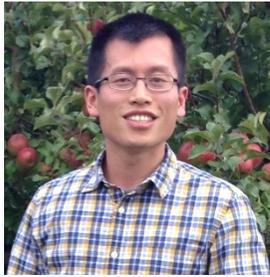
Dr. Steven is an environmental microbiologist who joined the Department of Environmental Sciences as an Assistant Scientist II in July, 2014. He holds a PhD degree in microbiology from McGill University. He plans to focus his research on how microbial populations in soil and water respond and contribute to various climate change scenarios using molecular and microbial techniques to better describe complex microbial systems including: wetlands, harmful algal blooms in Connecticut lakes, and wood-degrading bacterial/fungal communities.

Dr. Lindsay Triplett



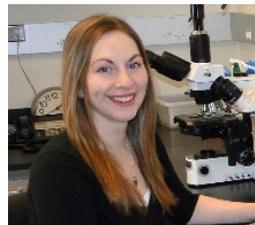
Dr. Triplett is a plant microbiologist and molecular geneticist who joined the Department of Plant Pathology & Ecology as an Assistant Scientist II in October, 2014. She holds a PhD degree in plant pathology from Michigan State University. Dr. Triplett will be working on diseases caused by plant-infecting bacteria (*Xanthomonas* species, bacterial leaf spot) to understand the mechanisms through which bacteria interact with plants with the idea of identifying new targets for resistance. She will also be developing novel diagnostic tools to identify bacterial plant pathogens.

Dr. Quan Zeng



Dr. Zeng is a bacterial plant pathologist who joined the Department of Plant Pathology & Ecology as an Assistant Scientist II in November, 2014. He holds a PhD degree in biological sciences from the University of Wisconsin-Milwaukee. Dr. Zeng will be conducting research on fire blight, an important bacterial disease of pome fruit using molecular and genomic tools to understand virulence mechanisms of pathogens and to develop novel disease management options. He will also be assessing streptomycin resistance in fire blight populations in New England.

Ms. Lindsay Patrick



Ms. Patrick is a plant diagnostician in the Plant Disease Information Office. She joined the Department of Plant Pathology & Ecology as a Research Technician I in November, 2014. She holds a MS degree in entomology from Purdue University and a BS degree in biology from Central Michigan University. Ms. Patrick will be assisting Dr. Yonghao Li and Dr. Sharon Douglas with diagnosis of plant health problems and conducting seed purity and germination analyses.

RETIREMENTS

Dr. Sandra L. Anagnostakis



Dr. Anagnostakis joined the staff of the Connecticut Agricultural Experiment Station in 1966 as a Technician I in the Department of Genetics. In recognition of her scientific contributions, she quickly rose through the ranks to Assistant Scientist and eventually to Scientist. Over the years, Dr. Anagnostakis worked on a variety of problems, but concentrated on the genetics of fungi, particularly those that cause corn smut, Dutch elm disease, and Chestnut blight.

Beginning in 1968, Dr. Anagnostakis worked tirelessly toward the goal of restoring chestnut trees to a prominent place in the Connecticut forest. In 1972, she imported hypovirulent strains of the Chestnut blight fungus from France and began to use these for studies on biological control of Chestnut blight. Her numerous studies on the basic biology of both the virulent and hypovirulent strains of the fungus earned her international recognition. Sandy's work to introduce resistance into both orchard and timber chestnut trees through breeding is yet another side of her multi-faceted program. Throughout her tenure, she maintained the Station's collection of species and hybrids of chestnut, which is recognized as one of the largest and finest collections in the world. Due in large part to Sandy's efforts, hypovirulence is beginning to slowly become established in the forest. Her competence, her contagious enthusiasm, and her engaging personality brought Sandy numerous accolades from many who shared her dream of restoring the chestnut.

For 48 years, Dr. Anagnostakis energetically and ably served the international scientific community as well as the citizens of the State of Connecticut—through her dedication and commitment to science and tirelessly fulfilling the Connecticut Agricultural Experiment Station's motto of "Putting Science to Work for Society." We honor Dr. Anagnostakis and her contributions on the occasion of her retirement.

Dr. Neil A. McHale

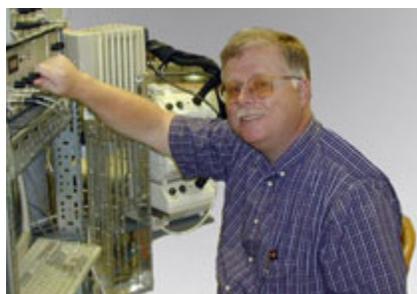


Dr. Neil McHale joined the staff of The Connecticut Agricultural Experiment Station in 1983 as an Assistant Geneticist in the Department of Biochemistry & Genetics. In recognition of his scientific contributions, he quickly rose through the ranks to Associate Geneticist and in 1994 became a Full Scientist and Head of the Department of Biochemistry & Genetics. Over the years, Dr. McHale's took a genetic approach to elucidating processes in photosynthesis and in plant development.

Dr. McHale asked a simple question about a complex problem – which genes in plants are necessary to develop a leaf – nature's ultimate solar panel. During his career, Dr. McHale deftly combined traditional and modern technologies including, chimeric plant generation, advanced histological and microscopic analysis, genetic screens and modern transgenic and molecular techniques. His research discovered a new gene, *Lam-1*, that controls how leaves expand in a lateral direction. *Lam-1* is one of the master regulatory genes that controls plant development. Through his efforts he also discerned how *lam-1* works and interacts with other master regulatory genes in laying down the foundation for leaf development. Although his work centered on the species *Nicotiana glauca*, the impact of his findings was widely applicable to all higher plants, since they share the same genes for leaf development. This basic research opened the door for future engineering of plant shape and development.

For 32 years, Dr. Neil McHale energetically and ably served the international scientific community through his publications in seminal scientific journals including *Proceedings of the National Academy of Sciences*, *Plant Cell and Development*. In particular, his work reflected the long legacy of plant genetics at the Experiment Station in pursuit of basic and applied science. Dr. McHale's work was a prime example of the Connecticut Agricultural Experiment Station's motto of "Putting Science to Work for Society." We honor Dr. McHale and his contributions on the occasion of his retirement.

Dr. Richard B. Peterson



Dr. Richard Peterson joined the Experiment Station staff in 1979 as an Assistant Biochemist in the Department of Biochemistry & Genetics, and devoted his entire career of 35 years to studies on the molecular foundations of photosynthesis. His insights and landmark publications earned him a rapid promotion to Associate Biochemist in 1982, then in 1992 he was promoted to Biochemist.

It was the hallmark of Dr. Peterson's career that he kept his eye on the key developments in a rapidly moving field, and made adjustments necessary to stay at the cutting edge. His journey began in the world of plant biochemistry, focusing on the underlying mechanisms that regulate photosynthetic efficiency. Eventually his work moved into the world of biophysics, seeking here to understand how plant leaves avoid the damaging effects of sunlight, while still capturing the energy that drives photosynthesis. Finally his attention turned to the C4 pathway for photosynthesis, a remarkable adaptation allowing grasses to maintain high levels of photosynthesis in semi-arid environments. What these areas of work had in common was their enormous potential to improve the primary productivity of agricultural plants. As powerful new tools became available to attack each of these subjects, Dr. Peterson was eager to exploit them, ever ready to realign the program, always wanting to be there when the big breakthrough arrived.

He could easily have remained encapsulated in a technical world understood only by his colleagues, but every Plant Science Day he could be found regaling groups of citizens eager to hear about the latest breakthroughs in modern plant biology. So it is with some sadness but a much larger measure of gratitude that we acknowledge Dr. Peterson's tireless devotion to the Experiment Station and his advancement of plant science as we honor him on the occasion of his retirement.

Ms. Roberta Milano-Ottenbreit



Ms. Roberta Milano-Ottenbreit joined the staff of the Connecticut Agricultural Experiment Station in 1989 as Executive Secretary to the Director. During the course of her 25 years she loyally served three different Directors with high levels of professionalism and dedication to the Experiment Station. A superb secretary, she prepared and maintained agency documents, filed notices with the Secretary of State's office, typed countless letters, manuscripts and reports including the Experiment Station's annual "Record of the Year". She competently organized arrangements for the Station's annual "Spring Open House" and "Plant Science Day" events at Lockwood Farm and reserved Jones Auditorium and other conference rooms for civic group meetings. Each year, she spearheaded the Station's United Way Campaign. Ever conscientious and

dependable, she quickly adapted to changes in computer technology 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. Ottenbreit was polite and courteous with co-workers and state residents who called upon the Station for assistance or information. She exhibited endless patience and understanding to diplomatically solve problems and ensure harmony in the workplace. Her work ethic, competence, cheerful outlook, and way of keeping operations moving smoothly were special qualities that will surely be missed. A true ambassador for the Experiment Station and the State of Connecticut, we honor Ms. Roberta Milano-Ottenbreit and her contributions on the occasion of her retirement.



PLANT SCIENCE DAY

2014

The weather on Plant Science Day 2014 was beautiful, warm, and clear. A total of 1,130 guests visited Lockwood Farm, making it one of the best attended Open Houses at the Farm that we have ever had. Governor Dannel P. Malloy was a special guest. He took a tour of many of the exhibits and research plots, and was impressed with the diverse programs, ongoing research, and present and past accomplishments coming out of the research done at the Station by our staff.

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. Jeffrey S. Ward	Managing the Roadside Forest: Balancing Aesthetics and Utility Reliability
Dr. Wade H. Elmer	Nanoparticles in Agriculture
Dr. Kimberly A. Stoner	Honey Bees and Bumble Bees – Their Problems, and What You Can Do To Help

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

DEMONSTRATION TENT:

Dr. Abigail A. Maynard	Compost: How to Make and Use in Your Garden
Dr. Todd L. Mervosh	Common Garden Weeds

Attendees took advantage of several tours around the farm:

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

Stops on the tour:

Dr. Alia Servin	Engineered Nanoparticles, Biochar, Plants and Earthworms
Dr. Claire Rutledge	Biological Control of the Emerald Ash Borer in Connecticut
Dr. James A. LaMondia	Management of Boxwood Blight, A New Disease of the Buxaceae in Connecticut and the United States

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

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

BIRD AND BUTTERFLY GARDEN:

BUTTERFLY IDENTIFICATION WALK – Jeffrey Fengler, Guide

Participants were guided around the garden where **Jeffrey Fengler** helped identify the different species of butterflies attracted there.

BUS TOURS – Dr. Neil A. McHale and Dr. Richard B. Peterson, 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.

Food Safety Surveillance and Research. Investigators: **Dr. Brian D. Eitzer, Dr. Walter J. Krol, Dr. Christina S. Robb, Dr. Roberto de la Torre Roche, Dr. Alia Servin and Dr. Jason C. White** - Assisted by **Terri Arsenaault, Craig L. Musante, John F. Ranciato, Kitty P. Riveros, Joseph R. Hawthorne, and Michael J. Cavadini**

Maternal Lineages of Honey Bees in Connecticut. Investigator: **Dr. Douglas W. Dingman.** Assisted by **Regan Huntley and Bryan Lehner**

2013 Emergence of Periodical Cicadas. Investigator: **Dr. Chris T. Maier.** Assisted by **Morgan F. Lowry and Tracy A. Zarrillo**

Oral Bio-accessibility of Polycyclic Aromatic Hydrocarbons (PAHs) in Fuel Soot Assessed By a Simulated Gastrointestinal Digestion Model. Investigator: **Dr. Joseph J. Pignatello.** Assisted by **Dr. Banyan Zhang**

The New Crops Program – Creating Opportunities for Connecticut’s Farmers. Investigators: **Dr. Abigail A. Maynard and Dr. David E. Hill**

Environmental Impact on Winegrape Production in CT. Investigator: **Dr. Francis J. Ferrandino.** Assisted by **Joan L. Bravo**

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, Rose Hiskes, Dr. Gale E. Ridge, Robert Durgy, and Diane Riddle**

Visitors were able to visit the following 90 Field Plots:

CHINESE CHESTNUT TREES	Dr. Sandra L. Anagnostakis, assisted by Pamela Sletten
SHEET COMPOSTING WITH OAK AND MAPLE LEAVES	Dr. Abigail A. Maynard and Dr. David E. Hill
POLLINATION OF SUMMER SQUASH	Dr. Kimberly A. Stoner, assisted by Tracy Zarrillo, Morgan Lowry, Amelia Tatarian, Benjamin Gluck and Alana Russell
SWEET POTATO TRIALS	Dr. Abigail A. Maynard and Dr. David E. Hill

SWEET CORN TRIALS	Dr. Abigail A. Maynard and Dr. David E. Hill
USE OF EARTHWORMS AND BIOCHAR TO SUPPRESS FUSARIUM CROWN ROT OF ASPARAGUS	Dr. Wade H. Elmer, assisted by Peter Thiel
COMMERCIAL CHESTNUT CULTIVARS	Dr. Sandra L. Anagnostakis, assisted by Pamela Sletten
PROTECT OUR TREES AND AGRICULTURAL RESOURCES: FOREST HEALTH AND THE COOPERATIVE AGRICULTURAL PEST SURVEY	Katherine Dugas, assisted by Nicole Gableman
REMOTE ACCESS WEATHER STATION	Dr. Francis J. Ferrandino, assisted by Joan Bravo
TABLE GRAPE DEMONSTRATION PLOT	Dr. Francis J. Ferrandino, assisted by Joan Bravo
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 COPPER, MANGANESE, OR ZINC TO SUPPRESS SOIL-BORNE DISEASES OF EGGPLANTS	Dr. Wade H. Elmer, Dr. Alia Servin, and Dr. Jason C. White, assisted by Peter Thiel
COMMERCIAL CHESTNUT SEEDLINGS	Dr. Sandra L. Anagnostakis, assisted by Pamela Sletten
TECHNICAL DEMONSTRATION TENT	
COMPARISON OF GRAFT UNION HEIGHT ON CHARDONNAY GRAPEVINES	Dr. Francis J. Ferrandino, assisted by Joan Bravo
QUESTION AND ANSWER TENT	Dr. Yonghao Li, Rose Hiskes, Dr. Gale E. Ridge, Robert Durgy, and Diane Riddle
ENVIRONMENTALLY-FRIENDLY CONTROL OF POWDERY MILDEW ON LANDSCAPE PLANTS	Dr. Francis J. Ferrandino, assisted by Joan Bravo
POWDERY MILDEW ON CHARDONNAY WINE GRAPES	Dr. Francis J. Ferrandino, assisted by Joan Bravo
FIG PRODUCTION IN SELF-WATERING PLANTERS IN CONNECTICUT	Dr. Charles R. Vossbrinck, assisted by Richard Cecarelli

GROWTH AND CONTROL OF NON-NATIVE BAMBOOS (<i>PHYLLOSTACHYS</i> SPP.)	Dr. Jeffrey S. Ward, assisted by Joseph P. Barsky
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
BIOLOGICAL CONTROL OF THE EMERALD ASH BORER IN CONNECTICUT	Dr. Claire E. Rutledge, assisted by Mioara Scott
SELF-GUIDED ACTIVITY FOR ALL CHILDREN, INCLUDING GIRL SCOUTS	Terri Arsenault
KIDS' KORNER	Roberta Milano-Ottenbreit, assisted by Kathryn Soleski, Lisa Kaczenski, and Tracy Zarrillo
CAN OAK TREES GIVE YOU LYME DISEASE?	Dr. Scott C. Williams, assisted by Michael Short and Megan Floyd
COMPOSTING LEAVES USING THE STATIC PILE METHOD	Dr. Abigail A. Maynard and Dr. David E. Hill
VERIZON TELEPHONE TRANSMISSION SILO	
FARMERS' COW	Kathy Smith of Farmers' Cow
NANOMATERIALS IN AGRICULTURE: POTENTIAL TRANSFER OF NANO-PARTICLES FROM ONE LEVEL OF THE FOOD CHAIN TO ANOTHER	Dr. Roberto De la Torre-Roche, assisted by Joseph Hawthorne, Dr. Alia Servin, Craig Musante, Katherine Alfieri, and Dr. Jason C. White
HANDS-ON CHEMISTRY	Dr. Christina S. Robb, assisted by Kitty Prapayotin-Riveros, Dr. Walter J. Krol, Terri Arsenault, Michael Cavadini, and Dr. Jason C. White
ENGINEERED NANOPARTICLES, BIOCHAR, PLANTS, AND EARTHWORMS	Dr. Alia Servin, assisted by Dr. Roberto De la Torre Roche, Joseph Hawthorne, Craig Musante, Katherine Alfieri, and Dr. Jason C. White
INVASIVE AQUATIC PLANT PROGRAM	Gregory Bugbee, assisted by Sara Benson, Jesse Schock, and Samantha Wysocki
ENVIRONMENTALLY-FRIENDLY CONTROL OF POWDERY MILDEW ON VEGETABLE PLANTS	Dr. Francis J. Ferrandino, assisted by Joan Bravo

ADVANCES IN TRAPPING SPOTTED WING DROSOPHILA	Dr. Richard S. Cowles, assisted by Steven Alm, Gabrielle D'Amico, Olivia Barsoian, Heather Faubert, Emily Hampton, Carissa Koski, and Elizabeth Young
USING LEAF COMPOST IN HOME GARDENS	Dr. Abigail A. Maynard and Dr. David E. Hill
MANAGEMENT OF BOXWOOD BLIGHT, A NEW DISEASE OF THE BUXACEAE IN CONNECTICUT AND THE UNITED STATES	Dr. James A. LaMondia, assisted by Michelle Salvas and Nathaniel Child
INTEGRATING FOREST AND ROADSIDE MANAGEMENT OBJECTIVES TO CREATE STORM RESILIENT FORESTS	Dr. Jeffrey S. Ward, assisted by Joseph P. Barsky
THE PUBLIC HEALTH AND ENTOMOLOGY TENT:	
THE "DEER" TICK <i>IXODES SCAPULARIS</i>	Dr. Kirby C. Stafford and Dr. Laura E. Hayes, assisted by Heidi Stuber
INTEGRATED TICK MANAGEMENT	Dr. Kirby C. Stafford, Dr. Scott C. Williams, Dr. Goudarz Molaei, Dr. Laura Hayes, assisted by Heidi R. Stuber, Megan Floyd, Stephanie Shea, and Heather Whiles
LYME DISEASE IN TICKS FROM CONNECTICUT CITIZENS	Dr. John F. Anderson, assisted by Elizabeth Alves and Nathan Kloczko
MOSQUITO SURVEILLANCE FOR WEST NILE AND EASTERN EQUINE ENCEPHALITIS VIRUSES	Dr. Philip M. Armstrong and Dr. Theodore G. Andreadis, assisted by John J. Shepard, Michael Thomas, and Michael Misencik
FIDDLEHEAD TRIALS	Dr. Abigail A. Maynard and Dr. David E. Hill
NATIVE WOODY SHRUBS	Dr. Jeffrey S. Ward, assisted by Joseph P. Barsky
BIRD AND BUTTERFLY GARDEN	Jane Canepa-Morrison and Jeffrey Fengler
FOOD BANK	Audrey Campos of CT Food Bank
DATING HERBACEOUS ROOTS	Dr. Jeffrey S. Ward
BIOLOGICAL CONTROL OF HEMLOCK WOOLLY ADELGID AND MILE-A-MINUTE WEED IN CONNECTICUT	Dr. Carole A. Cheah, assisted by Liz Young
SPECIALTY PEPPER TRIALS	Dr. Abigail A. Maynard and Dr. David E. Hill
KABOCHA SQUASH TRIALS	Dr. Abigail A. Maynard and Dr. David E. Hill

SPECIALTY MELON TRIALS	Dr. Abigail A. Maynard and Dr. David E. Hill
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 L. Smith, assisted by Tia Blevins, Mark Creighton, Jeffrey Fengler, Stephen Sandrey, and Peter Trenchard
LYMAN HALL HIGH SCHOOL AGRICULTURAL SCIENCE AND TECHNOLOGY PROGRAM	Emily Picard of Lyman Hall High School
THE CONNECTICUT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION: DIVISION OF FORESTRY	Chris Donnelly of DEEP
CONNECTICUT DEPARTMENT OF LABOR/ CONN-OSHA	Catherine Zinsser of Conn/OSHA
CONNECTICUT NORTHEAST ORGANIC FARMING ASSOCIATION	Deb Legge of CT NOFA
USDA NATIONAL AGRICULTURAL STATISTICS SERVICE, NEW ENGLAND	Gary Keough of USDA
UConn EXTENSION MASTER GARDENER PROGRAM	Jude Hsiang of UConn Extension
THE CONNECTICUT BOTANICAL SOCIETY	Truda Steinnagel of CT Botanical Society
CONNECTICUT DEPARTMENT OF AGRICULTURE	Ronald Olsen of CT Department of Agriculture
US DEPARTMENT OF LABOR/OSHA	Leona May of US Department of Labor/OSHA
THE CONNECTICUT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION: WILDLIFE DIVISION	Laura Rogers-Castro of DEEP, Wildlife Division
CONNECTICUT PROFESSIONAL TIMBER PRODUCERS ASSOCIATION	Joan Nichols of the Timber Producers Association
CONNECTICUT ENVIRONMENTAL COUNCIL	Erica Fearn of the CT Environmental Council
USDA, ANIMAL AND PLANT HEALTH INSPECTION SERVICE, PLANT PROTECTION AND QUARANTINE	Kate Aitkenhead of USDA
CONNECTICUT INVASIVE PLANT WORKING GROUP	Donna Ellis and Logan Senack of the CT Invasive Plant Working Group

FEDERATED GARDEN CLUBS OF CT	Leslie Martino of Federated Garden Clubs of CT
THE SLEEPING GIANT PARK ASSOCIATION	Chuck Schall of Sleeping Giant Park
CONNECTICUT TREE PROTECTIVE ASSOCIATION	Rita Smith of CTPA
buyCTgrown	Ashley Kremser of buyCTgrown
USDA, FARM SERVICE AGENCY	Debbie Castle and Ann Marie McCard of USDA
USDA, NATURAL RESOURCES CONSERVATION SERVICE	Lisa Krall of USDA
CONNECTICUT GREENHOUSE GROWERS ASSOCIATION	Susan Pronovost of CT Greenhouse Growers Association
COMMON INDOOR MOLDS	Dr. De-Wei Li
SUDDEN VEGETATION DIEBACK OF CONNECTICUT SALT MARSHES	Dr. Wade H. Elmer and Dr. Magali Bazzano, assisted by Peter Thiel
MAIZE GENETICS – INVESTIGATING WHY CORN IS SO MORE EFFICIENT AT PHOTOSYNTHESIS	Dr. Richard Peterson and Dr. Neil Schultes
FOOD BANK	
HOPS TRIALS	Dr. Abigail A. Maynard and Dr. David E. Hill
THE SOUND SCHOOL AGRICULTURE SCIENCE PROGRAM	Chas Mavrelion and Students of the Sound School
POLLINATION OF PUMPKINS AND WINTER SQUASH	Dr. Kimberly A. Stoner, assisted by Tracy Zarrillo, Morgan Lowry, Amelia Tatarian, Benjamin Gluck and Alana Russell
HYBRID AND VINIFERA WINEGRAPE CULTIVAR TRIAL	Dr. Francis J. Ferrandino, assisted by Joan Bravo
THE ROCK	
PINOT GRIS CULTURAL TRIALS	Dr. Francis J. Ferrandino, assisted by Joan Bravo
ROCKY HILL AMERICAN CHESTNUT TREES	Dr. Sandra L. Anagnostakis, assisted by Pamela Sletten
ASIAN CHESTNUT GALL WASP ON CHESTNUT	Dr. Sandra L. Anagnostakis, assisted by Pamela Sletten

BEACH PLUM TRIALS	Dr. Abigail A. Maynard and Dr. David E. Hill
PAWPAW TRIALS	Dr. Abigail A. Maynard and Dr. David E. Hill
JAPANESE PLUM VARIETY TRIALS	Dr. Abigail A. Maynard and Dr. David E. Hill
HYBRID ELM TREES	Dr. Sandra L. Anagnostakis, assisted by Pamela Sletten
EXPERIMENT STATION ASSOCIATES	Will Rowlands, President of Experiment Station Associates

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, Brian Hart, Ronald A. LaFrazier, 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, Peter W. Trenchard, and Roberta M.-Ottenbreit, who also helped the Maintenance crew. 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 10:45AM Director Theodore G. Andreadis introduced Dr. Mike Hoffmann, Director, Cornell University Agricultural Experiment Station and Associate Dean, College of Agriculture and Life Sciences and Professor of Entomology at Cornell University, Ithaca, NY as the Samuel W. Johnson Memorial Lecturer. He gave a talk on Climate Change and Agriculture: No Longer Business as Usual.

Following Dr. Hoffmann’s talk, Dr. Andreadis and Governor Dannel P. Malloy presented the Century Farm Award to Holdridge Farm Nursery of Ledyard, Connecticut.

Holdridge Farm Nursery, located in Ledyard, was started in 1912 by Judge Samuel Holdridge as a vegetable farm and as a mail order nursery for strawberry plants. His son, Paul Holdridge, Sr., added bare-root fruit trees and eventually a full line of nursery stock. A small store was built at the home farm at Geer Hill in 1941. Paul Holdridge Jr. and Alden Holdridge, the third generation on the farm, each added their own initiatives. Paul Jr. expanded the retail sector and added hard goods. Alden took over management of the growing operations and shifted from field-grown to container-grown nursery production. Currently, Holdridge Farm Nursery is the largest garden center and wholesale nursery in Southeastern Connecticut. It is run by Shari Hewes, daughter of Paul Jr. and fourth-generation of the Holdridge family on the farm. Holdridge Farm Nursery grows vegetable plants, annuals, perennials, nursery stock and contract nursery stock on 60 acres of which 16 acres are under irrigation for container production, and nearly 2 acres of greenhouses. The retail center in Ledyard Center is a landmark known for locally grown quality nursery stock and plants.

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.

At 11:50AM the Honorable Governor Dannel P. Malloy, who is also the President of the Station’s Board of Control, spoke to the crowd.

Plant Science Day 2014 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

JENKINS-WAGGONER LABORATORY RIBBON-CUTTING CEREMONY



State of Connecticut
The Honorable Dannel P. Malloy
Governor

and

The Connecticut Agricultural Experiment Station
Dr. Theodore G. Andreadis, Director

Welcome you to the

Jenkins-Waggoner Laboratory
Ribbon-Cutting Ceremony

Thursday, June 11, 2015 at 11:00 a.m.



To put science to work for society, The Connecticut Agricultural General Assembly chartered The Station to investigate plants and their pests, insects, soil, and water. Inspired by Samuel W. Johnson, professor of agricultural chemistry at Yale University, and established in 1875, The Connecticut Agricultural Experiment Station is the first in America and remains a separate state agency. Initially located at Wesleyan University and later at Yale, The Station moved to this site in 1882. The first building erected now houses the Osborne Library, named for the Station Scientist who discovered the first vitamin, A. The Jones Auditorium commemorates The Station scientist who invented hybrid corn. Under the direction of its Board of Control, Station scientists today investigate insects and diseases that damage trees and crops; analyze for food safety, water quality, and soil properties; study the genetics and biochemistry of plants; and experiment with new crops and changing forests. They also investigate mosquitoes and ticks that spread disease organisms that cause encephalitis and Lyme disease in humans.

JENKINS-WAGGONER LABORATORY

Project: Renovation and Addition to the Jenkins-Waggoner Laboratory

Project Number: BI-P-86

Location: 123 Huntington Street, New Haven

Total Budget: \$13.8 million

Architect: FLAD Architects

Engineer: BVH Integrated Services

Contractor: A. Secondino & Son, Inc.

Construction Administrator: A-Z Corporation

DAS Project Managers: Michael Rice and Raymond Overton

Size: 27,000 square feet

Floors: 3 floors

Project Scope: The renovation of the existing 16,000 square foot laboratory building constructed in 1932 and an 11,000 square foot addition to provide diagnostic laboratory services to Connecticut residents and businesses. The project provides Scientists with state-of-art laboratory facilities and the Jenkins-Waggoner Laboratory is ADA compliant and will be LEED certified as an energy efficient and high performance building.

Completion Date: December 31, 2014

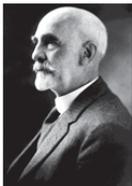


Dr. Paul E. Waggoner
Station Scientist
1951-1972



Director
1972-1987

Director
Emeritus
1987-present



Dr. Edward H. Jenkins
Chemist to The Station
1876 - 1900
Director
1900 - 1923
Director Emeritus
1923 - 1931



Jenkins Laboratory was constructed in 1932
The architect was Douglas Orr



Rendering of Jenkins-Waggoner Laboratory

JENKINS-WAGGONER LABORATORY RIBBON-CUTTING CEREMONY

Thursday, June 11, 2015

Program

Welcome

Dr. Theodore G. Andreadis, Director
The Connecticut Agricultural Experiment Station

Remarks

The Honorable Dannel P. Malloy
Governor

Mr. Terry Jones, Vice-President
Board of Control

The Connecticut Agricultural Experiment Station

Mr. Pasquale J. Salemi, Deputy Commissioner
Department of Administrative Services
Division of Construction Services

Dr. Paul E. Waggoner, Director Emeritus
The Connecticut Agricultural Experiment Station

CLOSING

Dr. Theodore G. Andreadis, Director

Reception

Laboratory Tours

Remarks from Station Director, Dr. Theodore Andreadis



On behalf of the Board of Control, it is an honor and privilege for me to welcome you here today on this special occasion as we gather to dedicate and celebrate the opening of the newly renovated and constructed addition to the Jenkins-Waggoner Laboratory.

This historic building which was originally constructed back in 1932 has served us well over the course of the last 80 years and many scientific advances have been made within these walls. However, the interior of the building had exceeded its useful life and we were dearly in need of more space.

The renovation and new addition now provide us with state-of-the art laboratories and additional space creating an ideal venue for our staff to address the many challenges that lie before us and allow us to utilize the latest advances in biotechnology, genomics and molecular biology as we address the important issues of the day that impact agriculture, public health and the environment and help us to more effectively serve the citizens of the State.

I am delighted that the Governor Malloy could be with us today, but before I introduce the Governor, I would like to acknowledge some of the special guests who have joined us here this morning:

Dr. Paul Waggoner, former Director of the Experiment Station and the man we honor here today, who for 64 years has served the Station, 25 years as Director. He has traveled over 2,000 miles from Seattle, WA to be with us today. He is accompanied by his two sons Von and Dan, brother Wayne, granddaughter Katherine, and Great Granddaughter Elizabeth. Also in attendance is Mr. Bud Salemi, Deputy Commissioner, Department of Administrative Services, Division of Construction Services; three members of the Station's Board of Control, Mr. Terry Jones, who serves as Vice-President, Mr. Steven Reviczky, Commissioner of Agriculture, and Ms. Joan Nichols; Dr. John Anderson, Former Director and Distinguished Scientist, CAES and his wife Marylyn and Ms. Susan Wahlen, Deputy Commissioner, DEEP

I would like to give you a bit of history about this building. The original building was constructed back in 1932 as a WPA project during the early years of the Great Depression at a cost of a mere \$50,000, half of which was appropriated by the General assembly and the other half from Experiment Station Board funds. Remarkably, it was completed in only one year. The architect was Douglas Orr, who was born in Meriden, CT, attended Yale University and designed many public buildings in the New Haven area and elsewhere including the Eli (former Southern New England Telephone), One Church Street (former New Haven National Bank), and the Robert A. Taft Memorial in Washington DC. At that time the Experiment Station was expanding and excerpts from former director William Slate in the Annual Report of CAES noted that "for the past 10 years the staff had been living under crowded conditions that made scientific work extremely difficult and at times ineffective". At that time the Jenkins Laboratory was devoted to research in four biological sciences, botany, entomology, plant breeding and forestry. It was named for Dr. Edward H. Jenkins, the Station's 3rd Director who was for 55 years a member of the Station Staff and for 23 years Director.

While this building served us well for over 80 years, I think it is fair to say that serious consideration of the need for renovating this historic building and creating additional laboratory space began some 10-15 years ago when it became increasing more difficult to maintain the standard of excellence in our scientific work that we had been accustomed to and to employ the latest technologies in molecular biology that would allow us to stay on the cutting edge of science and address the key issues of the day that impact agriculture, public health and the environment and effectively serve the citizens of the State. I am not exaggerating when I say that, the roof was leaking, mold was growing in the ground floor, the interior walls of building were virtually crumbling, the mechanical systems (heating, cooling, and electricity) were antiquated and in poor working conditions, we were not ADA compliant, and more space was sorely needed.

While it was clear to many of us who worked in the building that something had to be done, it was the vision and sheer determination of my predecessor, the late Dr. Louis Magnarelli that was the driving force behind this project, and without his efforts it would never have come to fruition. It is of course most unfortunate that Lou did not have the opportunity see the completion of this wonderful building where he began his career working with mosquitoes, ticks and vector-borne diseases, but I am delighted that his wife, Dr. Sharon Magnarelli is able to be with us this morning and share in the celebration. In honor and recognition of Lou's contributions to the Station over his 37 year career as a scientist and Director, we have erected a patio at the east entrance to the building which is beautifully decorated and I invite you all to visit.

Now, while we are here to celebrate the opening of the laboratory, it is of equal significance that we are here to pay homage to the man whose name it bears. Dr. Paul Edward Waggoner. Dr. Waggoner began his career at the Experiment Station on July 1st, 1951. He arrived in New Haven traveling from Ames Iowa, with his wife Barb and young son Von, who accompanied him here today in an old Plymouth hauling a homemade trailer that he purchased for \$50, loaded with a table, chairs and a refrigerator. Finding housing was scarce they took refuge in Bragheri's cabin camp in North Haven for about a month and then took up residence in the Yalesville section of Wallingford and eventually settled in Guilford where their second son Dan was born.

Dr. Waggoner was brought to the Station by then director James Horsfall to study the effects of radiation on plant disease and his job was financed by the Atomic Energy Commission. According to his own admission, this position provided him with a deferment from the Korean War. Paul had previously served in the Army Air Corps during the 2nd world War as a meteorologist. He was assigned to the Department of Botany and Plant Pathology and began his career in this very building which now bears his name. He worked alongside Chief Pathologist, Albert Diamond with whom he experimented with tomatoes and wilt disease caused by *Fusarium* and explored the effect of radiation on disease susceptibility in potatoes. I should note that Paul's first published paper was in 1949 and was entitled: "The influence of weekly cumulative rainfall and temperature on potato late blight epiphytotics in Iowa", and was published in *Plant Disease Reports*.

However, according to Horsfall, Paul was much more interested in climatology than plant pathology and in 1956 the Department of Soils and Climatology was established and Paul was made the Department Head. During the years that ensued Paul made many significant contributions including:

- He initiated watershed research on the physics and meteorology of aerial dispersal of fungus spores using the blue mold fungus of tobacco (1956).
- He initiated studies in forestry and hosted a conference on suburban forest ecology, which remains an important subject area that we continue to focus our research efforts today (1962).
- In a publication entitled *Plants, Shade and Shelter*, Waggoner showed how trees, thickets parking lots and beaches affected human behavior (1963)
- He was a guest of President Lynden B. Johnson at a White House conference on Natural Beauty and in 1966 he received an award for "Outstanding Achievement in Bioclimatology".
- In experiments in forests he showed that modifying leaf stomata (these are the tiny openings in the epidermis of a plant, through which gases and water vapor pass and permit the absorption of carbon dioxide necessary for photosynthesis from the air, as well as the removal of excess oxygen) openings could alter the hydraulic cycle and conserve soil water (1964-1979).
- Based on this work he then proceeded to make a computer simulation of the microclimate in a forest and demonstrated the impact of leaf area upon the temperature and evaporation in the canopy (1968).
- Perhaps his defining scientific achievement was his composition of the first computer simulation program modeling the epidemic of plant disease EPIDEM (1969).
- He rose quickly through the ranks and was appointed Vice Director in 1968.
- Four years later in 1972 became the 6th Director of the Experiment Station serving under three Governors until his formal retirement in 1987.

- Under his tenure as Director, many significant advances were made in this very building including the use of hypo virulence techniques for biological control of chestnut blight, the development of computer models to calculate long-distance aerial transport of plant disease spores, the first isolations of Lyme disease agents from wildlife and the first antibody tests for laboratory diagnosis of Lyme disease, and work on biological control of the gypsy moth that led to the discovery of the fungal pathogen, *Entomophaga maimaiga* that resulted in its demise and continues to this day to keep this exotic pest in check, and I think it is fair to say, the Station flourished.
- And finally, in recognition of his accomplishments he was elected to the National Academy of Sciences in 1978, one of the highest honors an American Scientist can aspire to.
- And on a final note, I was informed just this morning in an e-mail from Dr. Jesse Ausubelo, Director, Program for the Human Environment at The Rockefeller University who wanted me to know that within the next few days they would be submitting to a peer-reviewed journal a new paper, “*Converging Evidence of Global Greening*,” of which Paul Waggoner is a co-author.

So Dr. Wagner, in recognition of your accomplishments, 64 years of service to the Station, and guidance of this venerable institution we salute you and commemorate this building in your name.



Remarks from Dr. Paul Waggoner



Your Excellency, Governor Malloy, when I arrived in 1951, John Davis Lodge was governor, and like you, he was elected as its president by The Station Board of Control. I can, therefore, address you as Mr. President. And I can thank that line of Boards and presidents for appointing me, 64 years ago, as an Assistant Scientist, and now for putting my name on the Jenkins-Waggoner Lab.

My thanks also encompass my late wife Barbara, and my two sons, who are here with a granddaughter and great granddaughter. Also I thank colleagues in science and greet personal friends who are here.

From the Station, I extend its gratitude to the army of citizens who bring nibbled, wilted and rusted crops and ornamental trees to our labs, as well as red spots and welts raised on their arms and legs by ticks and mosquitoes and bedbugs. Collections by this volunteer army of scouts often start and inspire our useful discoveries of invasive insects, weeds, spores and insect-borne pathogens.

And so I end by thanking you again for this great honor, and by extending my best wishes to the future collaborative effort of the army of citizens and those who work in The Station, and wish them both well on the many discoveries that lie ahead.

Waggoner's Highlights at the Station (In his own words)

On July 1, 1951 I began work in the laboratory at the point where the Board of Control has now attached the Jenkins Lab to the Waggoner Lab, a nice coincidence. Six years after Hiroshima, I came to work on a radiation project with the chief plant pathologist, asking whether after an atomic bomb, plants would die of radiation sickness. I began badly by disabling the brakes on a Station auto on a steep hill at Lockwood Farm when burying a radioactive waste for its short half-life. That's a poor beginning on a path to become director in 21 years.

After 8 years I was, nevertheless, asked to lead a department of Soils and Climatology. During the next 13 years, superb young scientists joined me. Personally, I combined my experience in climatology with plant pathology. A wet climate encourages mildews to attack plants. A famous example is the Irish blight of potatoes (that probably encouraged Governor Malloy's ancestors to come to America.) Earlier I had devised a tedious and fallible forecast for blight from historical records of weather and blight. In 1969 with the collaboration of James Horsfall, I composed EPIDEM, the first simulator of plant disease written for a computer. Combining computers and experiments on the life stages of a pathogen, EPIDEM showed how to take advantage of experiments about the life stages of the pathogen and remove the tedium from disease forecasting. Horsfall joked that he had done the collaborating and I the labor in our collaboration.

During the same years, I combined my experience as a weather forecaster in the Army Air Corps with knowledge of the physics of plants to show that the microscopic pores in leaves could control the hydrologic cycle that dried out fields, forests and ultimately reservoirs. Doctrine at the time said that the perimeter, not the open width of the pores, controlled drying. In the lab with a colleague, we proved this doctrine was wrong. And with others, first in barley in England and then in pine in a State forest in Voluntown, we proved it was wrong outdoors, universally. The tiny, invisible pores in leaves do control the hydrologic cycle. The discoveries about leaf pores and disease forecasting won me election to the National Academy of Sciences.

In the 1970s, I understudied the director, beginning at the dawn of the environmental era with leading Governor Dempsey's Committee on the Environment. From that committee grew a Task Force to Preserve Agricultural Land, which begat the CT law for the preservation of prime farm land, which the CT Department of Agriculture has moved forward to preserve thousands of acres of prime land. During my 15 years as director, the country survived riots, shootings and bombs, even in New Haven and at Yale, next door to The Station. The Station gained from the General Assembly a State charter to perform research on plants and their pests—especially insects—soil and water. Also for chemical analysis.

The greatest change during my direction was not sudden change but instead evolution. In my beginning in 1972, the CT's oak-rich forests were stripped of leaves by voracious gypsy moths, even more thoroughly than they had periodically been since the beginning of the 20th century. Scouting for the eggs and opposing enthusiasm for widespread spraying of DDT preoccupied the Station and its entomologists. Fortunately, the Station discovered a microbe, likely introduced from Asia a couple generations earlier by Station scientists that stopped the moths without DDT.

Bugs, however, are always with us, and Station entomologists, contributed to the discovery that the new affliction of Lyme disease was spread by spirochetes carried by deer, mice and ticks on their way to our legs. Then Station scientists isolated the newly arrived West Nile virus in CT, the first isolation of this dangerous disease in the entire western hemisphere.

What was my contribution to this evolution? A greater role in analyzing food safety, growing trees toppling onto highways and wires, new plant pests, and weeds growing in CT waters, matching the State's need for useful discovery. Before and after retirement, I might point the direction and then stay out of the way.

Since retirement, a partnership at Rockefeller has allowed me to analyze how scientific discoveries and tastes have kept humanity's needs and income within global capacity, especially for crops, forests and water.



Governor Dannel P. Malloy



Mr. Terry Jones

Connecticut Tree Protective Association's 2015 Arbor Day Celebration

The Connecticut Agricultural Experiment Station (CAES) and the newly renovated Jenkins-Waggoner Laboratory were selected for the CT Tree Protective Association's (CTPA) 2015 Arbor Day Celebration on Friday, April 24, 2015. The event was coordinated by Charlie Iselin, Chair, CTPA Arbor Day Committee, and Dr. Sharon M. Douglas, CAES. CTPA celebrates Arbor Day each year by planting a tree with the assistance of the winners of its Arbor Day Poster Contest. Fifth grade students in every county of Connecticut were asked to submit posters based on the theme *My Favorite Tree in My Town*. Poster winners from each county were invited to the tree planting ceremony at CAES, during which the posters were on display and each winner was recognized for their artwork. Winners also participated in the redbud planting and all winning posters were posted on the CTPA web site (www.ctpa.org). Dr. Theodore Andreadis presented welcoming remarks and following the tree planting ceremony, many attendees enjoyed tours of Jenkins-Waggoner led by Dr. Douglas and Ms. Vickie Bomba-Lewandoski and heard about CAES research programs and services from Dr. Jeff Ward, Dr. Gale Ridge, Ms. Lindsay Patrick, Dr. Lindsay Triplett, Dr. Claire Rutledge, Dr. Doug Dingman, and Mr. John Shepard.



EVENTS HELD AT LOCKWOOD FARM

2014 Connecticut-FFA Forestry Career Development Event

On November 21, 2014, the Department of Forestry & Horticulture marked its 3rd year hosting the 2014 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, and finally a forest pests identification practicum. The students were then allowed to participate in two team events – Timber Stand Improvement and Timber Volume Cruising exercises. The 4-student team from E. O. Smith High School Agricultural Education Program finished in first place and will represent Connecticut in regional and national competition at the 2015 Eastern States Exposition and 2015 National FFA Convention in Louisville, KY. Dr. Scott Williams, Michael Short, J. P. Barsky, and Megan Floyd in the Department of Forestry & Horticulture organized and oversaw the event. Former Station staff members Emily 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, Research Farm Manager, opened up the barns and cottage to allow their use in the event.

EVENTS HELD AT THE VALLEY LABORATORY

Christmas Tree Twilight Meeting

The annual Christmas Tree Twilight Meeting was held at the Valley Laboratory on the evening of July 22, 2014 in cooperation with the Connecticut Christmas Tree Growers Association. Forty growers attended the meeting which featured CAES scientists presenting talks and answering questions at Christmas tree plantings on the farm. Speakers and topics were the following: Dr. Sharon Douglas, “Christmas tree diseases 2013”; Dr. Richard Cowles, “Insect pest management and the fir genetic improvement project”; Dr. Todd Mervosh, “Weed control options in the summer”; and Mr. Thomas Rathier, “Impact of weather extremes on conifers.” Growers having pesticide applicator licenses received 2 hours of re-certification credits for attending this meeting. Jim Preste helped with preparations for the meeting.

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 24, 2015. Dr. Jim LaMondia and Director Ted Andreadis 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. Jim 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 soils, microbial activity and tobacco. Jim LaMondia spoke about common molds in cured tobacco. Bill Leahey spoke about CT tobacco labeling and marketing and incorporation of the Connecticut-Massachusetts Tobacco Growers Association. Colleen Kisselburgh discussed tobacco insurance program changes and Ross Eddy of the Farm Services Administration provided updates on FSA services to growers. Jane Canepa-Morrison, Michelle Salvias, Nathaniel Child and Jim 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 65 persons received credit.

THE STATION IN THE COMMUNITY

Two Bedding Plant Meetings Held

The UCONN-CAES Spring Bedding Plant Meetings co-organized and co-sponsored by Drs. Wade Elmer and Yonghao Li from CAES and Ms. Leanne Pundt from UCONN, were held on February 3 in the UConn campus in Torrington and on February 5 in Vernon. Topics included “Diseases of spring crops” by Dr. Yonghao Li, CAES; “Feeding greenhouse crops and monitoring water quality” by Dr. Rosa Raudales, UConn Extension; “Biological controls” by Leanne Pundt, UConn Extension; and “How to maintain, calibrate and clean your fertilizer and chemigation injector” by Lela Kelly, Vice President, Horticulture Specialist, Dosatron, Clearwater, FL.

New Haven Public Schools Science Fair at Yale University

From May 11-12, 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 two CAES awards. Ms. Saryn Kunajukr, Ms. Lindsay Patrick, and Drs. Douglas Dingman, Sharon Douglas, Robert Marra, and Lindsay Triplett served as judges. Two awards were granted, the first was *The Connecticut Agricultural Experiment Station Award* (\$100) for the “Best project related to food, plants, insects, or the environment.” The CAES team unanimously chose Katie Rae Reynolds and Mara Cicarella from Ms. Evelyn Gallagher’s class at Nathan Hale School for their project titled “One Fish, Two Fish, Hot Fish, Cold Fish.” The second award was the *Albert E. Dimond Award of The Connecticut Agricultural Experiment Station* (\$150) for the “Best project demonstrating an innovative approach to discovery in plant science” (open to grades 6-12). The recipient of this award was Ayanna Blowes from Ms. Jillian Siquiefield’s class at Barnard Environmental Studies Magnet School for her project titled “Hydroponics Vs. Soil.” Dr. Marra presented the CAES awards and certificates to the students at the Awards Ceremony on the evening of May 13, which was held in Yale University’s Sheffield-Sterling-Strathcona Hall.

DONATIONS MADE TO THE COMMUNITY

Lockwood Farm

A total of 11,923 pounds of fresh produce, including cucumbers, eggplants, peppers, pumpkins, summer and winter squash, and tomatoes grown at Lockwood Farm were donated to the Connecticut Food Bank in East Haven, Cub Scouts Pack 472 in North Guilford, Dry Dock in Wallingford, Master’s Manna in Wallingford, and Waverly House in New Haven. Farm Manager Richard Cecarelli arranged for the distribution of the produce.

Valley Laboratory

A total of 11,360 pounds of fresh produce including bok choy/Chinese cabbage, corn, muskmelon, pumpkins, summer and winter squash, tomatoes, and watermelon 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 for their county fair 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.

AWARDS AND RECOGNITION RECEIVED BY STATION STAFF

On October 18, 2014 Mark H. Creighton was presented with the “Beekeeper of the Year” award at the CT Beekeepers Association meeting in Woodbury, CT.

On October 29, 2014 Dr. Claire E. Rutledge received “The Fred Borman Outstanding Urban Forestry Professional Award” at the annual meeting of the Connecticut Urban Forest Council in Plantsville, CT.

On October 29, 2014 Dr. Francis J. Ferrandino was named President of NED-APS, at the Annual Meeting of the Northeastern Division of the American Phytopathological Society held in Portsmouth, NH.

On December 8, 2014 John J. Shepard was elected to a three-year term as Treasurer of the Northeastern Mosquito Control Association.

On January 1, 2015 Dr. Lindsay R. Triplett was appointed as an Associate Editor for the journal *Phytopathology* for the year 2015.

On March 25, 2015 Joseph P. Barsky was selected to serve as Editor of the “News Quarterly” for the New England Society of American Foresters.

On April 22, 2015 Dr. Joseph J. Pignatello accepted the award for Best Paper of the Year from the Quinnipiac Chapter of the Sigma Xi at their annual meeting in Hamden.

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

DEPARTMENT OF ANALYTICAL CHEMISTRY

JASON C. WHITE

- President, International Phytotechnology Society
- Managing Editor, *International Journal of Phytoremediation*
- Editorial Board, *Environmental Pollution*
- 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 Representative, Association of Public Health Laboratories
- Member, CT DEEP Lobster Pesticide Study 2014 Steering Committee
- Member, Sustainable Nanotechnology Organization
- Chair, *Environmental Science and Technology* “Top Papers of the Year” Committee, 2014

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

CHRISTINA S. ROBB

- Board Member, Eastern Analytical Symposium
- Member Associate, Association of Public Health Laboratories (APHL)

DEPARTMENT OF ENTOMOLOGY

KIRBY C. STAFFORD III

- Member, Board, Connecticut Coalition Against Bed Bugs
- Member, U.S. EPA Network for Lyme Disease Prevention
- Member, Tick IPM Working Group

JOHN F. ANDERSON

- Member, Selection Committee, Connecticut Century Farm Award
- Nominating Committee, Connecticut Academy of Science and Engineering

TIA M. BLEVINS

- Treasurer, Horticultural Inspection Society, Eastern Chapter

DOUGLAS W. DINGMAN

- Member, Quinnipiac Chapter of Sigma Xi
- Member, Connecticut Beekeepers Association

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
- Member, Program Committee, Connecticut Pomological Society
- 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, The Connecticut Coalition Against Bed Bugs
- Member, Rapid Response Research Activity Working Group for Bed Bugs (Series 500)
- Member of the EPA FIFRA Scientific Advisory Panel

CLAIRE E. RUTLEDGE

- Director, Connecticut Tree Protective Association

VICTORIA L. SMITH

- Member, Connecticut Pomological Society
- Member and 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
- 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
- Authorized Certifying Official; certificate number 20080160

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

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

- 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

JOSEPH J. PIGNATELLO

- Professor Adjunct of Chemical and Environmental Engineering, Yale University
- Associate Editor, *Journal of Environmental Quality*
- Editorial Board, *Environmental Engineering Science*
- Chair, USDA-NIFA Multistate Research Project W-2082
- Biochar Advisory Committee, International Biochar Initiative

PHILIP M. ARMSTRONG

- 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
- Clinical Professor, Epidemiology of Microbial Disease Division, Yale School of Public Health

GOUDARZ MOLAEI

- Graduate Student External Advisor, Central Connecticut State University

DOUGLAS E. BRACKNEY

- Assistant Adjunct Professor in Section of Infectious Diseases, Yale School of Medicine
- Assistant Adjunct Clinical Professor in Microbial Diseases Division, Yale School of Public Health

GREGORY J. BUGBEE

- Member, PA 12-155 Nonpoint Source Phosphorus Workgroup
- Member, Government Affairs Committee, New England Aquatic Plant Management Society
- Director, Clear Lake Improvement Association

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

CHARLES R. VOSSBRINCK

- Visiting Professor, Department of Microbiology, State Key Lab of Silkworm Genome Biology, Southwest University, Chongqing, China
- Member, Editorial Board, SpringerPlus

DEPARTMENT OF FORESTRY AND HORTICULTURE

JEFFREY S. WARD

- Secretary, Connecticut Tree Protection Examination Board
- Executive Board Member, Connecticut Urban Forest Council
- Chair, New England Society of American Foresters Silviculture Working Group
- Program Chair, New England Society of American Foresters
- Member, Connecticut Invasive Plant Working Group Steering Committee
- Member, Audubon Connecticut Science Committee
- Member, USDA Natural Resources Conservation Service Wildlife Subcommittee
- 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
- Adjunct Professor, Department of Biology and Environmental Science, University of New Haven
- 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
- Graduate Advisor, Master's student Kelsey Schwenk, University of Connecticut, Storrs

DEPARTMENT OF PLANT PATHOLOGY AND ECOLOGY

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

WADE H. ELMER

- Senior Editor, *Phytopathology*
- Associate Editor, *Crop Protection*
- Senior Guest Editor, *Crop Protection*, Management of Fusarium Diseases
- Member, Widely Prevalent Fungi List Committee, American Phytopathological Society
- Member, Connecticut State Consulting Committee for Agricultural Science and Technology
- Member, Northeast Research, Extension and Academic Programs Committee for IPM
- Member, Program Committee, Connecticut Greenhouse Growers Association

FRANCIS J. FERRANDINO

- Member, CT Wine Council
- President, Northeastern Division of the American Phytopathological Society

YONGHAO LI

- Chair, 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

NEIL P. SCHULTES

- Junior Radiation Safety Officer, CAES
- Fellow, Linnaean Society of London
- Member, Executive Board, Quinnipiac Chapter of Sigma Xi
- Research Affiliate, Dept. of Molecular, Cellular and Developmental Biology, Yale University
- Member, Thesis Advisory Committees, University of Indiana – Purdue at Ft. Wayne, IN

LINDSAY R. TRIPLETT

- Associate Editor, *Phytopathology*
- Faculty Affiliate, Colorado State University

QUAN ZENG

- Member, Bacteriology Committee, American Phytopathological Society
- Member, Grant Review Panel 2015 USDA-AFRI Foundational Program “Understanding Plant-Associated Microbes and Plant-Microbe Interactions”

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*
- Member, Society of Nematologists Extension and Ecology Committees
- Member, Connecticut Agricultural Information Council
- Ex-Officio Member, Connecticut Tree Protection Examining Board
- Member, CT Vegetable & Small Fruit Growers’ Conference steering committee
- Member, Selection Committee, Connecticut Century Farm Award
- State Coordinator, North American Blue Mold Forecast Center
- Trainer, Worker Protection Standards for the Valley Laboratory

CAROLE CHEAH

- Fellow of the Cambridge Philosophical Society, UK

DEWEI LI

- Associate Editor, *Aerobiologia*
- Member, Environmental Microbiology Proficiency Analytical Testing Task Force, American Industry Hygiene Association
- Member, Editorial Board, *Fungal Biology and Biotechnology*

THOMAS M. RATHIER

- Vice President and Member of Program, Tree Improvement and Merit Award Committees, The 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.

- Gave a talk on CAES work with crosses designed to improve levels of nutrients in orchard chestnut fruits at the Annual Meeting of the Northern Nut Growers Association in Corvallis, OR *August 9-13, 2014*
- Gave a tour of Lockwood Farm and discussed chestnuts with Dr. Bruce Levine from Maryland *August 31*
- Reported on CAES chestnut research at the Federal Regional Chestnut Project meeting in La Crosse, WI *September 4-7*
- Gave an invited talk on CAES chestnut work at the annual meeting of the Canadian Chestnut Council held in Brantford, Ontario, and toured their back-crossed chestnut planting (their original resistant chestnut stock came from CAES trees at Lockwood Farm) (100 attendees) *October 18*

ANDREADIS, THEODORE G.

- Presented a lecture entitled “Global Climate Change and Mosquito-Borne Diseases” to a group of Connecticut high school science teachers as part of the NIH SEPA Peabody Fellows Program at Yale University *July 15*
- Was interviewed about the first detection of West Nile virus in mosquitoes this season in East Haven and the threat of Chikungunya virus in Connecticut by Fran Schneidau, CBS Radio *July 22*
- Was interviewed about mosquitoes and Chikungunya virus in Connecticut by Amanda Cuda, CT Post *July 23*
- Was interviewed about the detection of West Nile virus in mosquitoes in East Haven by Steven Busemeyer, Hartford Courant *July 23*
- Was interviewed about Plant Science Day by Ray Andrewsen, WQUN AM 1220 in Hamden *July 28*
- Participated in a Council Meeting of the Connecticut Academy of Science and Engineering held in Wethersfield *July 30*
- Was interviewed about Chikungunya virus in the Americas and the threat of active transmission in the northeastern US by the mosquito, *Aedes albopictus* by Brendan Gibbons of the Scranton Times-Tribune *August 11*
- Was interviewed about West Nile virus activity in Connecticut and the US this summer by Amanda Cuda of the CT Post *August 13*
- Was interviewed about the detection of West Nile virus in mosquitoes in Stamford and Norwalk by Renee Chmiel of News 12 Connecticut *August 21*
- Participated in an Invasive Plant Council Meeting at the Department of Agriculture in Hartford *September 9*
- Participated in an Invasive Plant Council Meeting at the Department of Agriculture in Hartford *October 21*
- Met with Kate Aitkenhead, Acting State Plant Health Director for CT/MA/RI, USDA, APHIS, PPQ to discuss plans for implementation of a state wide quarantine for the Emerald Ash Borer in Connecticut *November 4*
- Presented an invited talk entitled, *Chikungunya virus in the Americas: are we risk?* at the 60th Annual Meeting of the Northeastern Mosquito Control Association held in Cambridge, MA (170 attendees) *December 9*

- Presented an update on the Jenkins-Waggoner building, new research initiatives and new staff members at the 2015 Winter Symposium of the Connecticut Nursery and Landscape Association held at the Yale Commons in New Haven (700 attendees) *January 7*
- Presented an update on the Jenkins-Waggoner building, new research initiatives and new staff members at the Annual Meeting of the Connecticut Tree Protective Association held in Plantsville (700 attendees) *January 15*
- Presented an update on the Jenkins-Waggoner building, new research initiatives and new staff members at the Connecticut Vegetable and Small Fruit Growers Conference held in South Windsor (100 attendees) *January 15*
- Presided over a quarterly meeting of the Station's Board of Control held in Hartford *January 21*
- Participated in a Council Meeting of the Connecticut Academy of Science and Engineering held in Wethersfield *January 28*
- With Dr. Jason White, attended a meeting with Dr. Cameron Faustman, and Dr. Michael O'Neil of the University of Connecticut's College of Agriculture and Natural Resources to discuss the 2015 Plan of Work *January 29*
- Participated in an Invasive Council Meeting held in Hartford *February 10*
- With Mr. Michael Last, met with members of the State Construction Services QBS Selection Panel to interview and select an architectural firm for design of the Valley Laboratory renovation and new building *February 19*
- Presented an update on Station activities at the annual meeting of the Tobacco Growers held in Windsor (100 attendees) *February 24*
- With Mr. Michael Last and Dr. Jason White, gave a presentation on the Governor's FY 2016-2017 for the Experiment Station to the State Appropriations Committee in Hartford *March 2*
- Attended a CAES sponsored Forest Health Monitoring Workshop held in Burlington (50 attendees) *March 3*
- Participated in Ag Day at the State Capitol in Hartford *March 18*
- Presented an update on Station activities at a Board meeting of the Experiment Station Associates *March 18*
- Provided opening remarks on the Experiment Station to a meeting of the State Landscape Design School *March 24*
- With Mr. Michael Last, testified before the Finance, Revenue and Bonding Subcommittee in Hartford *March 26*
- Presented a talk titled, *Eastern equine encephalitis virus: reemergence and expansion in the northeastern United States* at the 81st Annual Meeting of the American Mosquito Control Association held in New Orleans, LA (900 attendees) *April 1*
- Was interviewed about Powassan virus in Connecticut by Fran Schneidau, WCBS Radio New York *April 7*
- Presided over a quarterly meeting of the Experiment Station's Board of Control *April 8*
- Presented an *Update on Activities at the Connecticut Agricultural Experiment Station* at the Annual Meeting of the Experiment Station Associates (30 attendees) *April 8*
- Presented a lecture, *Global climate change and mosquito-borne diseases* to a class of students at the Yale School of Public Health (12 attendees) *April 22*
- 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 CT Agricultural Experiment Station (75 attendees) *April 24*
- Presented opening remarks and a talk titled *Chikungunya Virus in the Americas: Are We at Risk?* in a workshop on "Public Health Research and Services at the Connecticut Agricultural Experiment Station" for State and local public health officials held in Jones Auditorium (50 attendees) *May 7*

- Presented opening remarks and a talk titled *Chikungunya Virus in the Americas: Assessing Our Risk* at the 6th Annual Northeastern Eastern Equine Encephalitis Conference held at the Station (40 attendees) *May 17*
- Was interviewed by Sabrina Tavernise, Health Reporter for The New York Times on the impact of climate change on the distribution and potential impact of the exotic invasive mosquito, *Aedes albopictus* *May 22*
- Was interviewed about the outlook for mosquitoes and West Nile virus for the 2015 season by Amanda Cuda, Connecticut Post *May 28*
- Was interviewed about the outlook for mosquitoes and West Nile virus for the 2015 season by Fran Schneido WCBS Radio New York *May 28*
- Attended a reception of the Northeast Association of State Departments of Agriculture held at the Governor's residence in Hartford *June 8*
- Presented an overview of research, service and regulatory activities of the Experiment Station to delegates from the Northeast Association of State Departments of Agriculture (50 attendees) *June 9*
- Hosted Governor Malloy and presented opening remarks and a tribute to Dr. Paul Waggoner during the ribbon cutting ceremony for the Jenkins-Waggoner Laboratory (150 attendees) *June 11*
- Presented opening remarks and an overview of the Experiment Station to a community group hosted by the Yale School of Forestry (15 attendees) *June 16*
- Was interviewed about current research programs and service related activities being conducted by scientific staff in the newly renovated Jenkins-Waggoner Laboratory by Aidan Quigley, Waterbury Republican *June 16*
- Was interviewed about the expanded tick testing services provided by CAES by Bob Miller, News Times and Aidan Quigley, Waterbury Republican *June 18*
- Presented an overview of research, service and regulatory activities of the Experiment Station to a group of students from Central Connecticut State University (25 attendees) *June 25*

ARANGO-VELEZ, ADRIANA L.

- Along with Joseph P. Barsky, participated in Electrical Hazard Awareness Program training at Northeast Utilities *October 16, 2014*
- Staffed a collaborative booth between CAES, CT-DEEP, and UConn Cooperative Extension at the Tree Care Industry Exposition in Hartford *November 15*
- With Joseph P. Barsky, gave a presentation on trees and forests to students from COOP High School in New Haven *November 20*
- Presented "Adaptation strategies of urban trees under abiotic and biotic stresses" at the CT DEEP, Forestry Division meeting at Winding Trails in Farmington *December 17*
- Presented "Being a good tree steward" at the Leete's Island Garden Club in Guilford (30 attendees) *January 12, 2015*
- Attended the 93rd Annual Meeting of the Connecticut Tree Protective Association at the Aqua Turf in Southington *January 15*
- Presented "Topics in Urban Forestry" to the Botany Club students from Southern Connecticut State University (12 undergrad students and the Botany class teachers) *March 13*
- Spoke on "Proper tree care and maintenance, and management of invasive species" at the City of Bridgeport Parks and Recreation Department and CUFC tree planting workshop in Bridgeport (13 attendees, including 4 from the Hispanic community) *March 21*
- Gave an interview on "Tiny, invasive beetles threaten state's pines" for the Waterbury Republican-American *April 7*
- Was interviewed about mechanisms used by pine trees to defend beetle attack, and how beetles and pathogenic fungal associates work together to overcome tree defenses by WTNH News8 *April 14*

- Participated in the Judges Committee at the Quinnipiac University Student Research conference sponsored by Sigma Xi *April 22*
- Participated in the Ninth Annual Connecticut Tree Festival at Cranbury Park in Norwalk where she displayed samples of Southern pine beetle collected in Connecticut (100 attendees) *May 16*
- Along with Dr. Lindsay Triplett, spoke on photosynthesis and stomata function for visiting 6th grade botany students from Celentano Biotech, Health and Medical Magnet School in New Haven (20 students, 1 teacher) *June 12*
- Was interviewed about the extent of Southern pine beetle infestation in Connecticut by John Burgeson from the Connecticut Post *June 10*
- Was interviewed about the impact of the Southern pine beetle infestation in Connecticut by Samuel Kantrow from WTNH/WCTX *June 19*

ARMSTRONG, PHILIP M.

- Was interviewed about mosquitoes and mosquito-borne diseases in Connecticut by the CT Radio Works Program *July 10, 2014*
- Was interviewed about the recent detection of West Nile virus in Connecticut by the Connecticut Radio Works Program *July 22*
- Was interviewed about the recent detection of West Nile virus in Connecticut by WTNH News Channel 8 *July 22*
- Presented his research and met with students during the Quinnipiac School of Medicine, Capstone Mentor Fair *October 16*
- Spoke to students from the Sound School and gave an overview of research within the Department of Environmental Sciences *November 13*
- Gave the lecture “Diversity of Mosquito-borne Viruses in Connecticut” to the Connecticut Entomology Society at the Yale Peabody Museum *November 21*
- Gave a talk titled “Eastern Equine Encephalitis Virus Reemergence in Connecticut” at the Annual Conference for the Northeastern Mosquito Control Association held in Cambridge, MA *December 9*
- Along with Mr. John Shepard and Mr. Michael Thomas, hosted a group of students from Plainfield High School as part of the Yale-Peabody Fellows SEPA NIH educational program on mosquito biology *December 16*
- Gave an invited lecture, “An Overview and Survey of Arboviral Diseases” for the Biology of Disease Vectors course held at the Yale School of Public Health (approx. 20 attendees) *January 21, 2015*
- Gave a lecture on arthropod-borne viral diseases as a part of the Principles of Infectious Diseases Course at the Yale School of Public Health (31 attendees) *February 5*
- Gave the talk “EEE Virus in Connecticut: Lessons Learned from 18 Years of Surveillance and Research” at the Annual Virginia Mosquito Control Association Meetings in Suffolk, VA (approx. 50 attendees) *February 6*
- Along with John Shepard and Michael Thomas, conducted a hands-on workshop on mosquito biology to a group from RHAM High School as part of the Yale-Peabody Fellows SEPA NIH program on mosquito biology (23 students and 5 adults) *March 3*
- Along with John Shepard and Michael Thomas, conducted a hands-on workshop on mosquito biology to a group from Ansonia Middle School as part of the Yale-Peabody Fellows SEPA NIH program on mosquito biology (27 students and 3 adults) *March 31*
- Presented research findings at the Annual Meeting of the Northeastern Multistate Research Project titled Biology, Ecology and Management of Emerging Disease Vectors (approx. 12 attendees) *April 1*
- Was interviewed about detection of Powassan virus in Connecticut ticks by the New Haven Register *April 8*
- Was interviewed about Powassan virus risk in Connecticut by Cablevision News 12 *April 9*
- Was interviewed about Powassan virus by News Channel 8 *April 10*

- Was interviewed about Powassan virus by News Channel 8 *April 14*
- Presented the talk “Surveillance for Mosquito Borne Viruses” at the Public Health Entomology Symposium, organized by The Connecticut Agricultural Experiment Station, held in Jones Auditorium (100 attendees) *May 6*
- Presented the talk “EEE virus in Connecticut: Lessons Learned from 18 Years of Surveillance and Research” at the 6th Annual Northeastern EEE Virus Conference, organized by The Connecticut Agricultural Experiment Station and Centers for Disease Control and Prevention, held in Jones Auditorium (50 attendees) *May 8*
- Was interviewed about mosquitoes and mosquito-borne diseases in Connecticut by Sam Gingerella at WTIC radio *May 14*
- Gave the talk “Surveillance for Mosquito Borne Viruses” at the State Laboratory Preparedness Advisory Committee Meeting in Rocky Hill (30 attendees) *June 1*
- Was interviewed about mosquito-borne diseases in Connecticut by Mark Sims of CT Radio Network *June 1*
- Was interviewed about the mosquito surveillance program by WTNH Channel 8 *June 2*
- Was interviewed about mosquito-borne diseases in Connecticut by Mark Sims of CT Radio Network *June 4*
- Was interviewed about the relationship between weather and mosquito populations by Fox CT News *June 15*

AYLOR, DONALD E.

- Gave the invited talk “Emission Rates of Bioaerosols from Sources Embedded in the Atmosphere’s Roughness Sublayer” at an NSF-sponsored Workshop on “Fluid Dynamics of Living Systems” in Arlington, VA (50 attendees) *September 15, 2014*
- Participated as a judge for the Finalist High School Physical Sciences projects at the Connecticut Science Fair at Quinnipiac University in Hamden (contacts with 22 youths and 10 adults) *March 12, 2015*
- Gave an invited talk titled “Aerial Dispersal of Pollen and Spores” in the Department of Civil and Environmental Engineering at the Massachusetts Institute of Technology (MIT) in Cambridge, MA (30 adults attended) *April 2*

BARSKY, JOSEPH P.

- Served as a judge for the FFA Regional Agriscience Fair at the Eastern States Exposition, Springfield, MA *September 12, 2014*
- With Amanda Massa, staffed the CAES Booth at the Brooksvale Fall Festival in Hamden (1,500 attendees) *September 27*
- Participated in the quarterly meeting of the Connecticut State Consulting Committee for Agricultural Science and Technology Education at Southington High School *October 1*
- Led a tree identification workshop for high school students at the Connecticut Forest and Park Association Headquarters in Middlefield *October 4*
- Spoke to students at Cheshire High School about career opportunities in natural resources and environmental science (75 student attendees) *October 15*
- Led two tree identification walks for the high school students at the 2014 Envirothon Forestry and Urban Forestry Workshop in Burlington (25 student, 2 teacher attendees) *October 18*
- Participated in the Connecticut Urban Forest Council Conference in Southington *October 29*
- Was interviewed for an upcoming segment on forestry in Connecticut by David Bibbey of CPTV *November 10*

- Presented a poster and staffed a collaborative booth between CAES, CT-DEEP, and UConn Cooperative Extension at the Tree Care Industry Exposition in Hartford (2,000 attendees) *November 12*
- Participated in the quarterly meeting of the Connecticut State Consulting Committee for Agriculture Science and Technology Education at Westhill High School in Stamford *December 3*
- Assisted in a site evaluation of LaSalette Park in Bloomfield with the Connecticut Environmental Review Team *December 10*
- Attended the 93rd Annual Meeting of the Connecticut Tree Protective Association at the Aqua Turf in Southington *January 15, 2015*
- Attended the Forest Health Monitoring Workshop at Sessions Woods Wildlife Management Area in Burlington *March 3*
- Participated in the Lyman Hall AgriScience Consulting Committee Meeting in Wallingford *March 16*
- Selected to serve as Editor of the “News Quarterly” for the New England Society of American Foresters *March 25*
- Presented the research poster “Integrating forest and roadside management objectives to create storm resilient forests” at the 95th Annual winter meeting of the Society of American Foresters in Fairlee, VT (75 attendees) *March 26*
- Met with collaborators from Audubon Connecticut, Connecticut Department of Energy and Environmental Protection, and Ferrucci and Walicki to discuss the “Forest for the Birds” project in Southbury (7 professionals) *April 9*
- Led a forest ecology and Spring wildflower hike for the Guilford Land Trust (8 attendees) *April 25*
- Evaluated Middletown High School ASTE Program as member of State Consulting Committee for Agricultural Science and Technology Education *May 4*
- Participated in the quarterly meeting of the State Consulting Committee for Agricultural Science and Technology Education at Bloomfield High School *May 5*
- Served as a panel judge for the ASTE Agriscience Fair at Southington High School *May 7*
- Evaluated Middletown High School ASTE Program as member of State Consulting Committee for Agricultural Science and Technology Education *May 11*
- Staffed a CAES booth at the Connecticut Tree Festival at Cranbury Park in Norwalk *May 16*
- Staffed a forestry and natural resources booth at the North Branford High School Career Day Event *May 22*
- Participated in the New England Society of American Foresters Executive Committee Meeting in Portland, ME *June 17*

BLEVINS, TIA M.

- Participated in the Horticultural Inspection Society Systems Approach to Nursery Certification Workshop, held at Monrovia Nursery in Granby and at the Valley Lab in Windsor (25 participants) *September 29-30, 2014*
- Participated in the CT Nursery and Landscape Association Winter Meeting held at Yale Commons in New Haven (approx. 80 participants) *January 7, 2015*
- Participated in the Forest Health Workshop held at Sessions Woods Wildlife Management Area in Burlington (60 participants) *March 3*

BRANSFIELD, ANGELA B.

- Gave a tour of the BSL3 Laboratory to the Director of the Biology and Surveillance Dept., Swamp Inc. *October 21, 2014*
- Participated in the 2014 Federal Select Agent Program Webcast *November 14*

BRACKNEY, DOUGLAS E.

- Gave an invited talk titled “Elucidating the dynamic interplay West Nile virus and mosquito innate immunity” at Baylor College of Medicine in Houston, TX (approx. 15 attendees) *May 15, 2015*

BUGBEE, GREGORY J.

- Participated in the State of Connecticut PA 12-155 Phosphorus Nonpoint Source Workgroup at the DEEP in Hartford *July 22, 2014*
- Spoke at the annual meeting of the Bashan Lake Association on CAES IAPP research on controlling variable watermilfoil (100 attendees) *July 26*
- Spoke on “Understanding Soils” at the annual meeting of the Connecticut Association of Landscape Architects at Naugatuck Valley Community College *August 7*
- Gave the talk “Fall Lawn Care” to the Morris Cove Garden Club in East Haven (25 attendees) *September 16*
- Served on a panel that included DEEP Commissioner Klee, State Senator Bartolomeo, State Representative Altobello and First Selectman Brayshaw at the Middlefield Community Center, to discuss the condition of Lake Beseck after drawdown and dam repairs (75 attendees) *September 22*
- Gave the lecture “Invasive Aquatic Plants in Connecticut” at the Connecticut Invasive Plant Working Group Conference at UCONN (50 attendees) *October 7*
- Taught a course on “Aquatic Plants” to the Federated Garden Clubs at the Kellogg Environmental Center in Bethany (30 attendees) *October 15*
- Presented his research and met with students during the Quinnipiac School of Medicine, Capstone Mentor Fair *October 16*
- Was interviewed about cyanobacteria problems in Connecticut lakes by Skyler Magnoli of the Danbury News-Times *October 30*
- Gave the talk “Improving Soil in the Home Garden” to the Mountain Valley Garden Club in West Hartford (35 attendees) *November 3*
- Gave the talk “Management of Invasive Aquatic Plants” at the annual conference of the Connecticut Association of Inland Wetland Commissions in Wallingford (75 attendees) *November 15*
- Participated in the PA 12-155 Nonpoint Source Phosphorus Committee at CT DEEP in Hartford *November 20*
- Presented a talk titled “Control of curlyleaf pondweed with diquat and protection of listed species with limnobarriers” at the 2015 Northeast Aquatic Plant Management Society Conference in Saratoga Springs, NY (approx. 100 attendees) *January 21, 2015*
- With Ms. Jennifer Fanzutti, administered the Northeastern State Aquatic Supervisory License Recertification Program at the 2015 Northeast Aquatic Plant Management Society Conference in Saratoga Springs, NY (approx. 100 participants) *January 22*
- Participated on a panel of lake experts to receive public input and on a watershed management plan at a special meeting of the Lake Hayward Association in East Haddam (approx. 60 attendees) *January 31*
- Gave a talk titled “Improving Soil in the Home Landscape” to the West Hartford Exchange Club in West Hartford (approximately 30 attendees) *February 4*
- Participated in the Phosphorus Nonpoint Source Pollution Workgroup at CT DEEP headquarters in Hartford (approx. 40 attendees) *February 20*
- With Ms. Jennifer Fanzutti, presented a seminar on “Invasive Aquatic Plants” to an environmental studies class at Three Rivers Community College in Norwich (approx. 30 attendees) *February 25*
- With Ms. Jennifer Fanzutti, presented the results of the 2014 aquatic plant surveys of Lakes Candlewood, Lillinonah, and Zoar to FirstLight Power Resources technical committee in New Milford (12 attendees) *February 25*

- Lectured on “Improving Soil in the Home Garden” to gardeners in the Derby area as part of a United Way campaign to improve the diets of inner city residents through gardening (25 attendees) *March 26*
- With Mr. Michael Cavadini, proctored the Entomology event at the Connecticut Science Olympiad in Farmington (40 attendees) *March 21*
- Gave a seminar titled “Soil Science for Arborists” at the Bartlett Arboretum in Stamford (12 attendees) *March 17*
- With Ms. Jennifer Fanzutti, presented a poster titled “Connecticut’s Invasive Aquatic Plant Program” at the Connecticut Conference on Natural Resources at the University of Connecticut in Storrs (200 attendees) *March 16*
- Gave a talk titled “Green Lawns and Clear Water – Lawn Care for the Environmentally Conscious” for an Earth Day observance at the Middletown Community Center (approx. 25 attendees) *April 22*
- Spoke on “Improving Soil in the Home Garden” to gardeners at the Towers Senior Center in New Haven (approx. 25 attendees) *April 14*
- Gave a talk titled “Lawn Care” as part of a gardening program sponsored by the Cragin Memorial Library in Colchester (approx. 25 attendees) *April 13*
- Published an article, Invasive Plants and Water Chemistry in Connecticut Lakes: Developing a Risk Assessment Tool, in National Water Quality Monitoring News, Spring 2015
- Participated as an invasive aquatic plant science advisor at the 2015 Wamago Regional High School Science Project Presentation Day in Litchfield (approx. 100 attendees) *May 12*
- Spoke at a meeting of the Fence Rock Lake Association in Guilford on “CAES IAPP Research Update on Control of Brazilian Waterweed in Fence Rock Lake” at the Guilford Community Center (approx. 25 attendees) *May 6*
- Gave a talk “Container Gardening Indoors and Out” at the Cragin Memorial Library in Colchester (approx. 25 attendees) *June 1*
- Was interviewed about invasive aquatic plants in Squantz Pond by Katlin Koerting of the Danbury News Times *June 9*
- Was interviewed about Water Chestnut in Lake Lillinonah by Katlin Koerting of the Danbury News Times *June 11*
- Spoke on “Soil Testing” to the Urban Resource Initiative (URI) at the Station (approx. 12 attendees) *June 16*
- Spoke on “Soil Testing and Invasive Aquatic Plants” to a group from Central Connecticut State University (approx. 20 attendees) *June 25*

CAVADINI, MICHAEL

- Along with Mr. Gregory Bugbee, proctored three entomology exams for the CT Science Olympiad (~30 middle school participants) *March 21, 2015*
- Presented information about the field of analytical chemistry and CAES’s work in nanoparticle research to students at the North Branford High School Environmental Science Fair (~30 students and 5 adults attended) *May 22*

CHEAH, CAROLE A.

- Was interviewed about biological control of mile-a-minute weed during a release of the weevils *Rhinoncomimus latipes* in Southington by Farah Duffany of the Record-Journal of Meriden *July 30, 2014*
- Was interviewed about control of mile-a-minute weed by Kim Lucey of Channel 3, WFSB *July 31*
- Was interviewed on battling mile-a-minute weed by Anne Ravers for an article in the New York Times *September 10*
- Presented a poster on the biological control program of Mile-a-Minute weed in Connecticut at the CIPWG Invasive Plants 2014 Symposium at the University of Connecticut in Storrs *October 7*

- Was interviewed about the probable effect of the severe winter of 2015 on Hemlock Woolly Adelgid populations by Bob Miller of the Danbury News Times *February 24, 2015*
- Gave a presentation titled “Adaptation and spread of *Rhioncomimus latipes*, introduced for biological control of mile-a-minute weed in Connecticut” at the Forest Health Monitoring Workshop held at Sessions Woods in Burlington (60 participants) *March 3*
- Gave a laboratory tour at the Valley Laboratory in Windsor, and together with Dr. DeWei Li, discussed hemlock woolly adelgid project possibilities for the Holster Scholars First Year program with Nick Russo, undergraduate student, and Dr. Morgan Tingley, avian ecologist from UConn *March 10*
- With Elizabeth Young, managed a CAES booth with displays and information on biological control of hemlock woolly adelgid and mile-a-minute weed for the Town of Windsor Earth Day at the Windsor Town Hall (40 attendees) *April 22*
- Was interviewed about assessments on hemlock woolly adelgid winter 2015 mortality in Norfolk and Salisbury regions by Willard Wood of Norfolk Now *April 30*
- Was interviewed about the effects of the 2014-2015 winter on populations of hemlock woolly adelgid in Connecticut by Patrick Skayhill of WNPR, Connecticut Public Radio *May 8*

COWLES, RICHARD S.

- Presented “Insect Pest Management and the Fir Genetic Improvement Project” to the CT Christmas Tree Growers Association at the Valley Laboratory in Windsor (40 participants) *July 22, 2014*
- Presented “Unconventional Chemistries for Targeting Spotted Wing Drosophila” at the Northeast Regional IR-4 meeting in Albany, NY (20 attendees) *August 20*
- Spoke about “Insect and Mite Pests” to the CT Christmas Tree Growers Association in Middletown (40 attendees) *August 20*
- Gave the talk “The Course at Yale as a Case Study in Insecticide Resistance” to the Connecticut Environmental Council (20 participants) *September 8*
- Spoke about “Unconventional Chemistries for Targeting Spotted Wing Drosophila” at the National IR-4 Meeting in Atlanta, GA (150 attendees) *September 10*
- Gave the talk “Can Mass Trapping SWD be Made to Work?” at a research and extension SWD workshop in Highland, NY (30 participants) *September 16*
- Talked at a workshop for the Connecticut Tree Protective Association on “Best Management Practices for Protecting Ash Trees with Insecticides from EAB” in Southbury (100 attendees) *September 18*
- Gave the talk “Turf Insect Management” to the UConn Athletic Turf Maintenance Class in Storrs (10 attendees) *September 18*
- Talked on “Mite, Scale, and Root Rot Management” at the CT Christmas Tree Growers Association Fall Meeting in Warren (40 attendees) *September 20*
- Presented “Neonics and the Future: Growing Plants Safe for Bees” to the Helena Company Educational Program in Ledyard (60 participants) *October 23*
- Gave a seminar on “A Quick Method for Making Educational Videos” to CAES personnel in New Haven (7 attendees) *October 27*
- Gave the lectures “Insect and Mite Pests of Landscape Ornamentals, Part I” and “Insect and Mite Pests of Landscape Ornamentals, Part II” on November 7 and 14, respectively, for the University of Massachusetts Green School in Marlboro, MA (100 participants) *November 7 and 14*
- Gave the talk “Neonicotinoids and Bee Health” (coauthor, David Smitley, Michigan State University) to the Tree Care Industry Association Expo in Hartford (150 participants) *November 13*
- Spoke on “Behavioral Control and Mass Trapping: Lessons Learned in Blueberries” (coauthors Steven Alm and Heather Faubert of the University of Rhode Island) for a spotted wing drosophila

symposium at the Entomological Society of America National Meeting in Portland, OR (120 participants) *November 18*

- Participated in an IR-4 program biopesticides conference call emphasizing products for targeting spotted wing drosophila (15 participants) *December 8*
- Presented “Systemic insecticides: assessing risk to pollinators in ornamental horticulture,” to the Pollinator Workshop, hosted by the IR-4 Program in Baltimore, MD (20 participants) *December 15*
- Presented “Neonics and bees: What does the science say?” to the CT Nursery and Landscape Association winter meeting in New Haven (120 attendees) *January 7, 2015*
- Met with the Hartland Pond Association to discuss hemlock woolly adelgid management (10 attendees) *January 11*
- Spoke about “Spotted wing drosophila” at the Progressive Grower Agricultural Supply educational seminar meeting (60 attendees) *January 16*
- Remotely presented via a video (and phone to answer questions) “Neonicotinoids and bee health” to the Tristate Green Industry winter meeting in Cincinnati, OH (80 attendees) *February 5*
- Presented “Neonicotinoid impact on pollinators” at the Society of American Floriculture national meeting in Orlando, FL (100 attendees) *February 20*
- Was interviewed about the use of neonicotinoids in ornamental horticulture crops by Jennifer Zurko of Grower Talks magazine *February 25*
- Was interviewed about the use of neonicotinoids in ornamental horticulture crops by Jennifer Zurko of Grower Talks magazine *February 27*
- Presented “Christmas tree insect update” to the CT Christmas Tree Growers annual meeting in Middletown (50 attendees) *March 7*
- Provided a video for remote presentation of “Making pesticides work: Interactions of formulations and application techniques” and provided phone Q&A for the CT Groundskeepers Association (200 attendees) *March 10*
- Participated in the Red Tomato annual meeting and presented “Neonics and bees: What does the science say” at Hyde Park, NY (50 attendees) *March 11*
- Presented “Neonics and bees: What does the science say?” to managers from Monrovia Nursery in Granby (20 attendees) *March 24*
- Presented “What’s Happening to All the Bees” to the Cornell Club of Greater Hartford in Windsor (15 attendees) *June 2*
- Discussed “Phagostimulants to Improve Effectiveness of SWD Insecticides” in a webinar hosted by Marrone Biosciences (international attendance, unknown number of attendees) *June 10*
- Spoke on the subject “Christmas tree pest management” at a twilight meeting of the CT Christmas Tree Growers Association in Guilford (35 attendees) *June 17*
- Discussed “Entomological research” to teachers attending an SCSU summer training program in Windsor (12 attendees) *June 24*

CREIGHTON, MARK H.

- Was interviewed about the health and status of honey bees in Connecticut by the Meriden Record Journal *July 7, 2014*
- Had a table display on honey bees and spoke with 25 visitors, made appointment for aviary inspections, and collected honey bee registration forms at Farmers Day at the Tractor Supply Store in Barkhamsted *July 12*
- Was interviewed on honey bee pollination activities in Connecticut for the fall season by The Day *July 25*
- Staffed a booth with a honey bee display and made pollinator buttons for the children in attendance at the National Honeybee Day event held at Massaro Community Farm in Woodbridge (100 + attendees) *August 16*

- Spoke about the role that honey bees play in pollination and displayed an observation hive for visitors at the Chester Fair (120 attendees at the talk) *August 23 and 24*
- Set up a honey bee information booth with an observation hive and spoke to visitors about the value of bees as pollinators at Winchester Center Day (50+ attendees) *September 13*
- Set up a honey bee information booth with an observation hive and spoke to visitors about honeybees, pollination, and bee health at the Big E in West Springfield, MA (1,218 attendees) *September 17*
- Presented a workshop on preparing bee hives for the winter at Massaro Community Farm in Woodbridge (30 attendees) *September 20*
- Displayed an observation hive and spoke to students in the 4-H Program at 4-H Day held at the Nautilus Museum in Groton (75 student attendees) *October 15*
- Spoke about honey bee topics and was presented with the “Beekeeper of the Year” award at the CT Beekeepers Association meeting in Woodbury (75 member attendees) *October 18*
- Spoke about overall bee health and winter preparation of hives to Ag students from Western Regional High School in their Bee Yard in Norfolk *November 4*
- Spoke on bee health issues to Farm Bureau delegates and set up a honey bee information table at the annual Farm Bureau meeting in Wallingford *November 14*
- Was interviewed for an article on bees, beekeeping, and the health of the honey bee by Denise Coffy for Reminder News *January 9, 2015*
- Presented a workshop on the role that pollinators play in support of Connecticut’s agriculture and provided an overview on how to set up and maintain honey bee hives in the backyard at the Middletown Agricultural Science & Technology Program’s Continuing Education Winter Conference held at Middletown High School (22 attendees) *January 10*
- Presented a talk on “Bee disease and pests” and handed out Honey Bee Registration forms to students at the CT Beekeepers Annual Bee School held in Woodbury (240 attendees) *February 7*
- Spoke about honey bees and presented information on the value of honey bee registration to students at the Eastern Beekeepers Association Bee School in Haddam (55 attendees) *February 10*
- Presented information on the value of honey bee registration and manned the CAES booth at a honey bee workshop held at Benedicts Home and Garden Center in Monroe (250 attendees) *February 14*
- Staffed a honey bee information booth and spoke about CAES, bees, and pollination at the Connecticut Flower and Garden Show in Hartford (78 attendees visited the booth) *February 19*
- Spoke to beekeepers on bee health topics and collected Honey Bee Registration forms at the CT Beekeepers Association meeting in Woodbury *February 21*
- Staffed a honey bee information booth and spoke about CAES, bees, and pollination at the Connecticut Flower and Garden Show in Hartford (320 attendees visited the booth) *February 22*
- Presented a talk on “Bee disease and pests” and handed out Honey Bee Registration forms at the CT Beekeepers 2nd Bee School held in Falls Village (200 attendees) *February 28*
- Was interviewed about the state of beekeeping in CT by the Republican-American *February 28*
- Attended a talk presented by Dr. Maria Spivak on the value of honey bees and pollination in Worcester, MA *March 7*
- Attended a meeting at Rockville Agricultural Center to help plan an apiary at the school *March 9*
- Submitted a USDA Specialty Crop Block Grant Concept Proposal to CTDA, titled Minority/Youth Beekeeping Initiative *March 10*
- Spoke about bees and the role they play in pollination to 3rd grade students at East Conn in Hampton (124 youths attended) *March 11*
- Assisted Dr. Kirby C. Stafford III on a Section 18 emergency exemption under Section 18 of FIFRA for the use of Hopguard II for Varro mite control *March 12*
- Attended a lecture by Dr. Dave Tarpy on the reasons for queen failure in Topsfield, MA *March 14*
- Attended a meeting with the ACO and Zoning Officer in Ansonia on proposed restrictions on beekeeping *March 19*

- Spoke on the role that bees play in pollination to students at Andover Elementary School (70 youths attended) *March 24*
- Was notified that a USDA Specialty Crop Block Grant Concept Proposal to CTDA, titled Minority/Youth Beekeeping Initiative was selected for Phase two: full application *March 24*
- Attended a Pollinator Health workshop held at UMass in Amherst, MA *March 26*
- With Dr. Kirby C. Stafford III, was advised by EPA that our Section 18 emergency exemption under Section 18 of FIFRA for the use of Hopguard II for Varro mite control was approved by the U.S. Department of Environmental Protection *March 31*
- Gave a workshop on putting a new bee package in a hive at Massaro Community Farm in Woodbridge (25 new beekeepers attended) *April 18*
- Attended a workshop on Top Bar hives at the Back Yard Beekeepers Association's Bee Yard in Weston *April 19*
- Spoke about pollinators and the role honey bees play in agriculture at the Earth Day event held at Natureworks in Northford (spoke to 75 attendees) *April 25 and 26*
- Submitted a Grant Application to the Connecticut Department of Agriculture on Youth and Minority Beekeeping *April 16*
- Set up a table and spoke about bees, pollination, and beekeeping at Farm City held at Common Ground High School in New Haven (spoke to 200 youths) *May 8*
- Spoke about bees and pollination and displayed an observation hive at ConnJam 2015, a meeting of all Boy Scouts in Connecticut, held at the Orange Fairgrounds *May 16*
- Was interviewed about honey bee losses in Connecticut by the Waterbury Republican-American *May 21*
- Was interviewed about bee losses in Connecticut by the Hartford Courant for an article that appeared on the front page on Memorial Day *May 22*
- Spoke about honey bee health and the role honey bees play in pollination at Save the Bees Day in Columbia (100 attendees) *May 23*
- Spoke on bees and pollination and displayed an observation hive for students at the YMCA pre-school in Middletown (45 youth attendees) *June 11*

DE LA TORRE ROCHE, ROBERTO

- Presented two lectures "Co-exposure to Engineered Nanoparticles Alters the Toxicity and Accumulation of Persistent Pesticides in Agricultural Crops" (30 attendees) and "Trophic Transfer Potential of Rare Earth Element Oxide Nanoparticles Through Terrestrial Food Chains" (30 attendees) at the 11th International Phytotechnologies Conference in Heraklion Crete (Greece) *September 30-October 3, 2014*

DINGMAN, DOUGLAS W.

- Presented a talk on *E. coli* on food to the Oxford Garden Club in Oxford *September 23, 2014*
- Presented a talk on honey bee basics to residents at Cedar Hill Commons in Newington *October 29*
- Gave a lecture titled "*E. coli* Concerns" at the University of St. Joseph in West Hartford *April 7, 2015*
- Judged the student poster presentations at the Quinnipiac Sigma Xi Conference held at Quinnipiac University in Hamden *April 22*
- Gave a presentation/demonstration of beekeeping equipment and practices to 5th graders for Arbor Day at CAES *April 24*
- Served as a judge for the Connecticut FFA Science Fair in Southington *May 7*
- Presented a talk titled "Honey Bee Basics" to the Branford Garden Club in Branford *May 11*
- Served as a judge for the New Haven Science Fair in New Haven *May 12*
- Conducted an all-day workshop on "Nosema monitoring" for the Backyard Beekeepers Association in Jones Auditorium *May 16*

- With Dr. Neil P. Schultes, presented a “lunch and learn” seminar titled “Know GMO” to staff at GE Financial Services in Stamford (50 attendees) *June 11*

DOUGLAS, SHARON M.

- Participated in a conference call of the Boxwood Blight Working Group about research funding and the upcoming APS Boxwood Blight Symposium (14 attendees) *July 9, 2014*
- Answered questions about current nursery diseases at the CNLA Summer Field Day at Van Wilgen’s Garden Center in North Branford *July 16*
- Organized and participated in the CTPA Summer Meeting at the Farmington Club and answered questions from arborists about tree diseases (745 attendees) *July 17*
- Presented the invited talk “Boxwood Blight and the Dawn of a Research Collaboration” in the Symposium “Boxwood Blight: Collaborative Connections to Study an Emerging Disease” and participated in the forum “Boxwood Blight Challenges” at the Annual Meeting of the American Phytopathological Society in Minneapolis, MN *August 9-13*
- Participated in the monthly meeting of the CTPA Board of Directors in Wallingford *August 19*
- Organized and moderated at the CTPA Workshop titled “Single Rope Positioning: Techniques and Considerations” held at CTPA headquarters in Wallingford (32 attendees) *August 28*
- Participated in the Board of Directors meeting of the CTPA at the Station (14 attendees) *September 9*
- Assisted the CT Tree Protection Examining Board with administering the oral exam to candidates for the CT arborist license *September 10*
- Was interviewed about state and region-wide problems with spruce trees by Skyler Magnoli of the Danbury News-Times *September 16*
- Was interviewed about the 2014 fall foliage season by Sam Kantrow of News 8 *September 23*
- Gave the presentation “Boxwood Blight: A New Threat to Boxwood in North America” for the Horticultural Inspection Society, Eastern Chapter SANC exercise at the Valley Lab in Windsor (25 attendees) *September 30*
- Participated in conference calls with CTPA Board of Directors members and Monica Hemingway of ITG Multimedia to discuss the revamping of the CTPA website *October 8 and 31*
- Participated in the monthly CTPA Board of Directors meeting held in the CAES Board Room *October 14*
- Gave the presentation “Poisonous Plants” at Cedar Mountain Commons Retirement Community in Newington (15 attendees) *October 15*
- Participated in the fall meeting of the Connecticut CAPS Program held at the USDA-APHIS-PPQ facility in Wallingford and discussed the *Phytophthora ramorum* survey protocol for 2015 and testing for phytoplasmas (apple proliferation) (12 attendees) *November 6*
- Organized and welcomed George Baldwin’s senior Genetics & Biotechnology class from the Sound School for a tour to hear about the diverse research being conducted at CAES (14 attendees) *November 13*
- Participated in a meeting of the CTPA Board to discuss and review proposed changes to the CTPA website at CTPA headquarters in Wallingford *November 20*
- Was interviewed about a synopsis of problems experienced by Connecticut gardeners for the 2014 growing season, with particular interest in the first molecular detection of rose rosette virus in Connecticut by Pamela Weil of The Connecticut Gardener *November 21*
- Attended the annual meeting of the Connecticut Pomological Society in Glastonbury and discussed current tree fruit diseases with grower attendees (105 attendees) *December 2*
- Participated in the monthly meeting of the CTPA Board of Directors, which included planning for the annual meeting in January 2015, held at Aqua Turf in Plantsville (14 attendees) *December 9*
- Participated in the December meeting of the Connecticut Tree Protection Examining Board and helped administer the oral exam to candidates for the arborist license *December 10*

- Attended the CNLA Winter Symposium held at Yale University *January 7, 2015*
- Participated in and organized the CTPA Annual Meeting and coordinated the CAES booth at the Aqua Turf in Plantsville (760 adult attendees) *January 15*
- Gave a presentation titled “Pruning for the home gardener” as part of the Institute for Learning in Retirement Short Course “Garden Care and Our Environment” (10 adult attendees) *April 15*
- Gave a presentation titled “Eco-friendly management of diseases of perennials” for the Franklin Garden Club in Franklin (25 adult attendees) *April 15*
- Was interviewed about poison ivy and why it seems to be more plentiful this year than in the past by Bob Miller of the Danbury News Times *June 8*
- Participated in the Cooperative Agricultural Pest Survey (CAPS) meeting to discuss current surveys and plans for 2016 in Jones Auditorium (12 adult attendees) *June 16*

DUGAS, KATHERINE D.

- Gave a talk about ALB and EAB at the Connecticut Natural History Museum at UConn in Storrs *August 2, 2014*
- Staffed a table with ALB and EAB displays and information at the Woodstock Fair (1,708 attendees visited the table) *August 29-September 2*
- With Nicole Gabelman, staffed an ALB/EAB booth at the Hebron Harvest Fair (300 visitors) *September 4-7*
- With Nicole Gabelman, staffed an ALB/EAB booth at the Somers Four Town Fair (600 visitors) *September 11-14*
- With Mark Creighton and Nicole Gabelman, staffed an ALB/EAB/honeybee booth in the Connecticut Building at the Big E in West Springfield, MA *September 23*
- With Nicole Gabelman, staffed an ALB/EAB booth at the Durham Fair *September 25-28*
- Participated in the Horticultural Inspection Society Systems Approach to Nursery Certification Workshop, held at Monrovia Nursery in Granby and at the Valley Laboratory in Windsor *September 29-30*
- Taught an Advanced Master Gardener course on common garden pests at the Cooperative Extension Office in Norwich (25 Master Gardener attendees) *October 2*
- Gave a talk on common garden pests to the North Haven Daytime Gardeners Garden Club (15 attendees) *October 14*
- With Dr. Gale Ridge, Heidi Stuber, and Nicole Gabelman, attended and staffed the CCABB Bed Bug Forum VIII at Middlesex Community College *October 16*
- With Nicole Gabelman, provided bed bug and CAES information to students and faculty at the Health Fair at the University of Bridgeport *October 23*
- Spoke about emerald ash borer, invasives, and future plans for tree management to the Clinton Tree Committee at the Henry Carter Hull Library in Clinton (5 committee member attendees) *October 30*
- Ran the Cooperative Agricultural Pest Survey meeting held at the USDA-APHIS-PPQ offices in Wallingford (12 attendees) *November 6*
- Gave a talk regarding winter moth and emerald ash borer to the North Stonington Grange (20 attendees) *November 14*
- Attended the public hearing to expand the emerald ash borer quarantine statewide, held at the Middlesex Cooperative Extension Offices in Haddam (20 participants) *December 4*
- Staffed a CAPS and Forest Pest booth at the CT Nursery and Landscape Association Winter Meeting in New Haven *January 7 and 8, 2015*
- Staffed a CAPS and Forest Pest booth at the CT Tree Protective Association Winter Meeting held at the Aqua Turf in Plantsville *January 15*
- Staffed a Forest Pest/Don’t Move Firewood Table at the Northeast RV and Camping Show at the Hartford Convention Center (300+ people visited the booth during the weekend) *January 23 and 25*

- Spoke to the Old Lyme Middle School Science Olympiad Entomology team and brought boxes of insects for the students and discussed insect identification (6 students attended) *February 6*
- Helped with the DEEP's display and contributed Asian longhorned beetle and emerald ash borer displays and information for the weekend at the CT Hunting and Fishing Show in Hartford (100 people stopped by the booth) *February 13*
- Staffed the CAES booth and had displays with information about honey bees, Asian longhorned beetle, and the emerald ash borer at the CT Flower and Garden Show in Hartford (300 people visited the booth) *February 20 and 21*
- Spoke to the 10 UConn Master Gardener Coordinators regarding forest pest outreach and future outreach opportunities such as ash tree tagging, Earth Day, and a Hot Topics talk in April at the Master Gardener Coordinator's Meeting in Hartford *February 25*
- Gave a talk about the Cooperative Agricultural Pest Survey and invasive forest pests at the Denison Pequotsepos Nature Center in Mystic (8 attendees) *February 26*
- Gave a short update on the 2014-2015 CAPS program as well as the upcoming surveys funded through the Farm Bill at the Forest Health Workshop held at the Sessions Woods Wildlife Management Area in Burlington (60 attendees) *March 3*
- Invited six members of the Old Lyme Middle School Science Olympiad Entomology team to come tour the Insect Inquiry Office and Dr. Claire Rutledge's *Cerceris* lab in the Jenkins-Waggoner building *March 10*
- Staffed a table and handed out information on forest pests such as the Asian longhorned beetle and emerald ash borer at the CT Master Gardener Symposium held at Manchester Community College (150 people visited the table) *March 21*
- With Jeff Fengler, Steve Sandrey, Vicki Smith, and Peter Trenchard, attended the combined meeting of the Eastern Plant Board, the Horticultural Inspection Society, and the Cooperative Agricultural Pest Survey, held at the Harborside Hotel in Portsmouth, NH (90 participants) *April 6-9*
- Staffed a Forest Pest Outreach booth at North Haven Earth Day (100 guests stopped by the booth) *April 11*
- Spoke at the Master Gardeners Hot Topics on emerald ash borer management; the talk was also taped so that it will be available online (90 Master Gardeners attended) *April 15*
- Spoke about emerald ash borer management and Southern pine beetle at the Flanders Nature Center in Woodbury (10 attendees) *April 16*
- Staffed a Forest Pest Outreach booth at Hamden Earth Day (200 guests stopped by the booth) *April 18*
- Staffed a booth at UConn's Earth Day and Arbor Day celebrations and spoke to students about emerald ash borer and other forest pests; twenty ash trees on UConn's Storrs campus were tagged as part of the program *April 22*
- With Mr. Mark H. Creighton, staffed a table with forest pest and honey bee information at the Boy Scouts ConnJam 2015 event held at the Orange Fairgrounds *May 16*
- With Dr. Sandra Anagnostakis, Mr. Joseph P. Barsky and Dr. Robert Marra, staffed tables with information about CAES, chestnuts, plant pathology, and forest pests at the Connecticut Tree Festival in Norwalk *May 16*
- Organized and ran the Statewide Cooperative Agricultural Pest Survey (CAPS) Committee meeting held in Jones Auditorium (11 attendees) *June 16*

DURGY, ROBERT J.

- Hosted a tour group of the Middlesex and New London Master Gardeners Class of 2014. The group toured the research field plots, receiving a description of the work and results. They also received instruction on field identification of common vegetable diseases and insects (24 attendees) *August 5, 2014*

- Attended as a member of the steering committee and ran the audio-visuals at the Connecticut Vegetable and Small Fruit Grower's Conference in Windsor (305 attendees) *January 15, 2015*
- Taught a University of Connecticut Master Gardener Program class on vegetables in Stamford (34 attendees) *February 16*
- Taught a University of Connecticut Master Gardener Program class on vegetables in Brooklyn (26 attendees) *February 20*
- Taught a University of Connecticut Master Gardener Program class on vegetables in West Hartford (43 attendees) *February 25*
- Taught a University of Connecticut Master Gardener Program class on vegetables in Haddam (46 attendees) *March 3*
- Taught a University of Connecticut Master Gardener Program class on vegetables in Bethel (44 attendees) *March 12*
- Taught Math Calculations and Calibration for Pesticide Applicator's Training in East Haven (38 attendees) *February 5*
- Taught Math Calculations and Calibration for Pesticide Applicator's Training in West Hartford (34 attendees) *February 24*
- Gave a lecture titled "Backpack Sprayer Calibration" in East Windsor (60 attendees) *February 19*
- Gave a lecture titled "Understanding Fertilizers" in Norwich (15 attendees) *March 7*

EITZER, BRIAN D.

- Presented a poster on the analysis of pesticides in produce and teas at the European Pesticide Residue Workshop in Dublin, Ireland (500 attendees) *June 30-July 3, 2014*
- Presided over a symposium on the analysis of pesticides in bee-related matrixes at the 51st Annual North American Chemical Residue workshop in St. Petersburg Beach, FL (250 attendees) *July 20-23*
- Was a participant in the FERN cCAP mycotoxin working group phone call *August 7*
- Was a participant in the LC-MS class group phone call *August 12*
- Was a participant in the T022 validation group phone call *August 28*
- Was interviewed for a video documentary to help raise funds to study issues raised about the use of neonicotinoid pesticides by the ornamentals industry by Thomas and Matthew Locastro of the American Horticultural Society *August 29*
- Presented a poster on the analysis of aflatoxins in milk at the AOAC International Meeting in Boca Raton, FL (900 attendees) *September 7-10*
- Presented a talk on the T022 method validation project at the FDA FERN cCAP Technical Meeting in Boca Raton, FL (60 attendees) *September 11-12*
- Participated in the North American Chemical Residue Workshop conference call (25 participants) *October 9*
- Led a conference call on the FERN-T022 Validation Project (15 participants) *October 17*
- Gave a webinar on "Analysis of Pesticide Residues in Tea Leaves" to the Northeast FERN Group (15 participants) *October 23*
- Participated in two conference calls concerned with the planning of a new FERN LC/MS Class (6 participants) *October 7 and 30*
- Participated in the North American Chemical Residue Workshop Program conference calls *November 6, 13, and 20*
- Participated in a conference call concerned with the planning of a new FERN LC/MS class *November 7*
- Participated in the FERN cCAP mycotoxin group conference call *December 4*
- Participated in the FERN cCAP conference call *December 11*
- Participated in the NACRW organizing committee conference call *December 11*

- Participant in the Ornamental Horticulture Pollinator Workshop held in Baltimore, MD (30 attendees) *December 15-16*
- Participated in the PI meeting of the NC1173 multi state hatch grant titled “Sustainable Solutions to Problems Affecting Bee Health” (25 attendees) *January 22, 2015*
- Attended the American Bee Research Conference in Tucson, AZ (100 attendees) *January 22-23*
- Participated in the NACRW organizing committee conference call *January 15*
- Participated in the NACRW organizing committee conference call *February 12*
- Gave a presentation titled “Determination of Pesticide Residues in Tobacco Plants” to the Tobacco Growers Association meeting in East Windsor (110 attendees) *February 24*
- Was a judge at the Connecticut Science & Engineering Fair held at Quinnipiac University in Hamden *March 11-12*
- Was a participant in phone calls on the development of an LC/MS class for the FDA in which he will be an instructor *March 18 and March 30*
- Was involved in conference calls on planning the upcoming meeting of the North American Chemical Residue Workshop *March 5 and March 30*
- Along with Dr. Richard Cowles of the Valley Laboratory, was a recipient of a \$54,000 grant from the Horticultural Research Institute of a grant to study neonicotinoid pesticides model plant systems
- Participated in conference calls related to the development of a class in liquid chromatography/mass spectrometry that will be taught for the FDA as part of our FERN cCAP grant *April 2, 7 and 22*
- Participated in a conference call by the North American Chemical Residue Workshop’s organizing committee *April 9*
- Talked to and was quoted by Greg Hladky of the Hartford Courant for a story on bees and pesticides that was in the May 25 edition of the paper
- Participated in several conference calls about an LC-MS class he will be teaching for the FDA *May 4, 6, 20, 26*
- Participated in the North American Chemical Workshop’s Organizing Committee phone call *May 21*
- Was an instructor for the class titled “LB511 FDA/FERN Chemistry Training for LC/MS” which was held at the Food and Drug Administration’s Forensic Chemistry Center in Cincinnati, OH (13 students) *June 21-26*
- Was a participant in the North American Chemical Residue Workshops organizing committee’s conference call *June 18*

ELMER, WADE H.

- Gave a presentation titled “*Fusarium palustre* in *Phragmites australis* dieback in Chinese salt marshes transferred by invasive *Spartina alterniflora*” at the international conference on invasive *Spartina* at the University of Rennes in Rennes, Bretagne, France. He also took extensive samples of invasive and native European *Spartina* species and sampled for *Fusarium* colonies *July 4-11, 2014*
- Reported to the Widely Prevalent Fungi Group and attended the Senior Editor meetings for Phytopathology at the Annual Meeting of the American Phytopathological Society in Minneapolis, MN *August 9-13*
- Was an invited speaker at the International Plant Nutrition Institute Symposium in Villavicencio, Colombia where he presented the seminar “Crop Nutrition and Plant Disease: Role of Macro and Micro Nutrients” to oil palm growers. He also spent time visiting oil palm growers and learning about the disease problems *August 26-29*
- Participated in the Capstone Mentor Fair at the Medical School of Quinnipiac University in North Haven *October 16*
- Gave the presentation “Use of Nanoparticles of Cu, Mn, and Zn to suppress soilborne diseases of eggplants and tomatoes” at the 16th World Fertilizer Congress held in Rio de Janeiro, Brazil (400 attendees) *October 20-24*

- Gave the presentation “Use of Nanoparticles of Cu, Mn, and Zn to suppress soilborne diseases of eggplants and tomatoes”, attended the Extension/Industry Meeting, led the Plant Pathology Jeopardy Game, and presided over the Graduate Student Awards at the Annual Meeting of the Northeastern Division of the American Phytopathological Society held in Portsmouth, NH (32 attendees) *October 29-31*
- With Peter Thiel, joined Dr. Kenneth Rapposa of the Narragansett Bay Research Reserve and Dr. Cathy Wigand of EPA on Prudence Island, RI in Narragansett Bay where Sudden Vegetation dieback had occurred and participated in the monitoring and sampling of dieback sites *November 12*
- Gave a presentation on Sudden Vegetation Dieback to students from the Sound School (12 students) *November 14*
- Visited Greenwich High School to speak to Andrew Bramante’s student Eloise Petersen, a junior working on biochar and plant viruses *December 23*
- Presented a talk titled “Latest strategies in Management of root rot of perennials” at the CT Nursery and Landscape Winter Meeting in New Haven (33 attendees) *January 8, 2015*
- Was visited by Lorie Staver, a PhD graduate student from the University of Maryland, and discussed salt marsh wetland projects *January 12*
- Attended the UConn-CAES Spring Bedding Plant Meeting in Torrington, where he participated in the Connecticut Greenhouse Growers Association Annual Business meeting *February 3*
- Presented the talk “Fighting Fusarium in flowers: role of mineral nutrition” at the Connecticut Flower and Garden Show in Hartford (9 attendees) *February 20*
- Attended the Connecticut Conference for Natural Resources at UConn in Storrs where his graduate student Magali Bazzano presented a portion of her MS thesis “Use of DMSP as an indicator of stress in *Spartina alterniflora* in salt marshes affected by SVD” (17 attendees) *March 16*
- Presented a lecture titled “Biochar, soil health, and plant nutrition for management of plant diseases” to the Bartlett Tree Co. at the Bartlett Arboretum in Stamford (36 attendees) *March 25*
- Attended the New England Estuarine Research Society Meeting in Bristol, where his graduate student, Magali Bazzano, presented the talk “Using DMSP as an Indicator for Stress in Salt Marshes Affected by Sudden Vegetation Dieback” *April 17*
- Was interviewed about experiences working with high school students from the Sound School by Josef Graham, a doctoral student at Western Connecticut State University *April 29*
- Participated as a judge for the AgriScience fair at Southington High School *May 7*
- Spoke about salt marsh dieback to fourth graders at the Cold Spring School in New Haven. He also participated in creating the fourth-grade Pod cast (3 student attendees) *June 16*
- Co-organized the Connecticut Greenhouse Growers Association/UConn/CAES workshop on hydroponics in Jones Auditorium *June 23*
- Was interviewed about “Stakeholder perceptions of student success in place-based schools” by Josef Graham, a doctoral student at Western Connecticut State University, for his Ph.D. program *June 24*

FERRANDINO, FRANCIS J.

- Gave the presentation “Turbulent Wind in a Vineyard Canopy” and was named President of NED-APS at the Annual Meeting of the Northeastern Division of the American Phytopathological Society held in Portsmouth, NH (32 attendees) *October 29-31*
- Participated in the annual meeting of the NE-1020 Project “Multi-state Evaluation of Winegrape Cultivars and Clones” in Geneva, NY and presented results of trials from Connecticut *November 10-12*
- Participated in the Connecticut Wine Council meeting held at the CT Department of Agriculture building in Hartford *December 11*
- Gave a presentation titled “Grape powdery mildew in Connecticut” to the Connecticut Vineyard and Winery Association at the CT Farm Bureau in Windsor (45 adult attendees) *February 23, 2015*

- Participated in the Connecticut Wine Council meeting in Hartford *March 19*
- Gave a talk titled “The role of CAES in support of the farm wine industry since 1970” at the Connecticut Farm Wine Council meeting in Hartford (20 adult attendees) *June 18*

GENT, MARTIN P. N.

- Presented the talk “Effect of Temperature on Composition of Hydroponic Lettuce” at the International Horticultural Congress 2014 in Brisbane, Australia (50 attendees) *August 18, 2014*
- With Dr. Wade Elmer and Kranti Macherla and Richard McAvoy of the University of Connecticut, presented the poster “Effects of Salinity and Irrigation Management on Poinsettia” (10 attendees) *August 21*
- Presented a report on “Effects of Salinity and Irrigation Management on Poinsettia” at the NE1335 regional research committee meeting on “Resource Management in Commercial Greenhouse Production” in Tucson, AZ (8 attendees) *March 28, 2015*

HAWTHORNE, JOSEPH R.

- Presented the poster “Identification and Avoidance of Potential Artifacts in Nanomaterial Ecotoxicity Measurements” and gave the lecture “Trophic Transfer Potential of Cerium Oxide Nanoparticles Through Terrestrial Food Chains at the Society of Environmental Toxicology and Chemistry North America 35th Annual Meeting in Vancouver, BC, Canada *November 11, 2014*
- Participated in the NE FERN Webinar *November 19*

HAYES, LAURA E.

- Organized a symposium titled “Ecology and Prevention of Tick-borne Diseases” and gave the talk “Host-targeted Measures and Biopesticides for the Integrated Management of Blacklegged Ticks” at the 45th Annual Society for Vector Ecology Conference held in San Antonio, TX (100 attendees) *October 2*

HUNTLEY, REGAN B.

- With Dr. Quan Zeng, attended the twilight meeting of the Connecticut Pomological Society and spoke with tree fruit growers and pollinator providers and answered their questions about fire blight and other tree fruit diseases at Norton Brothers Orchard in Cheshire (60 attendees) *June 23, 2015*

KROL, WALTER J.

- Along with Mr. Michael Cavadini and Ms. Terri Arsenault, attended the 4th Annual Manufactured Food Regulatory Alliance (MFRPA) Meeting and annual FDA ISO Accreditation Face-to-Face meeting in San Diego, CA *March 10-12, 2015*

LAMONDIA, JAMES A.

- Met with Greg Hannig and Bond McInnes of DuPont Crop Protection and toured the Valley Lab and a shade tobacco farm with them and discussed CAES tobacco and vegetable pathology research and breeding *July 2, 2014*
- Conducted a research integrity training for staff of the Valley Laboratory (20 attendees) *July 11*
- Spoke about boxwood blight and Phytophthora on nursery crops during the CNLA summer meeting at Van Wilgen’s Garden Center in North Branford (75 attendees) *July 16*
- Spoke to a group of teachers and students from Windsor High School about Valley Laboratory research and services (15 attendees) *July 23*
- Spoke about “Common diseases in ornamental and vegetable gardens” to the Enfield Garden Club (25 attendees) *July 23*
- Discussed plant pathology research at the Valley Laboratory with Dr. Olena Castello of Dow Agro Sciences *July 24*

- Met with Bernard Cailleateau (France and European region) and Jean Marie Piquemal (Laos and Asian region) of Imperial Tobacco to tour research plots and discuss ongoing research concerning blue mold efficacy and fungicide residue on cured cigar tobacco leaves *July 29*
- Led a tour of the Valley Laboratory and Research Farm and discussed plant pathology research with Dr. John Cramer and Kevin Deehan of Valent *August 7*
- Presented an invited paper “Kryptonite for Boxwood Blight: Management with Fungicides and Sanitizers” as part of a symposium “Boxwood Blight: Confronting an Emerging Disease Through Collaborative Connection” at the annual meeting of the American Phytopathological Society in Minneapolis, MN *August 9-14*
- Provided boxwood blight management information to Bartlett Tree Research Laboratories for a presentation to the North Carolina green industry at the NC Arboretum *August 21*
- Examined candidates for the Connecticut Arborist License and participated in the quarterly meeting of the Connecticut Tree Protection Examining Board in New Haven *September 10*
- Submitted posters on “Management of Boxwood Blight Caused by *Calonectria pseudonaviculata*” and “*Calonectria pseudonaviculata* can cause leaf spot and stem blight of *Pachysandra terminalis* and *P. procumbens*” to the International Plant Propagators Society Eastern Region meeting in Niagara Falls, Ontario, Canada *September 17-20*
- Participated in a steering committee meeting to develop an agenda for the Connecticut Vegetable and Small Fruit Growers conference in Vernon *September 22*
- 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 (40 attendees) *September 24*
- Spoke about boxwood blight fungicide management to plant inspectors at the SANC meeting held in Windsor (28 attendees) *September 27*
- Spoke about research results and chaired the annual meeting of the Northeast Regional Multistate Nematology Technical Committee (NE-1040) held in Morgantown, WV *October 13-15*
- Presented research results as a part of the potato cyst nematode research conference call between University researchers and USDA APHIS and Idaho growers and government officials *October 21*
- Met with officials and staff of the Department of Consumer Protection to discuss pesticide use issues in the medical marijuana program *October 24*
- With Rose Hiskes and Diane Riddle, spoke about plant diseases, insects and soil testing and toured the Valley Laboratory with teachers and students from Windsor High School (10 attendees) *October 31*
- Was interviewed about research and services at the Valley Laboratory by Eric Stecker of the Windsor Journal Weekly Newspaper *November 19*
- Was interviewed for the tobacco oral history project for the Library of Congress by Dale and Darcy Cahill *November 25*
- Examined candidates for the Connecticut arborist license and participated in the quarterly meeting of the Connecticut Tree Protection Examining Board in New Haven *December 10*
- Participated in a meeting of the Connecticut Agricultural Information Council at the Valley Lab *January 13, 2015*
- Presented a poster on “Bloat Nematode in Garlic” at the Connecticut Vegetable and Small Fruit Conference held in East Windsor *January 15*
- Spoke to seniors from MARC about research and services at the Valley Lab (12 people) *January 16*
- Participated in the UConn Internship and Co-op Career Fair in Storrs *February 4*
- Spoke about research and services at the Station and Valley Lab summer employment opportunities at the Central Connecticut State University Biology Department Career Fair (60 people) *February 23*
- Welcomed growers to the Annual Tobacco Research Meeting and spoke about research topics and recent developments at the Station, spoke about research on management of tobacco pathogens

including poty viruses, black shank, target spot and blue mold fungicide resistance, spoke about the CORESTA pesticide residue program and strategies to reduce pesticide residues in wrapper leaves, and common molds of cured tobacco (110 people) *February 24*

- 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 (38 people) *February 25*
- 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 *February 27*
- Met with Wisconsin horticulturalist Michael Yanny to talk about boxwood blight research and boxwood breeding *March 4*
- Examined candidates for the Connecticut arborist license and participated in the quarterly meeting of the Connecticut Tree Protection Examining Board in New Haven *March 11*
- Participated in Agriculture Day at the Capitol, speaking about the 2014 Century Farm Award and Holdridge Farm Nursery (100 attendees) *March 18*
- Spoke about boxwood blight biology and management to attendees of the Central Plant Board Meeting held in Lincoln, NE (70 people) *April 15*
- Participated in a meeting of the Connecticut Agricultural Information Council at the Valley Lab *April 28*
- Spoke about research on management of tobacco pathogens including poty viruses, black shank, target spot and blue mold fungicide resistance, and spoke about the CORESTA pesticide residue program and strategies to reduce pesticide residues in wrapper leaves in Windsor Locks (100 people) *April 29*
- Answered questions about Station activities and research while manning a display at the Capitol Corridor *May 27*
- Spoke about the Valley Laboratory, Connecticut wrapper tobacco production and research and toured shade tobacco in Windsor to the Northeast Association of State Departments of Agriculture at the Valley Laboratory (40 people) *June 8*
- Participated in farm tours and interviews by the Connecticut Agricultural Information Council to select the Connecticut Century Farm Award *June 15*
- Met with Greg Hannig of Dupont at the Valley Lab to tour plots and discuss research *June 23*
- Spoke about the Station, services and plant pathology research to Southern Connecticut State University 5th year certificate science teachers *June 24*
- Participated in a planning meeting for Arboriculture 101 in Northford *June 29*

LI, DEWEI

- Gave the oral presentation "Changes of Melbourne Code (1F=1N) and its Implications for Aeromycological Research" at the International Congress of Aerobiology held in Sydney, Australia (58 attendees) *September 21-26, 2014*
- Gave two presentations "The Latest Development of Fungal Systematics" and "Principles of Research Paper Writing (in English) and Publication" at the College of Forestry, NJFU (41 and 84 attendees in the audience, respectively) *September 29-October 28*
- Conducted lab workshops on hyphomycete specimens collected from two field trips in Jiangsu and Hubei Provinces and collaborative studies on fungi associated with pine wood nematode *September 29-October 28*
- Hosted two visiting mycologists, Dr. Bao-Kai Cui and Dr. Li-Wei Zhou, of the Beijing Forestry University and the Applied Ecology Institute, Chinese Academy of Sciences, respectively *December 4*
- Participated in an advisory board meeting of the project "Recovery from catastrophic weather: Hurricane Sandy mold exposure and health-related training" at UConn Health Center *December 19*

- Hosted two visiting mycologists, Dr. Bao-Kai Cui and Dr. Li-Wei Zhou, of the Beijing Forestry University and the Applied Ecology Institute, Chinese Academy of Sciences, respectively *December 4*
- Participated in an advisory board meeting of the project “Recovery from Catastrophic Weather: Hurricane Sandy: Mold Exposure and Health-Related Training” at the UConn Health Center *December 19*
- Participated in a meeting of the advisory board and research team for “Recovery from Catastrophic Weather – Hurricane Sandy: Mold Exposure and Health-Related Training project” held at UConn Health Center, Center for Indoor Environments and Health in Farmington *March 13, 2015*
- Participated in the indoor air quality meeting of the Connecticut Institute for Clinical and Translational Research (CICATS), and represented CICATS’s Occupational Safety and Health Core Interest Group (OSH CIG) at the UConn Health Center *March 25*
- Participated in a meeting of the advisory board and research team for “Recovery from Catastrophic Weather – Hurricane Sandy: Mold Exposure and Health-Related Training project” at the UConn Health Center, Center for Indoor Environments and Health in Farmington. Dr. De-Wei Li is serving as an advisor for the project. During the meeting participants discussed the progress of the project and the final workshop (12 participants) *June 12*

LI, YONGHAO

- Staffed the CAES booth and answered questions about tree diseases at the CTPA Summer Meeting held at the Farmington Club (745 attendees) *July 17, 2014*
- Gave the talk “Phytophthora Root Rot of Christmas Trees and Their Management” at the CCTGA Twilight Meeting in Windsor (35 attendees) *July 22*
- Gave the talk “Common Needlecasts of Christmas Trees and their Control” at the CT Christmas Tree Growers Association twilight meeting in Middletown (35 attendees) *August 20*
- Was interviewed about the fall foliage season in Connecticut by Pam McLoughlin for the New Haven Register *September 4*
- Spoke on “Disease Management in Christmas Tree Farms” at the CCTGA Fall Field Day in Warren (40 attendees) *September 20*
- Was interviewed about how stress shows up in foliage by Penelope Overton for the Waterbury Republican-American *September 24*
- Staffed the “hands-on” table with tree diseases for Arboriculture 101 in Wallingford (40 attendees) *October 22*
- Presented “Update of Plant Diseases in 2014” at the Extension/Industry Meeting at the annual Meeting of the Northeastern Division of the American Phytopathological Society in Portsmouth, NH (32 adult attendees) *October 29-31*
- Gave the invited talk “Plant Quarantine Regulations in the United States” for students, faculty and staff at Northeast Agricultural University in Harbin, China (50 attendees) *November 24*
- Gave a talk titled “Diseases of greenhouse vegetables” at the UConn extension program “Growing Container-Grown Greenhouse Vegetables” in Torrington (61 attendees) *December 16*
- Staffed the Station booth and answered questions about tree diseases at the CTPA Winter Meeting held at Aqua Turf in Plantsville (760 adult attendees) *January 15, 2015*
- Gave a talk titled “Bedding crop diseases and their management” at the UConn-CAES Spring Bedding Plant Meeting in Torrington (35 attendees) *February 3*
- Gave a talk titled “Bedding crop diseases and their management” at the UConn-CAES Spring Bedding Plant Meeting in Vernon (37 attendees) *February 5*
- Gave a lecture titled “Diseases of the landscape” for the Stamford Arboretum’s Arboriculture 101 class in Stamford (8 attendees) *February 17*

- Spoke about “Disease control in the home vegetable garden” at the Connecticut Flower and Garden Show in Hartford (70 attendees) *February 20*
- Was interviewed about the impact of this year’s cold winter temperatures on woody ornamentals by Robert Miller of the News-Times *February 24*
- Was interviewed about whether we can expect anything different this spring due to the harsh winter by Dana Whalen of WTIC Radio in Farmington *March 2*
- Gave a talk titled “Fungal diseases associated with spruce decline” at the Forest Health Monitoring Workshop at Sessions Woods in Burlington (60 attendees) *March 3*
- Spoke about “Organic management of vegetable diseases” at CT NOFA’s 33rd Annual Winter Conference in Danbury (43 attendees) *March 7*
- Staffed the “Hands-on” table with tree diseases for Arboriculture 101 in Wallingford (36 attendees) *March 11*
- With Ms. Lindsay A. Patrick, spoke about the Plant Disease Information Office for a visiting group from Southern Connecticut State University Botany Club in New Haven (13 attendees) *March 13*
- Was interviewed about white pine blister rust by Glenn Rosenholm, the public affairs specialist at the USDA Forest Service in New Hampshire *March 13*
- Gave a talk titled “Common Diseases in Woody and Herbaceous Ornamentals” for the 2015 Study Group of the Institute for Learning in Retirement in New Haven (4 attendees) *April 29*
- Spoke about the role of the Plant Disease Information Office to a group from the Urban Resources Initiative of Yale University’s School of Forestry & Environmental Studies who were touring the Station (20 attendees) *June 16*
- Gave a talk titled “Needlecast disease management” at the twilight meeting of the CT Christmas Tree Growers Association in Guilford (35 attendees) *June 17*

MAIER, CHRIS T.

- Displayed the sugar maple borer, a longhorned beetle not seen in about 50 years, and a fact sheet about it, at a meeting of the Connecticut Entomological Society at UConn in Storrs *September 19, 2014*
- Displayed new entomological literature and a large katydid species at a meeting of the Connecticut Entomological Society at Yale University in New Haven *October 17*
- Spoke about the wild and ornamental host plants of the spotted wing drosophila while attending the annual New England, New York, and Canadian Fruit Pest Management Workshop in Burlington, VT (44 attendees) *October 21*
- Displayed new entomological literature and a large katydid species at a meeting of the Connecticut Entomological Society at Yale University in New Haven *October 17*
- Spoke about the wild and ornamental host plants of the spotted wing drosophila while attending the annual New England, New York, and Canadian Fruit Pest Management workshop in Burlington, VT (44 attendees) *October 21*
- Spoke about the distribution and impact of the brown marmorated stink bug at a meeting of the Advisory Committee of the Cooperative Agricultural Pest Survey, USDA, in Wallingford (12 attendees) *November 6*
- Presented the poster “Emergence of Periodical Cicadas of Brood II in Connecticut in 2013” while attending the annual meeting of the Entomological Society of America in Portland, OR *November 18*
- Discussed the brown marmorated stink bug with growers at the annual meeting of the Connecticut Pomological Society in Glastonbury (70 attendees) *December 2*
- Displayed new entomological literature at a meeting of the Connecticut Entomological Society at Yale University, New Haven *February 20, 2015*
- Spoke about “Alien insects lurking in or near Connecticut forests” at the Forest Health Monitoring Workshop at Sessions Woods in Burlington (60 attendees) *March 3*

- Attended a meeting of the Connecticut Entomological Society at the University of Connecticut in Storrs *March 27*
- Exhibited historical Connecticut maps and live insects at the Annual Dinner Meeting of the Connecticut Entomological Society in Jones Auditorium *May 15*
- Spoke about the brown marmorated stink bug at a meeting of the Advisory Committee of the Cooperative Agricultural Pest Survey held in Jones Auditorium *June 16*
- Spoke about alternate hosts of the brown marmorated stink bug and the spotted wing drosophila at a twilight meeting of the Connecticut Pomological Society at Norton Brothers Orchard in Cheshire *June 23*

MAJUMDAR, SANGHAMITRA

- Presented a poster “Nanoceria affects kidney bean proteome compromising seed nutritional quality” at the Gordon Research Conference on Environmental Nanotechnology, Mount Snow, West Dover, VT (180 attendees) *June 21-26, 2015*

MARRA, ROBERT E.

- Participated in a conference call of the Boxwood Blight Working Group about research funding and the upcoming APS Boxwood Blight symposium (14 attendees) *July 9, 2014*
- Gave a presentation on molecular diagnostics and detection of the boxwood blight pathogen for the Horticultural Inspection Society, Eastern Chapter SANC exercise at the Valley Laboratory in Windsor (25 attendees) *September 30*
- Gave the presentation “Assessing Internal Decay in Trees Nondestructively Using Tomography” at the 26th Annual Conference on Urban and Community Forestry and 10th Annual Forest Forum held at the Aqua Turf Club in Plantsville (60 adult attendees) *October 29*
- Presented the talk “Molecular Diagnostics for the Boxwood Blight Pathogen” at the annual meeting of the Northeastern Division of the American Phytopathological Society held in Portsmouth, NH (32 adult attendees) *October 29-31*
- Presented a talk titled “Tropical Storms, Hurricanes, and Superstorms: Impacts and Influences on Tree Diseases” to the North Haven Garden Club (45 attendees) *January 8, 2015*
- Presented a talk titled “Assessing internal decay in trees nondestructively with tomography” at the Forest Health Monitoring Workshop, held at Sessions Woods Wildlife Management Area, in Burlington (60 attendees) *March 3*
- Was an invited speaker at the 53rd Annual Minnesota Shade Tree Short Course, a conference for tree care professionals, sponsored by the Minnesota Society of Arboriculture and the University of Minnesota Continuing Education Program. Dr. Marra’s seminar titled “Drought and its impact on tree health” was presented on both days (1,200 attendees) *March 17-18*
- Participated in a discussion and luncheon with members of the Yale School of Forestry and Environmental Studies to discuss opportunities for collaborations and interactions between CAES and YSFES in Jones Auditorium *April 13*
- Participated in a bioinformatics training workshop in Raleigh, NC *May 18-23*
- Gave a presentation at the Childs Center at Great Mountain Forest, in Falls Village, on nondestructive tree assessment using tomography, called “CAT Scans for Trees.” The 1-hour presentation was followed by a 30-minute demonstration of both Sonic Tomography and Electrical Resistance Tomography *May 30*
- Spoke to a citizens group from the Urban Resources Initiative of Yale University’s School of Forestry & Environmental Studies, who were visiting the Station to learn about the role of CAES, its services, and the grounds *June 16*

MAYNARD, ABIGAIL A.

- Spoke to growers about the New Crops Program at the Farmers' Market in New Haven *August 20, 2014*
- Spoke to growers about the New Crops Program at the Farmers' Market in Durham *August 21*
- Spoke to growers about the New Crops Program at the Farmers' Market in Bethel *August 23*
- Spoke to growers about the New Crops Program at the Farmers' Market in North Haven *August 24*
- Spoke to growers about the New Crops Program at the Farmers' Market in West Haven *August 28*
- Spoke to growers about the New Crops Program at the Farmers' Market in Hamden *August 29*
- With Dr. David Hill, judged fruits and vegetables at the North Haven Fair *September 4*
- Talked about the New Crops Program with growers at the Hamden Farmers' Market *September 12*
- Talked to students about careers in agriculture at Hamden Hall Country Day School (16 students, 1 teacher) *October 16*
- Reported on Station activities at a quarterly meeting of the Council on Soil and Water in Windsor (10 attendees) *October 30*
- Was filmed in a documentary about local food production by Wesleyan students at Lockwood Farm *November 7*
- Spoke about the New Crops Program to students of George Baldwin from the Sound School (10 students, 1 teacher) *November 13*
- Displayed information on the New Crops Program at the annual meeting of the Connecticut Pomological Society in Glastonbury *December 2*
- Reported on CAES activities at a meeting of the State Technical Committee in Tolland (21 attendees) *January 14, 2015*
- Displayed information about the New Crops Program at the Connecticut Vegetable and Small Fruit Growers meeting (300 attendees) *January 15*
- Participated in a quarterly meeting of the Council on Soil and Water Conservation *January 22*
- Visited and discussed the New Crops Program at Borelli's Farm in North Haven and Hindinger's Farm in Hamden *February 13*
- Discussed the New Crops Program with an AP Biology class at Hamden Hall Country Day School (12 students, 1 teacher) *February 19*
- Spoke on "Unusual Garden Vegetables" to the North Haven Garden Club (37 adult attendees) *March 12*
- Spoke about the New Crops Program to the Botany Club from Southern Connecticut State University (15 students, 1 teacher) *March 13*
- Visited the Medlyn Farm in Branford *March 16*
- Assisted Lower School teachers in planning springtime garden projects at Hamden Hall Country Day School (5 teachers) *April 16*
- Attended a meeting at the Station with Richard Fu from Agrevolution to discuss indoor vertical vegetable farming (with Charles Vossbrinck and Theodore Andreadis) *April 17*
- Reported on Station activities at a quarterly meeting of the Council on Soil and Water Conservation in Middletown (23 adults) *April 21*
- Worked with environmental science students with their projects at Hamden Hall Country Day School (2 teachers, 16 students) *May 6*
- Talked about careers in agricultural to biology students at Hamden Hall Country Day School (2 teachers, 52 students) *May 21*
- Discussed the New Crops Program and toured Rose Farm in Glastonbury *June 19*

MERVOSH, TODD L.

- Organized the meeting and presented the talk "Evaluation of a new herbicide, Indaziflam" at the Christmas Tree Twilight Meeting at the Valley Laboratory in Windsor (45 attendees) *July 22, 2014*

- Volunteered as a judge and photographer at the Collegiate Weed Science Contest (65 graduate and undergraduate students from seven universities) and participated in a board meeting of the Northeastern Weed Science Society at Penn State University in State College, PA *July 29-30*
- Was interviewed about biological control of mile-a-minute weed by Matt Dwyer of WTIC-AM 1080 News *August 1*
- Participated in a symposium planning meeting for the Connecticut Invasive Plant Working Group at the Valley Laboratory *August 5*
- Participated in the northeast regional planning meeting for the IR-4 Program for Specialty Crops in Albany, NY *August 20-21*

MOLAEI, GOUDARZ

- Gave the talk “Tracking Ticks and Tick-borne diseases in Connecticut,” and represented the CAES on a panel to discuss new scientific approaches to Lyme disease testing and diagnosis at a symposium on the laboratory testing for spirochetemia in *Borrelia burgdorferi* and *Borrelia miyamotoi* infections at the Connecticut State Capitol Building *September 16, 2014*
- Presented his research and met with students during the Quinnipiac School of Medicine, Capstone Mentor Fair *October 16*
- Was skype-interviewed by Fanming Shirley Wang as part of the career exploration of the University of Toronto students by participation in the Extern Job Shadowing program to explore career directions *November 3*
- Hosted and discussed services offered at the CAES Tick Testing Laboratory and gave a tour of the lab to Alpa Patel of Lyme Care Outreach and Stephen Arndt, Director of Lyme Care Services, My Health 1st Urgent Care in Milford *November 26*
- Gave an invited talk titled: “Dynamics of Vector-Host Interaction and Emergence of Eastern Equine Encephalitis in Northeastern USA,” and was a co-author of another presentation at the 60th Annual Meeting of the Northeastern Mosquito Control Association in Cambridge, MA *December 9*
- Gave an invited lecture, “Eco-epidemiology of Old World Malaria” for the Biology of Insect Disease Vectors course at the Yale School of Public Health (approx. 20 attendees) *January 28, 2015*
- Gave an invited talk “Dynamics of vector-host interactions and epizootiology of eastern equine encephalitis virus” at the Virginia Mosquito Control Association Annual Meeting *via video conferencing February 6*
- Gave an invited talk “New threats and old enemies: Vector-host interactions and the emergence and expansion of arboviruses in the USA” for the Department of Entomology, Rutgers University (approx. 45 attendees) *February 6*
- Met with Professor Rebecca Rico-Hesse, Department of Molecular Virology & Microbiology and the Department of Pediatrics, Baylor College of Medicine and discussed research topics of interest *February 19*
- Hosted two members of the Pennsylvania Department of Environmental Protection for a one-day training on mosquito blood meal analysis *March 11*
- Along with Ms. Saryn Kunajukr, presented an invited talk to the Western Connecticut Council of Governments Tick Borne Illness Prevention Task Force (joint meeting of the Lyme Registry, Danbury Hospital and Health Departments) where they also discussed research on ticks and tick-borne pathogens, as well as changes to the CAES Tick Testing Program (23 attendees) *March 18*
- Along with Drs. Philip Armstrong and Doug Brackney and Director Theodore Andreadis, met with Dr. Albert Ko, of the Yale School of Public Health to discuss collaboration *April 10*
- Along with Dr. Scott Williams and Michael Thomas, led graduate students, postdoctoral fellows and faculty of the Yale School of Public Health on tours of the CAES mosquito and tick study sites in Chester and Madison, as well as the relevant CAES laboratories in New Haven (10 attendees) *April 18*

- Organized a symposium titled, “Public Health Research and Services” at the CAES in coordination with the Connecticut Department of Public Health and health departments from throughout the State and presented a talk on “Tick Research and Diagnostic Services” (approx. 55 attendees) *May 6*
- Helped organize the Annual Northeastern Eastern Equine Encephalitis Virus Conference at the CAES in collaboration with the CDC and presented the talk “Dynamics of Vector-Host Interaction and Emergence of Eastern Equine Encephalitis in the Northeastern USA” (approx. 40 attendees) *May 8*
- Hosted a summer season citizens group of the Hixon Center for Urban Ecology, Urban Resources Initiative (URI), Yale School of Forestry & Environmental Studies at the CAES Tick Testing Laboratory, and presented a short talk on tick-associated diseases and services offered at this laboratory (20 attendees) *June 16*
- Was interviewed by WNPR about the CAES Tick Testing Program *June 23*
- Hosted a group of students from the Central Connecticut State University at the Molecular Vector Biology Laboratory/Tick Testing Laboratory, and presented a short talk on mosquito and tick research projects, as well as services offered by the CAES Tick Testing Laboratory (17 attendees) *June 25*
- Was interviewed by the newspaper Republican American, Waterbury, about the CAES Tick Testing Program and research projects *June 28*

PATRICK, LINDSAY A.

- Attended the CTPA Arboriculture 101 course in Wallingford *January-April 8, 2015*
- Staffed the Station booth and answered questions about tree diseases at the CTPA Winter Meeting held at Aqua Turf in Plantsville (760 adult attendees) *January 15*
- Attended and participated in the NPDN STAR-D Quality Management Systems Training workshop in Ames, IA *January 27-30*
- Attended and participated in the NPDN Phytoplasma Molecular Detection Training workshop in Beltsville, MD *March 3-4*
- With Dr. Yonghao Li, spoke about the Plant Disease Information Office for a visiting group from Southern Connecticut State University Botany Club in New Haven (13 attendees) *March 13*
- Attended and participated in the NPDN *Phytophthora ramorum*/*P. kernoviae* Molecular Diagnostics Workshop in Beltsville, MD *March 24-27*
- With Pamela Sletten, spoke about the Plant Disease Information Office for a visiting group of young students on Arbor Day in New Haven (40 attendees) *April 24*
- Volunteered as a Special Award Judge for the New Haven Science Fair *May 11-12*
- With Dr. Yonghao Li, spoke about the Plant Disease Information Office for a visiting group from the Urban Resources Initiative at Yale University in New Haven (20 attendees) *June 16*
- Spoke about the Plant Disease Information Office for a visiting group of students from Central Connecticut State University in New Haven (20 attendees) *June 25*

PIGNATELLO, JOSEPH J.

- Gave two lectures, “Formation of Exceptionally Strong ‘Low-Barrier’ Hydrogen Bonds Between Weak Acid Adsorbates and Carboxyl/Hydroxyl Groups on Pyrogenic Carbonaceous Surfaces” and “Sorption Selectivity in Natural Organic Matter Studied with NMR Spin and Relaxation Probes”; co-authored five additional oral presentations and one additional poster; and co-chaired a symposium titled “Pyrogenic Carbonaceous materials as Adsorbents of Inorganic and Organic Compounds: Fundamentals and Applications” at the 248th American Chemical Society National Meeting, Environmental Chemistry Division, in San Francisco, CA *August 10-14, 2014*
- Presented his research and met with students during the Quinnipiac School of Medicine, Capstone Mentor Fair *October 16*
- Was Keynote Speaker for the symposium “Nanoparticle Form and Fate in Soil and Water,” and presented the talk “Biochar Nanoparticles and their Interaction with Engineered Cerium Oxide

Nanoparticles” at the Soil Science Society of America Annual Meeting in Long Beach, CA (150 attendees) *November 2-6*

- Met with Yale CEE seminar speaker, Prof. Phillip Jessop, Dept. of Chemistry, Queen’s University, Ontario to discuss mutual research interests *December 3*
- Attended a grantees workshop Heavy Hydrocarbon Scientific Research Group, at the Chevron Inc. corporate headquarters in San Ramon, CA (approx. 100 attendees) *January 22-23, 2015*
- Visited Prof. Baoshan Xing, University of Massachusetts, Amherst, to discuss collaborative research *February 12*
- Gave the talk “Laboratory Tests of Biochars as Absorbents for Use in Recovery or Containment of Marine Crude Oil Spills” and co-organized and co-chaired the symposium “Oil-Dispersants-Sediment Interactions and Their Implications on Weathering and Remediation of Spilled Oil in the Gulf of Mexico Ecosystems” at the Gulf of Mexico Research Initiative Conference in Houston, TX (approx. 200 attendees) *February 17*
- Gave a keynote lecture, “Interactions and Reactions of Organic Compounds at Interfaces between Water and Pyrogenic Carbonaceous Materials” (100 attendees) and a volunteered lecture, “Sunlight-Driven Photochemical Halogenation of Dissolved Organic Matter in Seawater: A Natural Abiotic Source of Organobromine and Organoiodine” (50 attendees) at the 249th American Chemical Society National Meeting in Denver, CO *March 22-26*
- Visited with Prof. Paige Novak, The Biotechnology Institute, University of Minnesota, to discuss mutual research interests *April 22*
- Accepted the award for Best Paper of the Year from the Quinnipiac Chapter of the Sigma Xi at their annual meeting in Hamden *April 22*
- Gave the keynote address, “Biochar—Research at the CAES on its Potential Uses,” at the Annual Meeting of the Experiment Station Associates (approx. 40 attendees) *April 8*
- Gave the talk “Adsorption of Polar and Ionic Compounds to Pyrogenic Carbonaceous Materials” and co-authored a poster “Bioaccessibility of PAHs in Fuel Soot Assessed by an *in vitro* Gastrointestinal Model Including a Third-phase Absorptive Sink: Effect of Food Ingestion” at the Society of Environmental Toxicology and Chemistry, Europe Annual Meeting in Barcelona, Spain (approx. 250 attendees) *May 3-7*
- Attended the annual meeting of the Connecticut Academy of Science and Engineering (CASE) in Cromwell *May 19*
- Presented a poster “Nanoscale Interactions between Engineered Nanomaterials and Black Carbon (Biochar) in Soil” and co-authored a second poster at the Gordon Research Conference on Nanoscale Science & Engineering for Agriculture & Food Systems at Bentley University in Waltham, MA (135 participants) *June 7-12*
- Gave a talk “Photocatalysis By Polyoxometalates In Water Treatment: A Detailed Study Of Catalyst Regeneration And Reactive Oxygen Species Formation From Bulk Oxidants” (approx. 100 attendees); and co-authored a second talk and two posters at the conference of the Association of Environmental Engineering Scientists and Professors, Yale University (approx. 600 registrants) *June 13-16*

PRAPAYOTIN-RIVEROS, KITTY

- Attended the 4th Annual Manufactured Food Regulatory Alliance (MFRPA) & Governmental Food and Feed Laboratories Accreditation Meeting in San Diego, CA and received 13 credits from Professional Acknowledgement for Continuing Education (P.A.C.E) by Association of Public Health Laboratories (APHL) *March 10-12, 2015*
- Participated in the educational activity titled “Integrating Measuring and Monitoring for Effective Lab Improvements” and received 6.5 credits from P.A.C.E by APHL in Silver Spring, MD *March 19*

RIDGE, GALE E.

- Was interviewed about summertime insect pests by *The Day* *July 16, 2014*
- With Drs. Alia Servin and Roberto de la Torre Roche (Department of Analytical Chemistry), established a Spanish interpretation service for citizens who do not speak English. This was due to a rise in the number of Spanish-speaking citizens calling in for help *July*
- With Dr. Kimberly A. Stoner, met with the Superintendent of Southington Schools and other leaders regarding a solitary ground-nesting bee aggregation in a playground at Strong Elementary School in Plantsville *August 25*
- Was interviewed by Channel 3 about solitary ground-nesting bees *August 27*
- Was interviewed about the unusually high populations of yellow jackets experienced in Connecticut this year by the *Record Review* *September 23*
- Was interviewed about the science of Entomology by *Trekaroo*, a children's magazine *September 23*
- Presented a talk about bed bugs and their history with capitalism to the Connecticut Community Providers Association in Rocky Hill (30 attendees) *September 25*
- Planned and held Bed Bug Forum VIII at Middlesex Community College in Middletown (110 attendees) *October 16*
- Participated in the Capstone Mentor Fair held at the Medical School of Quinnipiac University in North Haven *October 16*
- Was invited to review and rewrite the Quinnipiac University Bed Bug Protocol Student Handout *October 20*
- With Katherine Dugas and Nicole Gableman, staffed a bed bug information table at the Health Fair at the University of Bridgeport (500 attendees) *October 23*
- Gave a lecture on bed bugs and human history at the Connecticut Mental Health Center in New Haven (78 attendees) *October 28*
- Was interviewed about the discovery of the Southern Pine Beetle on Long Island, which is suspected to have been introduced by Hurricane Sandy in 2012, by John Burgeson of the Connecticut Post *October 30*
- Spoke about bed bug management in multi-unit housing at the Connecticut Apartment Association annual conference held at Foxwoods Casino in Ledyard (102 attendees) *November 7*
- Hosted students from the Sound School in the insect inquiry office (15 students and teachers) *November 13*
- Was interviewed about insects of medical importance in Connecticut by Harlan Levy of the *Journal Inquirer* *November 17*
- Presented a half-day training program to pest management supervisors for their recertification accreditation in Meriden (114 attendees) *November 18*
- Spoke about bed bugs, poverty, and current management to a meeting of northeastern health directors, town officials, healthcare representatives, and social and emergency service providers in Brooklyn (75 attendees) *November 25*
- Presented a talk about bed bugs, economic history, and how international trade assisted the insect in its return, in Burlington, VT (65 attendees) *December 3*
- Participated in an EPA-sponsored webinar titled "Controlling Bed Bugs in School Environments" (600 participants nationally) *December 16*
- Was a guest in a live radio broadcast about bed bugs with Larry Rifkin of WATR in Waterbury *January 6, 2015*
- Spoke about bed bug management in senior housing to the Susan B. Perry senior community in Winsted. Upon their request, she followed up by writing bed bug pest management protocols for the community (40 attendees) *March 16*
- On March 19, Dr. Ridge identified the Southern pine beetle *Dendroctonus frontalis* Zimmermann, found in red pine from Wharton Brook State Park, on the North Haven/Wallingford town line, and

collected by Dr. Claire Rutledge on March 17. This is a new State record. It is a bark beetle of concern, since it is a destructive pest of pine in the Southern United States.

- Dr. Ridge participated in a national EPA webinar focusing on bed bugs and school environments *March 19*
- Six type and cotype slide mounts of mites identified by Garman were loaned to Dr. Salvatore Ragusa at the Laboratori Acarologia Applicata in Palermo, Italy, to assist in a revision of a group of mites of which these are a part. These are part of the holdings of the insect collection *March 23*
- Presented a lecture on bed bugs at Southern Connecticut State University (90 attendees) *March 25*
- Was interviewed by a reporter from the Record Journal about the discovery of a dead caterpillar in processed pears found by a student at Wallingford High School *March 25*
- Gave a talk about bed bugs to the Capital Region Mental Health Center in Hartford (27 attendees) *March 31*
- Gave a talk about bed bugs to the Department of Developmental Services via webcast in Wallingford (Statewide) *March 31*
- Was published in the Hartford Courant under the headline “Pesky Pests Become An Epidemic.” The article was about bed bug management in Connecticut *April 6*
- Was interviewed about Powassan Virus and Lyme disease transmitted by the black legged tick by Larry Rifkin of WATR *April 14*
- In collaboration with Sherill Baldwin of DEEP and Justine Fallon of the Mattress Recycling Council, she published an informational trifold addressing bed bugs, to help transfer station attendants cope with handling recycled mattresses that are bed bug infested. This is part of a recently passed mattress recycling law in Connecticut *April 14*
- Spoke about bed bug to nurses of the Department of Developmental Services in Wallingford (45 attendees) *April 15*
- Teleconferenced from her desk at the Station a talk on bed bugs and school management with West Hill School in Rocky Hill. Staff members from other area schools, the Board of Education, and the Health Department attended the talk (60 attendees) *April 20*
- Spoke to two school groups visiting the insect information office as part of the celebration of Arbor Day at the Station *April 24*
- Was visited by first-grade students from St. Thomas Day School and discussed the roll of the Insect Information Office *May 6*
- Gave a talk about numerous protective behaviors and speciation of the Common bed bug *Cimex lectularius* L. at the Public Health Research and Services Symposium, which was sponsored by CAES under the leadership of Dr. Goudarz Molaei *May 6*
- Was interviewed about gypsy moth, mosquitoes and chikungunya virus, and emerald ash borer by Harlan Levi, Hartford Courant *May 11*
- Was interviewed and broadcast on WTNH TV Channel 8 about the current gypsy moth outbreak *June 18*
- Was interviewed about gypsy moths by WATR, Waterbury *June 19*
- Was interviewed about gypsy moths by the Waterbury Republican-American *June 22*
- Was interviewed about gypsy moth defoliation and its effects on tree health by the Waterbury Republican-American *June 26*
- The Shelton Herald published her comments on the “Gypsy moth outbreak in Connecticut” *June 26*

ROBB, CHRISTINA S.

- Gave a tour of the department to a student from Sport and Medical Sciences Academy in Hartford *August 19, 2014*
- Participated in the FERN FDA T022 Validation Workgroup conference call *August 28*

- Participated by phone in the September Board meeting for the Eastern Analytical Symposium *September 19*
- Gave the presentation “Screening the Food Supply Routinely and in Emergencies” to the Science Club at Hamden High School (35 attendees) *October 3*
- Conducted a tour of the department for the Sound School (15 attendees) *November 14*
- Participated in the Eastern Analytical Symposium in Somerset, NJ *November 16-19*
- Participated in the EAS Board Meeting *November 16*
- Attended a board meeting for the Eastern Analytical Symposium (EAS) in Somerset, NJ *December 5*
- Participated in a webinar-based board meeting for the Eastern Analytical Symposium *February 13, 2015*
- Gave a presentation titled “Screening the food supply: routinely and in emergencies” to the Sigma Xi seminar series at Quinnipiac University in Hamden (30 attendees) *March 24*
- Served as a judge for the Sigma Xi Student Research Symposium at Quinnipiac University *April 22*
- Attended a board meeting of the Eastern Analytical Symposium by phone *May 1*
- Gave a tour of the department to visiting students from Central Connecticut State University *June 25*

RUTLEDGE, CLAIRE E.

- Presented the talk “Emerald Ash Borer in Connecticut” at the White Memorial Conservation Center in Litchfield (15 attendees) *July 7, 2014*
- Presented the talk “An Update on Emerald Ash Borer in Connecticut” at the Connecticut Tree Protective Association’s annual summer meeting held in Farmington (80 attendees) *July 17*
- Presented the talk “Emerald Ash Borer in Connecticut” at the Flanders Nature Center in Woodbury (23 attendees) *July 30*
- Met with officials from the Minnesota Department of Agriculture, the Department of Entomology at the University of Minnesota, and the Department of Forest Resources at the University of Minnesota, at a ball field with a colony of *Cerceris fumipennis* in Oakdale, Minnesota to demonstrate Wasp Watching techniques and to discuss the nascent Minnesota Wasp Watching Program *August 12*
- Presented the talk “Emerald Ash Borer in Connecticut, Current Range, Severity and Biological Control” to the 3rd Annual Connecticut Tree Protective Association EAB Tour in Southbury (80 attendees) *September 18*
- Presented the talk “The Connecticut Wasp Watchers Experience: Using a Native Wasp and Citizen Scientists to Detect the Emerald Ash Borer” at the Urban Forest Entomology Seminar at the Joint Annual Meeting of the Entomological Societies of Canada and Saskatchewan held in Saskatoon, SK, Canada (34 attendees) *September 29*
- Taught the lecture and laboratory sections of “Insects that attack trees” for the Connecticut Tree Protective Association’s Arboriculture 101 course in Wallingford (45 attendees) *October 15, 22*
- Presented the talk “*Cerceris fumipennis*” using a native wasp to find an invasive beetle” to the Connecticut Entomological Society in New Haven (37 attendees) *October 17*
- Presented the poster “Prey diversity of *Cerceris fumipennis* in Connecticut” at the annual meeting of the Entomological Society of America in Portland, OR *November 18*
- Attended the Connecticut Tree Protective Association Winter Meeting where she was honored to be nominated for and elected to the Governing Board of the Connecticut Tree Protective Association *January 15, 2015*
- Gave a talk titled “Little trees get eaten too, insects attacking trees” to the Greater New Haven Bonsai Society in New Haven (15 adults attended) *February 10*
- Taught the lecture and laboratory sections of “Insects that attack trees” for the Connecticut Tree Protective Association’s Arboriculture 101 course in Wallingford (45 adults attended) *February 18, March 11*

- Taught the class “Insects attacking trees” for an arborist course at Bartlett Arboretum in Stamford (15 adults attended) *February 19*
- Presented a table “Biosurveillance, using a native wasp to find invasive beetles” at the African Americans in Science Day at the Discovery Museum in Bridgeport (75 adults and youths attended) *February 21*
- Gave a lecture titled “Little trees get eaten too: insects and mites attacking bonsai” for the Greater Hartford Area Bonsai Club in Wethersfield (16 adult attendees) *March 16*
- Gave a lecture titled “Using a native wasp to find an invasive beetle” for the Master Gardener course in Haddam (40 adult attendees) *March 31*
- Was interviewed about Southern pine beetle by Tony Terzi, FoxCT *April 1*
- Gave a talk titled “Emerald ash borer in Connecticut” to the Litchfield Hills Audubon Society at the Litchfield Community Center (45 adult attendees) *April 6*
- Was interviewed about Southern pine beetle by Michael Puffer, Waterbury Republican-American (story published April 13) *April 7*
- Met with a group from the Vermont Department of Forests, Parks and Recreation for a tour of the University of Connecticut’s Biodiversity Research Collections in Storrs *April 10*
- Was interviewed about Southern pine beetle by John Silva, WTIC AM 1080 *April 13*
- Was interviewed about Southern pine beetle by Sujata Jain, WFSB, Eyewitness News 3 *April 13*
- Was interviewed about Southern pine beetle by Tina Detelj, WTNH, News 8 *April 14*
- Gave a talk titled “Biosurveillance, finding an invasive beetle with a native wasp” to the Master Gardeners class at the UConn Cooperative Extension Center in Bethel (50 adult attendees) *April 16*
- Gave a guest lecture on “Detection and biological control of Emerald ash borer in Connecticut” in the course Integrated Pest Management, taught by Dr. Ana LeGrand, at UConn in Storrs (30 adult attendees) *April 21*
- Gave a talk “Emerald ash borer in Connecticut” to the group “People Enjoying People” at the Calvary Presbyterian Church in Enfield (25 adult attendees) *April 21*
- Gave talks on invasive insects to two groups of 5th graders, one from Chester and one from Eastford, visiting the Station for the Arbor Day celebration (50 youth and 15 adult attendees) *April 24*
- Was interviewed about Southern pine beetle by Steve Singer, Associated Press, Hartford *April 30*
- Spoke about the emerald ash borer at the Connecticut Audubon Society Center in Ridgefield as part of their master naturalists program *May 5*
- Was interviewed about Southern pine beetle by Judy Benson of The Day, resulting in the article “Southern Pine Beetle Found Invading All Corners of State,” which ran on June 1, 2015 <http://www.theday.com/article/20150530/NWS01/150539946> *May 29*
- Served as examiner for the state arborist licensing exam held at the Station *June 10*
- Attended the semi-annual Cooperative Agricultural Pest Survey (CAPS) meeting in Jones Auditorium *June 16*

SCHULTES, NEIL P.

- Spent a week in the laboratory of colleague and collaborator Dr. George Mourad in the Department of Biology, Indiana-Purdue University, Ft. Wayne, IN. During the week, he held meetings with undergraduate and graduate students discussing results and planning experiments for the upcoming year. Participants included Dr. Vamsi Nalam, Amanda Stoffer, Micha Rapp, and Geeta Buda *July 7-11, 2014*
- Hosted Anna Mercaldi, a senior at Cheshire High School, as part of a day-long job shadow *August 9*
- With Dr. Richard Peterson, participated in an executive meeting of the Quinnipiac Chapter of Sigma Xi *September 17*
- Presented a lecture titled “Genetically Modified Plants in Agriculture” to a freshman Seminar class at the University of Hartford (18 students attended) *October 1*

- Spoke to high school students from the Sound School, who are studying biotechnology, about current experiments in the C4 Rice project that he and Dr. Richard Peterson are researching *November 13*
- Participated in an executive board meeting for the Quinnipiac Chapter of Sigma Xi *January 22, 2015*
- Presented a lecture on “Genetically Modified Plants” to a Yale University Freshman Science Seminar class Scie031 (12 students attended) *January 23*
- Presented a lecture on “Genetically Modified Plants” to a Yale University Freshman Science Seminar class Scie031 (12 students attended) *January 30*
- Presented a lecture on “Genetically modified plants” to a Yale University Freshman Science Seminar class Scie031 (12 students attended) *February 6*
- Arranged a tour of the Experiment Station by twelve members of the Southern Connecticut State University Botany Club. Drs. Yonghao Li, Blaire Steven (Dept. of Environmental Sciences), Abigail Maynard and Adriana Arango-Velez (Dept. of Forestry & Horticulture) discussed their research programs *March 13*
- Organized the judging for the Fourth Annual Student Research Conference hosted by Quinnipiac Sigma Xi Chapter. Other members of the Department of Plant Pathology and Ecology who served as judges were Drs. Wade H. Elmer, Richard Peterson, Lindsay R. Triplett, and Quan Zeng. Additional judges from CAES were Dr. Adriana Arango-Velez (Dept. of Forestry & Horticulture), Drs. Douglas Brackney, Blaire Steven, Charles Vossbrinck (Dept. of Environmental Sciences), Dr. Douglas Dingman (Dept. of Entomology) and Dr. Christina Robb (Dept. of Analytical Chemistry) *April 22*
- With Dr. Douglas W. Dingman, presented a “lunch and learn” seminar titled “Know GMO” to staff at GE Financial Services in Stamford (50 attendees) *June 11*

SERVIN, ALIA

- Presented the lecture “Nanoscale Interactions Between Engineered Nanomaterials and Black Carbon (Biochar) in Soil” at the 11th International Phytotechnologies Conference in Heraklion, Crete (Greece) (30 attendees) *September 30-October 3, 2014*

SHEPARD, JOHN

- Participated in a meeting of the Board of Directors of the Northeastern Mosquito Control Association in Northboro, MA (11 attendees) *September 26, 2014*
- Gave a talk titled “Arbovirus Activity in Connecticut, 2014” at the 60th Annual Meeting of the Northeastern Mosquito Control Association in Cambridge, MA (approximately 170 attendees) *December 8-10*
- Was elected to a three-year term as Treasurer of the Northeastern Mosquito Control Association *December 8*
- Together with Mr. Michael Thomas, conducted a hands-on workshop on mosquito biology to a group from Plainfield High School as part of the Yale-Peabody Fellows SEPA NIH program on mosquito biology (19 students and 1 teacher) *December 16*
- Attended a meeting of the Board of Directors of the Northeastern Mosquito Control Association in Northboro, MA (7 attendees) *January 23, 2015*
- Along with Phil Armstrong and Michael Thomas, conducted a hands-on workshop on mosquito biology to a group from RHAM High School as part of the Yale-Peabody Fellows SEPA NIH program on mosquito biology (23 students and 5 adults) *March 3*
- Participated in a Board of Directors meeting of the Northeastern Mosquito Control Association in Falmouth, MA (10 attendees) *March 13*
- Along with Phil Armstrong and Michael Thomas, conducted a hands-on workshop on mosquito biology to a group from Ansonia Middle School as part of the Yale-Peabody Fellows SEPA NIH program on mosquito biology (27 students and 3 adults) *March 31*

- Presented a display on the Mosquito Trapping and Testing Program, West Nile Virus, Eastern Equine Encephalitis, and mosquito biology at “Bitten! Bloodsuckers & Climate” at the Yale Peabody Museum of Natural History (approx. 1,500 museum visitors) *April 16*
- Spoke about the mosquito life cycle and the Mosquito Trapping and Testing Program to a group participating in the CTPA Arbor Day Tree Planting Ceremony (approx. 30 attendees) *April 24*
- Met with members of the Vermont Agency of Agriculture and the Vermont Department of Health to discuss the Connecticut Mosquito Arbovirus Surveillance Program and the processing of mosquitoes for identification, submission for virus testing, and data management *May 7*
- Spoke to a group of students from Central Connecticut State University about the state Mosquito Surveillance Program, West Nile virus and Eastern Equine Encephalitis (20 attendees) *June 25*

SHORT, MICHAEL R.

- Staffed a Station display at the 26th Annual CT Urban Forest Council Conference and CT Forest Forum in Southington (175 attendees) *October 29, 2014*
- Presented a poster titled “Relationship between acorn abundance and adult tick *Borrelia* infection in Japanese barberry stands in Connecticut” at the 71st Annual Northeast Fish & Wildlife Conference held in Newport, RI (250 attendees) *April 19-21*

SMITH, VICTORIA L.

- Participated in the CT Nursery and Landscape Association summer meeting held at Van Wilgens Nursery and Garden Center in North Branford (200 participants) *July 16, 2014*
- Gave the talk “Thousand Cankers Disease: a Threat to Walnut” at the CT Tree Protective Association’s Summer Meeting held at the Farmington Club in Farmington (200 attendees) *July 17*
- Participated in the annual Northeast Sustainable Agriculture Research and Education summer tour (45 participants) *July 22*
- Participated in the 88th annual meeting of the National Plant Board, as a representative of the Eastern Plant Board, held at the Hilton by the Ballpark in St. Louis, MO (200 participants) *July 27-31*
- Completed the course “Understanding Audit” conducted by USDA Professional Development Center, held at the USDA Eastern Field Office Headquarters in Raleigh, NC (10 participants) *August 26-27*
- Participated in a meeting of the Yale Biosafety Committee in New Haven (20 participants) *September 18*
- Participated in the Horticultural Inspection Society Systems Approach to Nursery Certification Workshop, held at Monrovia Nursery in Granby and at the Valley Lab in Windsor (25 participants) *September 29-30*
- Participated in the annual meeting of the US Forest Service Northeast Area Cooperators, held at Waquoit Bay National Estuarine Research Preserve, Falmouth, MA, with discussions on winter moth, EAB, aerial survey, and Cynipid gall wasp (25 participants) *October 1-2*
- Volunteered with the US Fish and Wildlife Service Stewart B. McKinney Wildlife Refuge on Falkner Island near Guilford, to take in nest boxes for endangered roseate terns *October 10*
- Participated in the monthly meeting of the Yale Biosafety and Recombinant DNA Committee in New Haven (20 participants) *October 16*
- Participated in the 38th Annual Meeting of the North American Plant Protection Organization, held at Las Brisas Resort in Hualtuco, Mexico, with discussions on quarantines, invasive species, and a symposium on electronic certification of plant exports (150 participants) *October 20-24*
- Participated in the Fall meeting of the Cooperative Agricultural Pest Survey held at USDA-APHIS-PPQ offices in Wallingford (12 participants) *November 6*
- Was interviewed about upcoming changes to the emerald ash borer quarantine by Patrick Skahill of WNPR Public Radio *November 17*

- Was interviewed about issues facing gardeners in 2014 by Pamela Weil of Connecticut Gardener Magazine *November 20*
- Participated in a meeting of the Yale Biosafety and Recombinant DNA Committee in New haven (20 participants) *November 20*
- Participated in the public hearing to expand the emerald ash borer quarantine statewide, held at the Middlesex Cooperative Extension Offices in Haddam (20 participants) *December 4*
- Presented a talk titled “Emerald Ash Borer - Boxwood Blight** plus a new one” at the CT Nursery and Landscape Association Winter Meeting held at Yale Commons in New Haven (approx. 80 participants) *January 7, 2015*
- Participated in a meeting of the Yale Biosafety Committee in New Haven (20 participants) *February 19*
- Organized the annual Forest Health Workshop, held at Sessions Woods Wildlife Management Area in Burlington, and presented a talk titled “Southern Pine Beetle and Cynipid Gall Wasp—Two New Players” (60 participants) *March 3*
- Participated in a meeting of the Yale Biosafety Committee in New Haven (20 participants) *March 19*
- With Katherine Dugas, Jeff Fengler, Steve Sandrey, and Peter Trenchard, attended the combined meeting of the Eastern Plant Board, the Horticultural Inspection Society, and the Cooperative Agricultural Pest Survey, held at the Harborside Hotel in Portsmouth, NH. Vicki presented at talk titled “CWR Update,” and Peter presented an update on Boxwood blight (90 participants) *April 6-9*
- Participated in a meeting of the Yale Biosafety Committee in New Haven (20 participants) *May 21*
- Was interviewed about gypsy moth, winter moth, and ticks by Judy Benson of the New London Day *June 23*

STAFFORD, KIRBY C., III

- Presented a seminar at the Centers for Disease Control and Prevention in Fort Collins, Colorado on the CDC-funded integrated tick management project in Connecticut (36 attendees plus teleconference participants) *July 9, 2014*
- Was interviewed about the expansion of the emerald ash borer in Connecticut by Ed Stannard, New Haven Register *July 16*
- Was interviewed about the emerald ash borer by Matt McFarland, Channel 3 News (WFSB) *July 17*
- Was interviewed about the emerald ash borer by Charles Kreutzkamp, Record Journal *July 23*
- Was interviewed about the emerald ash borer by Steve Grant, Hartford Courant *July 23*
- Was interviewed about the emerald ash borer by Patrick Skahill, WNPR, Connecticut Public Radio *July 25*
- Was interviewed about the emerald ash borer by John Charlton, FoxCT TV *July 28*
- Was interviewed about the emerald ash borer in Connecticut by David Dawson of the Journal Inquirer *August 1 and 4*
- Was interviewed about “digger wasps” in Southington by Farrah Duffany of the Record Journal *August 15*
- Participated in a tick IPM Working Group conference call *August 13*
- Was interviewed about “digger wasps” in Southington by Evan White of Channel 3 News *August 18*
- Was interviewed about ticks by John Mahon of WINY, Putnam *September 4*
- Participated in the conference call of the Tick IPM Working Group *September 10*
- With Dr. Kimberly Stoner, participated in a meeting with Steve Young, the new Director of the Northeastern IPM Center, at UConn in Storrs *September 15*
- Was interviewed about ticks and Lyme disease by Adrian Stroud of WJMJ Radio, Hartford *September 17*
- Participated in a press conference in the CAES atrium by Senator Richard Blumenthal to call for additional federal funding for Lyme research *October 2*

- With Dr. Laura Hayes, participated in a conference call of the Tick IPM Working Group *October 8*
- Participated in a Bed Bug Forum organized by Dr. Gale Ridge, held at Middlesex Community College in Middletown *October 16*
- Participated in Quinnipiac University's Capstone Mentor Fair at their School of Medicine in North Haven *October 16*
- With Dr. Claire Rutledge, spoke on the emerald ash borer at the meeting of the Connecticut Entomological Society in New Haven *October 17*
- Was interviewed about the emerald ash borer and invasive insects by Jackson Blum, a journalism student at Yale *October 30*
- Participated in a meeting of the Cooperative Agricultural Pest Survey in Wallingford (12 attendees) *November 6*
- Participated in a conference call of the tick IPM Working Group *November 12*
- Presented the poster "Integrated Control of the Blacklegged Tick (*Ixodes scapularis*) in a Lyme Disease Endemic Community" at the annual meeting of the Entomological Society of America *November 18*
- Presented the talk "Ecological and Biorational Strategies for Tick Control and the Prevention of Tick-borne Disease" in a symposium at the annual meeting of the Entomological Society of America held in Portland, OR *November 19*
- Participated in the public hearing to expand the emerald ash borer quarantine statewide at the Middlesex Cooperative Extension Offices in Haddam (20 participants) *December 4*
- Participated in a tick IPM working group conference call *December 10*
- Was interviewed about ticks and current tick control products by Dave Mance for Northern Woodlands magazine *December 16*
- Attended the Connecticut Nursery and Landscape Association meeting in Manchester *January 14, 2015*
- Participated in the Connecticut Tree Protective Association winter meeting held at the Aqua Turf in Plantsville *January 15*
- Spoke on tick integrated pest management at the NOFA Organic Land Care Course at the Three Rivers Community College in Norwich (44 attendees) *February 11*
- Participated in the Public Hearing Environment Committee on Raised Bill No. 867, An Act Concerning the Enforcement of Firewood Transport Restrictions by the Department of Energy and Environmental Protection *February 13*
- Spoke on firewood regulations at the Forest Health Workshop in Burlington (60 attendees) *March 3*
- Participated in the tick IPM conference call *March 11*
- Spoke on ticks and Lyme disease at the Branford Land Trust (45 attendees) *March 24*
- Participated in a conference call with US Biologic, Inc. about summer research plans for the rodent Lyme vaccine *March 27*
- Attended the meeting of the Connecticut Entomological Society in Storrs *March 27*
- Was interviewed about Southern pine beetle by Judy Benson for The Day *March 31*
- Was visited by Dr. Maria Diuk-Wasser, Columbia University, to discuss collaborative research projects *April 2*
- Was interviewed about the Southern pine beetle by Bill Leukhardt, Hartford Courant *April 2*
- Was interviewed about the Southern pine beetle by Mike Patrick, Republican American *April 6*
- Was interviewed about the Southern pine beetle by Bob Miller, Danbury News Times *April 6*
- Was visited by Dr. Michael Levin, CDC - Atlanta *April 8*
- Met with the candidate for the Weed Scientist position, Dr. Jatinder Aulakh *April 9*
- Was interviewed about tick management by Kathleen G. Connolly, Lawncare.About.com *April 14*
- Was interviewed by Janet Marinelli for an article on tick management *April 15*
- Was interviewed about the Southern pine beetle by Patrick Skahill, WNPR, CT Public Radio *April 16*

- Was interviewed about overwintering tick survival by Ann Slokin, WFSB, Channel 3 News *April 16*
- Was interviewed about overwintering tick survival by Tim Hahn, Channel 12 News *April 17*
- Spoke on ticks and tick-borne diseases at the Westport Library (70 attendees) *April 21*
- Provided a Station and honey bee product registration update at the meeting of the Backyard Beekeepers Association in Weston (100 attendees) *April 28*
- With Dr. Kimberly Stoner, introduced the Lockwood Lecture speaker, Sam Droege *April 29*
- With Dr. Claire Rutledge speaking on the emerald ash borer, presented a talk on ticks and tick management at the Connecticut Audubon Society Center in Ridgefield as part of their master naturalists program followed by a field excursion to tag ash trees and collect ticks *May 5*
- Spoke about tick control at the Public Health Research and Services Symposium in Jones Auditorium (60 attendees) *May 6*
- Was visited by Chuck Lubelczyk, Maine Medical Center Research Institute, to discuss our tick overwintering study funded by the NE-IPM Center *May 11*
- Was interviewed about the upcoming tick season by Mark Sims, Connecticut Radio Network *May 11*
- Presented a talk on biorational and ecological strategies for tick control for the Dutchess County Tick Task Force Webinar *May 13*
- With Dr. Philip Armstrong, was interviewed about ticks and the upcoming tick season by Sam Gingerella, WTIC-Radio *May 14*
- Was interviewed about mosquitoes by Kari Niiri, New England Public Radio *May 21*
- With Dr. Kimberly Stoner, was interviewed about bees and the President's new proposed national pollinator health strategy by Jim Altman, Fox CT News *May 26*
- Attended the symposium and dinner in honor of the retirement of Dr. Durland Fish at Yale University *June 1*
- Was interviewed about the relapsing fever bacterium *Borrelia miyamotoi* by Erin Logan, WTNH Channel 8 News *June 9*
- Was interviewed about tick control research and support of tick research by Amy Masters, WCVB Channel 5 Boston *June 11*
- Was interviewed about tick control and education by Sam Evans-Brown, New Hampshire Public Radio *June 17*
- Was interviewed about tick control studies by Keith Kountz, WTNH Channel 8 News, on behalf of Amy Masters, WCVB Channel 5 Boston *June 17*
- Was interviewed about tick control studies by Melinda Wenner Moyer, a science and health writer for Nature magazine *June 18*
- Was interviewed about tick control research by Aidan Quigley, Waterbury Republican-American *June 23*
- Was interviewed about tick activity and tick testing by Judy Benson, The Day-New London *June 23*
- Was interviewed about tick-bite prevention by Sophie Ota, Redding Pilot *June 25*
- Was interviewed about the gypsy moth by Cynthia Drummond, Westerly Sun *June 25*

STEVEN, BLAIRE T.

- Presented his research and met with students during the Quinnipiac School of Medicine, Capstone Mentor Fair *October 16, 2014*
- Gave the lecture "From the Very Large to the Extremely Small: Putting Microorganisms in Climate Models" for the Sigma Xi Quinnipiac Chapter Seminar Series held at Quinnipiac University in Hamden (30 attendees) *October 29*
- Gave an invited lecture "A Microbial Ecological View Including Soil Fluxes in Climate Models" at the Yale Eco lunch of the Yale School of Forestry and Environmental Studies (20 attendees) *January 26, 2015*

- Visited Drs. Julie Rose and Lisa Milke of the National Oceanic and Atmospheric Administration, Northeast Fisheries Science Center in Milford to discuss possible collaborations in studying the environmental effects of oyster cultivation practices on greenhouse gas fluxes *March 3*
- Gave a talk “From the Very Large to the Extremely Small: Including Microbiology in Climate Models” at Albertus Magnus College in New Haven (approx. 15 students and 3 faculty members attended) *April 10*
- Gave a talk titled “A Microbial Ecological View of Sudden Vegetation Dieback in a Connecticut Wetland” at the New England Estuarine Research Society Spring Meeting in Bristol, RI (approx. 100 attendees) *April 16-18*
- Gave an invited talk “From the Very Large to the Extremely Small: Including Microbiology in Climate Models” in the Henry Voegeli Seminar Series in Microbiology at the University of New Haven (approx. 20 students and 10 faculty members attended) *April 30*
- Presented the talk “A Microbial Ecological View of Sudden Vegetation Dieback in a Connecticut Wetland” at the Society of Wetland Scientists Meeting in Providence, RI (approx. 30 attendees) *June 1-4*

STONER, KIMBERLY A.

- Led a garden and pest walk around the gardens at Common Ground School in New Haven (15 adult and 3 youth participants) *August 9*
- Staffed a table and displayed materials on native bees and factsheets on protecting bees from pesticides and planting for native bees, at the National Honeybee Day event held at Massaro Community Farm in Woodbridge *August 16*
- With Dr. Gale Ridge, met with officials of the Southington School System to discuss ground-nesting bees and visited the Strong Elementary School where there was a large aggregation of the bees in the spring *August 25*
- With Dr. Gale Ridge, presented a talk on ground-nesting bees and wasps to parents of elementary school students in response to concerns from parents that ground-nesting bees would harm the children at the William Strong School in Southington (200 attendees) *September 3*
- Participated in a meeting of the City Farm & Garden Working Group at City Hall in New Haven *September 5*
- Presented the talk “Growing Plants That Are Good For Bees” at a symposium organized by the Connecticut Greenhouse Growers Association and UConn Cooperative Extension and held at Naugatuck Valley Community College in Waterbury (28 attendees) *September 10*
- Was interviewed about honey bee health and proposals to ban neonicotinoid insecticides by Patrick Skahill of Connecticut Public Radio *September 30*
- Participated in a meeting of the City Farm and Garden Working Group at City Hall in New Haven *October 3*
- Presented the talk “Habitat for Bees” to the Advanced Master Gardener Course for Coastal Landscapes at the Mercy Center in Madison (15 attendees) *October 20*
- With Tom Rathier, met with officials from the New Haven Land Trust’s Community Garden Program to discuss lead and other contaminants at community garden sites, current recommendations from the Environmental Protection Agency, and provisions for soil testing *October 22*
- Hosted a workshop sponsored by CAES on season extension, and introduced Jonathan Bates, speaker, on “Extending the season: backyard bioshelters” at the New Haven Friends Meetinghouse in New Haven (55 attendees) *November 2*
- Gave the talk “Habitat for Bees” at the annual meeting of the East Granby Land Trust held at the East Granby Library (35 attendees) *November 6*
- Participated in a meeting of the City Farm & Garden Working Group at City Hall in New Haven (15 attendees) *November 7*

- Gave the talk “Bee Visitation to Flowering Plants on Diversified Vegetable Farms in Connecticut” at the annual meeting of the Entomological Society of America in Portland, OR (55 attendees) *November 16*
- Participated in a meeting of the Southern New England Bee Assembly in Groton *November 22*
- Spoke on “Habitat for Bees” at the Flanders Nature Center in Woodbury (15 attendees) *December 4*
- Participated in a meeting of the Steering Committee for the New England Vegetable and Fruit Conference at the Hillsborough Extension Center in Goffstown, NH *December 12*
- Spoke on “Honey Bees, Bumble Bees, and Other Bees, Both Managed and Wild: Differences in Conservation Status, Feeding and Nesting Behavior Among these Groups” and co-facilitated a discussion, “Developing the Database: Pollinator Attractiveness and Management of Pests Resources” as part of an Ornamental Horticulture Pollinator Workshop organized by the Northeast IR-4 program in Baltimore, MD (41 attendees) *December 15-16*
- Gave a talk titled “Saving our Bees” to members of the Danbury Garden Club (35 attendees) *January 16*
- Met with the directors of New Haven Urban Agriculture Organizations (Common Ground School and Environmental Center, New Haven Land Trust, New Haven Farms, and CitySeed) to explore ways for the organizations and the Experiment Station to work together *March 3*
- Spoke to the Perennial Plant Conference on “Growing plants that are good for bees” at the University of Connecticut in Storrs (125 attendees) *March 5*
- Met with the City Farm and Garden Working Group at City Hall in New Haven *March 6*
- Was interviewed about the current status of native pollinators by Alan Bjerga of Bloomberg News *March 6*
- Spoke on “Growing plants that are good for bees” at the CT NOFA Winter Conference at Western Connecticut State University in Danbury (65 attendees) *March 7*
- Spoke on “Growing plants that are good for bees” at the annual planning meeting of the Shelton Community Garden at City Hall in Shelton (35 attendees) *March 9*
- Spoke on “Making a habitat for bees” to the New Hartford Land Trust at the New Hartford Town Hall (75 attendees) *March 15*
- Participated in the Steering Committee meeting for the New England Vegetable and Fruit Conference in Goffstown, NH (25 attendees) *March 19*
- Spoke on “Neonicotinoids in agriculture and landscapes: do they harm honey bees or native bees?” at the University of Massachusetts Extension Symposium on Pollinator Health for Agriculture and Landscapes in Amherst, MA (268 attendees) *March 26*
- Was a guest for two hours on the radio show “Garden Talk” on WTIC, speaking about planting native plants for pollinators. The host, Scott Reil, said that the ratings for the show indicate an average of 35,000 listeners *April 4*
- Gave a talk titled “The buzz about bees” at the Salt Meadow Unit of the Stewart B. McKinney National Wildlife Refuge in Westbrook (30 attendees) *April 10*
- Participated in the annual project meeting of the Northeast Pollination Security Project at the University of Massachusetts in Amherst, MA *April 14*
- Gave the keynote lecture, “Gardening for Bees” at the annual “Hot Topics” session for the Connecticut Master Gardener program at the UConn campus in West Hartford; the talk was recorded on video so that an additional 200 Master Gardeners will see the talk by the end of June (120 attendees) *April 15*
- Presented a talk on “Gardening for Bees” to the Institute for Learning in Retirement in New Haven (7 attendees) *April 22*
- Arranged for a Lockwood Lecture given by Sam Droege titled “The Natural History Gap and the Citizen” in Jones Auditorium *April 29*

- Visited Thalberg and Strong Elementary Schools in Southington with the principals of the schools and the maintenance staff to collect and identify bees nesting in aggregations on the grounds of the two schools *May 22*
- Was interviewed about the current status of bees in Connecticut and the White House Strategy for Pollinator Health by Mike Puffer of the Waterbury Republican-American *May 22*
- Was interviewed about the current status of bees in Connecticut and the White House Strategy for Pollinator Health by Greg Hladky of the Hartford Courant *May 22*
- Spoke on “Keeping the Bees” at a program sponsored by the Connecticut Farm Bureau and the Agricultural Commissions of the towns of Ashford, Coventry, Mansfield, Tolland, and Windham, at Knowlton Memorial Hall in Ashford (39 attendees) *May 26*
- With Dr. Kirby Stafford, was interviewed about bees and the White House Strategy for Pollinator Health by Jim Altman of Fox CT News *May 28*
- Was interviewed about bees and pollination by Sean Sullivan, a freelance writer *June 3*
- Gave a talk titled “Keeping the Bees” to a meeting of the Northeastern Association of State Departments of Agriculture at the Study at Yale (40 adult attendees) and gave them a tour of the Bee Laboratory at CAES and followed up with answers to questions from the talk *June 9*
- Was interviewed about bees and pollination research by Anders Helm for a story in Moo Dog Press *June 11*
- Was interviewed about native bee diversity in Connecticut by Greg Hladky of the Hartford Courant *June 26*

THOMAS, MICHAEL C.

- Participated in the Hartford Biodiversity Camp and BioQuest sponsored by the Center for Conservation and Biodiversity at the University of Connecticut *July 10, 2014*
- Co-led the North American Butterfly Association’s Farmington Valley butterfly count (14 attendees) *July 12*
- Participated in an Executive Board Meeting of the Connecticut Entomological Society in Willimantic, CT (7 attendees) *August 21*
- Demonstrated insect collecting and preservation techniques to the University of Connecticut Entomology and Yale University Terrestrial Arthropods classes at the Yale Forestry Camp in Norfolk (35 student attendees) *September 5-6*
- Co-instructed a lab field trip to Archbold Biological Research Station, Venus, Florida, for the Yale University EEB Terrestrial Arthropod Class (14 attendees) *October 22-26*
- Along with Dr. Philip Armstrong and Mr. John Shepard, hosted a group of students from Plainfield High School as part of the Yale-Peabody Fellows SEPA NIH educational program on mosquito biology *December 16*
- Along with Mr. John Shepard, conducted a hands-on workshop on mosquito biology to a group from RHAM High School as part of the Yale-Peabody Fellows SEPA NIH program on mosquito biology (23 students and 5 adults attended) *March 3, 2015*
- Along with Mr. John Shepard, conducted a hands-on workshop on mosquito biology to a group from Ansonia Middle School as part of the Yale-Peabody Fellows SEPA NIH program on mosquito biology (27 students and 3 adults attended) *March 31*
- Led a bird walk for the Hartford Audubon Society at Bartholomew’s Cobble, Ashley Fall, MA (14 participants) *May 9, 2015*
- Participated in a Biodiversity Camp (Northwest Park, Windsor) held for children in grades 6 to 8 from the Environmental Sciences Magnet School (ESM) at Mary Hooker, Two Rivers Magnet Middle School in East Hartford, and other Greater Hartford middle schools (28 attendees) *June 25*

TRENCHARD, PETER W.

- Discussed pest and disease problems and export issues with growers at the Summer Meeting of the CT Nursery and Landscape Association held at Van Wilgen's Nursery in North Branford *July 16, 2014*
- Organized and participated in the Horticultural Inspection Society Systems Approach to Nursery Certification Workshop held at Monrovia Nursery in Granby and at the Valley Lab in Windsor (25 participants) *September 29-30*
- Discussed pest and disease problems and export issues with growers at the CNLA Winter Meeting at Yale University in New Haven *January 7, 2015*
- Staffed the Station exhibit and presented material about boxwood blight, Asian longhorned beetle, and emerald ash borer at the CT Flower and Garden Show in Hartford *February 19-21*
- Presented a talk titled "Aerial Survey 2014 – Rise of the Green Menace" at the Forest Health Monitoring Workshop held at Sessions Woods Wildlife Management Area in Burlington *March 3*
- Gave an update on boxwood blight in Connecticut at the 41st Annual Meeting of the Horticultural Inspection Society, Eastern Chapter, held at the Harborside Hotel in Portsmouth, NH *April 6-9*

TRIPLETT, LINDSAY R.

- Gave the guest lecture "*Xanthomonas oryzae* and bacterial blight of rice: Virulence genes, TAL effectors and host defense" for the graduate plant bacteriology class (15 student attendees) *October 9*
- Presented the invited seminar "Searching bacterial DNA for new disease resistance strategies in rice" to the Department of Plant and Environmental Protection Sciences at the University of Hawaii at Manoa (40 attendees) *October 10*
- Was approved by the Colorado State University's Department of Bioagricultural Sciences and Pest Management as a Faculty Affiliate, or adjunct professor; gave an invited talk titled "Bacterial leaf streak of rice: Unusual strategies for pathogenesis and defense" at the Yale Botany Seminar Series (25 attendees) *December 8*
- Was appointed as an Associate Editor for the journal *Phytopathology* for the year 2015 *December __?*
- With Dr. Claire E. Rutledge, set up a CAES demonstration table for the African-American History Month celebration at the Bridgeport Discovery Museum, where attendees participated in demonstration activities related to plant disease and insect pests (25 adults and 50 youths attended) *February 21*
- Gave a guest lecture on career opportunities in agriculture and plant sciences for the class "Career Seminar in Environmental Sciences" at Mitchell College in New London (15 students attended) *February 26*
- Gave an invited talk titled "Resistance to African bacterial leaf streak in an American heirloom rice variety" to the Department of Plant Pathology and Plant-Microbe Biology at Cornell University in Ithaca, NY; the visit included meetings with 8 Cornell professors, and lunch and dinner with groups of graduate students (40 attendees, 10 phoned in from the Geneva campus) *March 18*
- Participated in a workday at Celentano Magnet School where 12 volunteers helped the 5th grade teachers build a planter garden for plant science lessons *March 28*
- Gave a Yale Green Café presentation titled "Carolina gold rush: rice comes to America" at the Marsh Botanical Garden greenhouse in New Haven (25 students, faculty, and community members attended) *June 4*
- With Dr. Adriana Arango-Velez, hosted the 6th grade classes of Ms. Bell and Mr. Alvarez from Celentano Health and Biotech Middle School. The students brought leaf samples they collected in Edgerton Park as part of their project "Is a tree an ecosystem?" The students asked questions in the plant disease and insect inquiry offices, made bacterial leaf prints on nutrient agar, and examined the stomata of their leaves under the microscope (38 students attended) *June 9 and 12*

VOSSBRINCK, CHARLES R.

- Presented his research and met with students during the Quinnipiac School of Medicine, Capstone Mentor Fair *October 16, 2014*
- Hosted a fig grafting workshop at which a nurseryman demonstrated various techniques for grafting figs, held at Broken Arrow Nursery in Hamden (3 attendees) *January 26, 2015*
- Met with Carol Royal, manager of Strawberry Fields Farm in Sherman, at Lockwood Farm to discuss fig tree care and propagation *February 11*
- Served as judge in the Sustainability category at the Connecticut State Science Fair held at Quinnipiac University *March 12*
- Helped judge the Student Research Symposium sponsored by the Quinnipiac Chapter of the Sigma Xi at Quinnipiac University *April 22*
- Visited colleagues in Chongqing, China; presented two lectures on phylogenetic analysis and taxonomy (15 attendees at each lecture); advised graduate students at the University of Southwest China and at Chongqing Normal University; and presented information about the Connecticut Agricultural Experiment Station, the State of Connecticut, and the USA to a class of 10th grade high school students (40 attendees) *May 21-31*

WARD, JEFFREY S.

- Spoke on “Strategies for reducing deer browse damage” to the Old Ripton Garden Club in Shelton (27 attendees) *July 7, 2014*
- Spoke on “Roadside Forest Management – tree-by-tree” at the Connecticut Tree Protective Association annual summer meeting (250 attendees) *July 17*
- Participated in the USDA Forest Service Tools for Engaging Landowners Effectively workshop in Windsor *July 23*
- Organized the New England Society of American Foresters Silviculture Working Group’s summer workshop in Bradley, ME (35 attendees) *July 24*
- Participated in the USDA NRCS Wildlife subcommittee meeting in Tolland *July 29*
- Was interviewed about running bamboo growth and control by John Dankosky on WNPR’s “Where We Live” program *September 5*
- Was interviewed about fall colors by Pam McLoughlin of the New Haven Register *September 5*
- Was interviewed about fall colors by Dana Whalen of WTIC AM-1080 *September 8*
- Was interviewed about fall colors by Amanda Beaulier of NBC-30 *September 8*
- Administered practical and oral examinations to arborist candidates for the Connecticut Tree Protection Examining Board *September 10*
- Spoke of habitat management for birds at Project Covert Workshop in Norfolk (34 attendees) *September 13*
- Was interviewed about declining spruce by Skyler Magnoli of the Danbury News-Times *September 16*
- Participated in the CT Statewide Vegetation Management Task Force in Middlefield *September 23*
- Was interviewed about fall colors by Penelope Overton of the Waterbury Republican-American *September 25*
- Participated in an Executive Committee meeting of the Connecticut Urban Forest Council in Middlefield *September 26*
- Gave an invited talk “The Link Between Deer, Invasive Plants and Lyme Disease” to the Conservation Commissions of Dummerston, Putney, Guilford, Marlboro, and Brattleboro, VT (80 attendees) *September 30*
- Spoke on invasive plant control at the 2014 Connecticut Invasive Plant Working Group symposium in Storrs (150 attendees) *October 7*

- Spoke on tree biology and led two field identification walks at the 2014 Envirothon Forestry and Urban Forestry Workshop in Burlington (120 student and 12 teacher attendees) *October 18*
- Moderated a session on novel uses of urban forests and waste wood at the 2014 CT Urban Forest Conference/Forest Forum in Southington (100 attendees) *October 29*
- Staffed a collaborative booth between CAES, CT-DEEP, and UConn Cooperative Extension at the Tree Care Industry Exposition in Hartford *November 14*
- Spoke on “Identification and Control of Bamboo” at the CT Association of Conservation and Inland Wetlands Commissions 37th Annual Meeting in Wallingford (43 attendees) *November 15*
- Gave the invited lecture “Improving the Competitive Status of Oak Regeneration Using Stand Management and Prescribed Fires” at Wesleyan University in Middletown (26 students) *November 18*
- Met with Lisa Brodlie, VP Land Management Aspetuck Land Trust, to discuss invasive control on their preserves *December 1*
- Demonstrated bamboo control research plots on a Connecticut Invasive Plant Council field tour (5 attendees) *December 4*
- Participated in a Connecticut Invasive Plant Council meeting in Hartford *December 9*
- Administered practical and oral examination to arborist candidates for the Connecticut Tree Protection Examining Board *December 10*
- Participated in CT DEEP, Forestry Division meeting at Winding Trails in Farmington *December 17*
- Along with Dr. Adriana Arango-Velez, spoke on “Poda de árboles y arbustos” at the Seminarios en Español of the CNLA Annual Meeting in New Haven (32 attendees) *January 8, 2105*
- Spoke on “A short history of Connecticut's forests” at the Connecticut Tree Protective Association’s 93rd Annual Meeting in Plantsville (400 attendees) *January 15*
- Attended the annual meeting of the Connecticut Chapter, Society of American Foresters in Middlefield *February 24*
- Spoke on “Engaging private forest owners to promote forest health and biodiversity” at the Forest Health Monitoring Workshop in Burlington (60 attendees) *March 3*
- Met with Marty Rodskoch to discuss CCC and forest history *March 6*
- Administered practical and oral examination to arborist candidates for the Connecticut Tree Protection Examining Board *March 11*
- Along with Dr. Adriana Arango Velez and J.P. Barsky, answered questions about CAES research and outreach at Ag Day at the Capitol *March 18*
- Was interviewed about the effect of the deep snow on forest health by Judy Benson of the New London Day *March 18*
- Spoke on “Non-traditional pests – how deer and interfering species hamper forest regeneration” at the annual winter meeting of the New England Society of American Foresters in Fairlee, VT (80 attendees) *March 25*
- Moderated the session “Silviculture II: Uneven-aged northern hardwood management for small family woodlots” at the annual winter meeting of the New England Society of American Foresters in Fairlee, VT (200 attendees) *March 25-26*
- Participated in an Executive Board meeting of the Connecticut Urban Forest Council in Middlefield *March 27*
- Was interviewed about the effect of the lingering snow on agriculture by Dana Whalen of WTIC 1080 radio *March 27*
- Spoke on invasive species control for a graduate forestry class at Yale University *March 31*
- Met with Nick Zito, forester for Regional Water Authority, to discuss forest management *April 22*
- Spoke on how trees grow to 5th grade students at the Arbor Day celebration (30 students, 15 adults) *April 24*

- Was visited by Richard Chiaramonte, President of the Stamford Land Conservation Trust, to discuss forest management on private lands *April 24*
- Met with Bruce Villwock and James Barnes (Conn DOT) and Tom Degnan (Burns and McDonnell) in Monroe to discuss roadside forest management *April 30*
- Spoke on careers in natural resources to students from Lyman Hall (10 students and 1 teacher attended) *May 11*
- Spoke on “A short history of Connecticut’s forests” for the Burlington Historical Society (17 attendees) *May 14*
- Along with Drs. Adriana Arango, James LaMondia, and Carole Cheah, with Ms. Jennifer Fanzutti hosted an exhibit on innovative research by the Station in the Capitol Corridor in Hartford *May 27*
- Was interviewed about black locust flowering by Chris Mascaro of the Danbury News-Times *May 28*
- Spoke on “Tree and shrub identification” for the Master Gardeners in Norwich (9 attendees) *May 29*
- Was interviewed about roadside forest management by Judy Benson of the New London Day *May 29*
- Spoke on roadside forest management at the Northeastern Area Association of State Foresters Utilization Committee annual meeting in Norfolk (15 attendees) *June 2*
- Spoke of CAES forestry research at the Hudson to Housatonic landowner outreach in Greenwich (11 attendees) *June 3*
- Spoke of CAES forestry research at the Hudson to Housatonic landowner outreach in Stamford (17 attendees) *June 4*
- Spoke on tree identification and life histories on the Meriden Linear Trail for National Trails Day (8 children and 12 adults attended) *June 7*
- Along with Dr. Adriana Arango-Velez, administered practical and oral examination to arborist candidates for the Connecticut Tree Protection Examining Board *June 10*
- Spoke on managing trees and forests to increase utility resiliency to storm damage at the Connecticut Chapter - American Society of Landscape Architects’ Trees and Design program in Waterbury (105 attendees) *June 16*
- Was interviewed about running bamboo by Sujata Jain of WFSB-3, Hartford *June 17*
- Spoke on forestry and horticultural research to students from Central Connecticut State University (12 attendees) *June 25*
- Was interviewed about barberry, ticks, and Lyme disease by Erin Connolly of WFSB-3, Hartford *June 25*
- Attended an Executive Committee meeting of the Connecticut Urban Forest Council in New Haven *June 26*

WHITE, JASON C.

- Spoke by phone with representatives of the Bigelow Tea Company regarding findings of pesticide residues in certain products *July 10, 2014*
- With Kitty Prapayotin-Riveros, Terri Arsenault, Dr. Brian Eitzer, Craig Musante, Michael Cavadini, Dr. Christina Robb, Joseph Hawthorne, John Ranciato, and Dr. Walter Krol, participated in the monthly FDA FERN Chemistry Cooperative Agreement Program teleconference call *July 10*
- With Dr. Walter Krol, participated in the first Lobster Pesticide Study 2014 Steering Committee Meeting at the DEEP Marine Fisheries Headquarters in Old Lyme (15 attendees) *July 11*
- Served as an external ad hoc reviewer for the USDA proposal being evaluated under the FY-2014 USDA-NIFA Exploratory Program *July 18*
- With Kitty Prapayotin-Riveros, Terri Arsenault, Dr. Christina Robb and Dr. Walter Krol, participated in an ISO 17025 Mentor/Mentee Conference Call with Ohio Department of Agriculture *July 24*
- Gave a tour of the Station facilities and discussed programs with Ms. Anne Horsfall-Thomas and David Thomas. Ann Horsfall Thomas is the daughter of Dr. James Horsfall who served as CAES Director from 1948-1971 *July 28*

- Participated in the Association of Public Health Laboratories Data Acceptance Workgroup teleconference call *July 28*
- Participated in the quarterly teleconference call of the APHL Agricultural/Chemist Laboratories Working Group *July 31*
- With Kitty Prapayotin-Riveros, Terri Arsenault, Dr. Brian Eitzer, Craig Musante, Michael Cavadini, Dr. Christina Robb, Joseph Hawthorne, John Ranciato, and Dr. Walter Krol, participated in the monthly FDA FERN chemistry cooperative agreement program teleconference call *August 14*
- With Craig Musante, Michael Cavadini, and John Ranciato, participated in an FDA and AAFCO Animal Feeds Regulatory Program Standards teleconference call focused on Standard 10 (Laboratory Services) *August 19*
- Participated in the Association of Public Health Laboratories Data Acceptance Workgroup teleconference call *August 21*
- With Kitty Prapayotin-Riveros, Terri Arsenault, Dr. Brian Eitzer, Craig Musante, Michael Cavadini, Dr. Christina Robb, Joseph Hawthorne, John Ranciato and Dr. Walter Krol, participated in an FDA FERN-wide call and viewed a presentation by Dr. Douglas Heitkemper of the FDA Forensic Chemistry Center *August 21*
- With Dr. Walter Krol, participated in a teleconference call of the DEEP-led Lobster Pesticide Study 2014 Steering Committee *August 27*
- With Kitty Prapayotin-Riveros, Terri Arsenault, Dr. Brian Eitzer, Craig Musante, Michael Cavadini, Dr. Christina Robb, Joseph Hawthorne, John Ranciato, and Dr. Water Krol, participated in the FDA ISO Accreditation teleconference Quarter 4 “Wrap-Up” call with Dr. Ruiqing Pamboukian and Dr. Anthony Adeuya of the FDA *August 28*
- With Dr. Blaire Steven and Ms. Terri Arsenault, met with Mr. John Adams of Agilent concerning instrument platforms to detect methane and carbon dioxide *August 28*
- With Dr. Christina Robb, Dr. Arnab Mukherjee, and Dr. Walter Krol, participated in an FDA FERN Chemotherapeutics Working Group teleconference call *September 3*
- With Kitty Prapayotin-Riveros, Terri Arsenault, Dr. Brian Eitzer, Craig Musante, Michael Cavadini, Dr. Christina Robb, Joseph Hawthorne, John Ranciato, Dr. Alia Servin, Dr. Roberto de la Torre Roche, Dr. Arnab Mukherjee, and Dr. Walter Krol, participated in a Year 2 “wrap-up” teleconference call with FDA as part of our ISO Accreditation Program *September 4*
- With Dr. Brian Eitzer, Dr. Christina Robb, Terri Arsenault, and Joseph Hawthorne, attended the annual FDA FERN cCap Technical Meeting in Boca Raton, FL and gave a presentation titled “Pyrethroids, Lobsters, and Long Island Sound – Oh My” (60 attendees) *September 12*
- Participated in a USDA NIFA Grant Review Panel for Program A4172 “Identifying and Targeting Critical Food Safety Needs” *September 19*
- With Kitty Prapayotin-Riveros, Terri Arsenault, and Michael Cavadini, participated in a bimonthly mentor/mentee teleconference call with the Ohio Department of Agriculture *September 25*
- Attended the 11th International Phytotechnologies Conference in Heraklion, Crete (Greece) as Society President and gave the opening and closing plenary talks, as well as a mini-plenary titled “Plant Nanoparticle Interactions” (300 attendees) *September 29-October 3*
- Chaired the “Plant Nanoparticle Interactions” session, and chaired the annual Business Meeting of the International Phytotechnology Society (IPS) at the annual meeting in Heraklion, Crete (Greece) *September 30*
- With Dr. Walter Krol, Dr. Christina Robb, Joseph Hawthorne, Terri Arsenault, and Michael Cavadini attended the Northeast FERN Group webinar on “Analysis of Pesticide Residues in Tea Leave” *October 23*
- Chaired a session “Agriculture and Food” at the 3rd Annual Sustainable nanotechnology conference in Boston, MA *November 2*
- Participated in the Association of Public Health Laboratories Quarterly Agriculture and Chemist Conference *November 6*

- Was interviewed about the recent publication on the trophic transfer of nanoparticles by Robert Miller of the Danbury News Times *November 10*
- Participated in a conference call with colleagues from Louisiana State University and several Romanian institutions concerning a joint grant proposal being submitted to the EU Program titled “Safe Implementation of Innovative Nanoscience and Nanotechnology *November 14*”
- With Kitty Prapayotin-Riveros, Terri Arsenault, Dr. Brian Eitzer, Michael Cavadini, Dr. Christina Robb, Joseph Hawthorne, and Dr. Walter Krol, participated in the monthly FDA FERN chemistry cooperative agreement program teleconference call *November 13*
- Chaired a session titled “Detection and Fate of Nanoparticles in Biota” and presented a lecture titled “Fate and Effects of Engineered Nanomaterials in Agricultural Systems” at the Eastern Analytical Symposium and Exhibition in Somerset, NJ *November 18*
- With Kitty Prapayotin-Riveros, Terri Arsenault, Dr. Brian Eitzer, Michael Cavadini, and Dr. Christina Robb, participated in a bi-monthly FDA ISO Accreditation mentor/mentee conference call with the Ohio Department of Agriculture *November 20*
- Participated in an FDA 50 state conference call on food package labelling *November 25*
- Attended the monthly Laboratory Preparedness Advisory Group Meeting at the CT Department of Public Health Laboratory in Rocky Hill CT *December 1*
- Along with Dr. Christina Robb, Dr. Brian Eitzer, Dr. Walter Krol, Ms. Kitty Prapayotin-Riveros and Ms. Terri Arsenault, participated in a phone call concerning the Year 3 Quarter 1 report on the FDA ISO 17025 accreditation grant *December 3*
- Travelled to El Paso, TX and participated as a Committee Member in the Ph.D. Dissertation defense of Dr. Sanghamitra Majumdar of the University of Texas-El Paso Department of Chemistry *December 4-5*
- Gave a remote lecture titled “Environmental Implications of Nanotechnology” to an Environmental Engineering graduate class at North Dakota State University (15 attendees) *December 9*
- Along with Ms. Kitty Prapayotin-Riveros, Ms. Terri Arsenault, Dr. Brian Eitzer, Mr. Craig Musante, Mr. Michael Cavadini, Dr. Christina Robb, Mr. Joseph Hawthorne, and Dr. Walter Krol participated in the monthly FDA FERN cCAP conference call *December 11*
- Met with Dr. Erik Lehnhoff of Montana State University who is a candidate for a Weed Scientist position at the Valley Laboratory *December 12*
- Met with Dr. John Wallace of Pennsylvania State University who is a candidate for a Weed Scientist position at the Valley Laboratory *December 19*
- Participated in a conference call with colleagues from Louisiana State University and several Romanian institutions concerning a joint grant proposal being submitted to the EU Program titled “Safe Implementation of Innovative Nanoscience and Nanotechnology (SIINN)” *December 19*
- Met with Ms. Gina Impronto, a graduate student at the University of New Haven, regarding a potential research internship *December 19*
- Attended the monthly Laboratory Preparedness Advisory Group Meeting at the CT Department of Public Health Laboratory in Rocky Hill CT (20 attendees) *January 5, 2015*
- Participated in a conference call with colleagues from Louisiana State University and several Romanian institutions concerning a joint grant proposal being submitted to the EU Program titled “Safe Implementation of Innovative Nanoscience and Nanotechnology (SIINN)” (5 attendees) *January 5 and 9*
- Was asked by the American Chemical Society to chair the *Environmental Science and Technology* Best Papers of 2014 Selection Committee *January 19*
- Participated in the Association of Public Health Laboratories (APHL) Data Acceptance Work Group teleconference call (15 attendees) *January 20*
- Attended the New Haven County Farm Bureau “Meet and Greet” dinner and gave an update on Station activities (35 attendees) *January 20*

- Along 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 bimonthly FDA ISO Accreditation Mentor-Mentee teleconference call with the Ohio Department of Agriculture *January 22*
- Met with Dr. Mino Alasti, a postdoctoral candidate from the University of Iowa, who was interviewing for the Louis A. Magnarelli Post-Doctoral Fellowship *January 23*
- Along with Dr. Christina Robb, participated in an FDA teleconference call on program updates for the FERN Chemistry Cooperative Agreement Program (cCAP) *January 28*
- Along with Dr. Theodore Andreadis, met with Dr. Cameron Faustman and Dr. Mike O'Neill of the University of Connecticut College of Agriculture, Health and Natural Resources to discuss our agencies joint USDA Plan of Work *January 29*
- Along with Dr. Arnab Mukherjee, Dr. Sanghamitra Majumdar, Dr. Alia Servin, Dr. Roberto de la Torre-Roche and Mr. Joseph Hawthorne, met with collaborators at the University of Massachusetts Amherst and planned new collaborative investigations *February 4*
- Was interviewed by Ms. Jay-Me Brown of "60 Minutes Sports" on the use of pesticides on golf courses and the potential links to disease *February 6*
- Along with Dr. Brian Eitzer, Dr. Christina Robb, Dr. Walter Krol, Ms. Kitty Prapayotin-Riveros, Dr. Roberto de la Torre-Roche, Dr. Alia Servin, Dr. Arnab Mukherjee, Dr. Sanghamitra Majumdar, Mr. Michael Cavadini, Mr. Joseph Hawthorne, Mr. Craig Musante, Mr. John Ranciato and Ms. Terri Arsenault, attended a pre-assessment accreditation audit by A2LA *February 11*
- Along with Dr. Brian Eitzer, participated in the FERN cCAP monthly conference call *February 12*
- Along with Drs. Christina Robb and Brian Eitzer, participated in the FDA FERN Northeast Region Conference Call *February 18*
- Participated in a webinar hosted by the University of California Center for the Environmental Implications of Nanotechnology (UC CEIN) on exposure assessment of nanomaterials (10 attendees) *February 20*
- Participated in a teleconference call hosted by the Sustainable Nanotechnology Organization and discussed potential NSF funding opportunities (10 attendees) *February 23*
- Spoke by phone with Professor Stephen Ebbs of Southern Illinois University about collaborative projects *February 24*
- Along with Dr. Walter Krol, participated in a Lobster Pesticide Steering Committee Conference Call to discuss progress on the current research project (12 attendees) *February 26*
- Viewed a USDA NIFA webinar on establishing Centers of Excellence *February 26*
- Along with Dr. Brian Eitzer, participated in an FDA FERN 50-State Conference Call *February 26*
- Along with Ms. Kitty Prapayotin-Riveros and Mr. John Ranciato, met with Ms. Virginia Veneziano of the CT Department of Consumer Protection to discuss the current Manufactured Food Regulatory Program Standard (MFRPS) Sampling Agreement *February 27*
- Attended the monthly Laboratory Preparedness Advisory Committee meeting at the Department of Public Health Laboratory in Rocky Hill *March 1*
- Along with Dr. Brian Eitzer, Dr. Christina Robb, Dr. Walter Krol, Ms. Kitty Prapayotin-Riveros, Dr. Roberto de la Torre-Roche, Dr. Alia Servin, Dr. Arnab Mukherjee, Dr. Sanghamitra Majumdar, Mr. Michael Cavadini, Mr. Joseph Hawthorne, Mr. Craig Musante, Mr. John Ranciato and Ms. Terri Arsenault, participated in the FDA ISO Accreditation Quarter 2 teleconference call *March 2*
- Attended the SUN-SNO-GUIDEnano Sustainable Nanotechnology Conference in Venice, Italy and gave a presentation titled "Trophic transfer of engineered nanomaterials in terrestrial food chains" (40 attendees) and chaired a plenary panel discussion on "Nanotechnology in Food and Agriculture (75 attendees) *March 9-11*
- Was an invited participant in the 2015 EU-US Bridging NanoEHS Research Efforts Joint Workshop and gave a presentation to the Ecotoxicity Testing Community of Research (CoR) titled

“Nanomaterial exposure assessment studies at the CT Agricultural Experiment Station” in Venice, Italy (15 attendees) *March 12-13*

- Participated in a teleconference call with colleagues from Carnegie Mellon University, Binghamton University and the Sustainable Nanotechnology Organization about preparation of a joint NSF Conference Proposal *March 17*
- Along with Dr. Walter Krol, participated in a teleconference call with colleagues at the University of CT Center for Environmental Science and Engineering regarding a joint project on the detection of pesticides in lobster tissues *March 17*
- Was an invited participant in the University of California Los Angeles (UCLA) Center for the Environmental Implications of Nanotechnology (CEIN) workshop on “Implementing environmentally relevant exposures for improved interpretation of laboratory toxicology studies of manufactured and engineered nanomaterials” and gave a presentation of the same title (30 attendees) *March 18-20*
- Along with Ms. Kitty Prapayotin-Riveros, participated in a FDA MFRPS pre-audit teleconference call with the CT Department of Consumer Protection *March 24*
- Along with Mr. Craig Musante, participated in a teleconference call with colleagues at the Arkansas Department of Public Health regarding validation an ICP-MS protocol for arsenic determination in juice *March 25*
- Participated by teleconference in the *Environmental Science & Technology* and *Environmental Science & Technology Letters* annual Editorial Advisory Board meeting *March 25*
- Along with Dr. Brian Eitzer, hosted a visit with Michael Rickenbach, Robert Lockwood, and Anuja Bharadwaj of the Chemistry Section of the State of CT - Department of Emergency Services & Public Protection to discuss high resolution liquid chromatography/mass spectrometry *March 26*
- Participated in a teleconference call with colleagues at Kansas State University to initiate planning for the upcoming 12th International Phytotechnologies Conference to be held in Manhattan KS this coming September *April 2*
- Attended the monthly Laboratory Preparedness Advisory Committee meeting at the Department of Public Health Laboratory in Rocky Hill *April 6*
- Met with Dr. Jatinder Aulakh and described Department programs and areas of mutual interest; Dr. Aulakh was interviewing for the Weed Scientist position at the Valley Lab *April 8*
- Hosted Professor Stephen Ebbs of Southern Illinois University and discussed current and future collaborative research projects *April 9*
- Along 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 *April 9*
- Along with visiting Post-Doctoral Fellow Dr. Luca Pagano held a Skype video conference call with colleagues at the University of Parma regarding ongoing collaborative research *April 10*
- Gave an invited lecture at the CT Department of Public Health Laboratory titled “Nanotechnology: Applications, Implications, and Risk...Oh my” (60 attendees) *April 28*
- Along with Dr. Brian Eitzer, participated in a FDA FERN teleconference call on the recently released request for applications for the funding the next 5 years of the chemistry Cooperative Agreement Program (cCAP) *April 30*
- Attended the monthly Laboratory Preparedness Advisory Committee meeting at the Department of Public Health Laboratory in Rocky Hill *May 4*
- Gave a presentation titled “Food Safety and Public Health” at the Public Health Research and Services Symposium held in Jones Auditorium *May 6*
- Along with Dr. Brian Eitzer, Dr. Christina Robb, Dr. Walter Krol, Dr. Sanghamitra Majumdar, Dr. Arnab Mukherjee, 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 *May 14*

- Participated in a teleconference call with collaborators from Carnegie-Mellon University and Duke University to begin organizing a conference that has been funded by NSF is titled “FEW Workshop for Applying Sustainable Nanotechnology to Optimize and Unify Food, Energy and Water Systems” *May 22*
- Along with Dr. Brian Eitzer, participated in the bimonthly Northeast Regional FERN teleconference call *May 28*
- Along with Dr. Christina Robb, Dr. Walter Krol, Ms. Kitty Prapayotin-Riveros, Mr. Michael Cavadini, Mr. John Ranciato, and Ms. Terri Arsenault, participated in a bimonthly FDA ISO Accreditation Mentor-Mentee teleconference call with the Ohio Department of Agriculture *May 28*
- Attended the monthly Laboratory Preparedness Advisory Committee meeting at the Department of Public Health Laboratory in Rocky Hill CT *June 1*
- Hosted Lockwood Lecturer Dr. Melanie Kah of the University of Vienna (Austria) *June 3-4*
- Along with Dr. Walter Krol, participated in a CT DEEP-led conference call of the Lobster Pesticide Study 2014 Steering Committee to discuss the upcoming method validation with the University of CT *June 4*
- Attended the Nanoscale Science and Engineering for Agriculture and Food Systems Gordon Research Conference and gave a lecture titled “Trophic transfer of engineered nanoparticles in agricultural systems” (120 attendees) *June 7-12*
- Met with representatives from the Northeast Association of State Departments of Agriculture (NEASDA) and provided a tour of Department laboratories and description of key programs (30 attendees) *June 9*
- Along with Dr. Brian Eitzer, Dr. Christina Robb, Dr. Walter Krol, Dr. Sanghamitra Majumdar, Dr. Arnab Mukherjee, 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 *June 11*
- Along with Dr. Christina Robb, Dr. Walter Krol, Ms. Kitty Prapayotin-Riveros, Mr. Michael Cavadini, and Ms. Terri Arsenault, participated in the FDA ISO MFRPS quarter 3 teleconference call *June 11*
- Attended a day-long CHRO training session at the Legislative Office Building in Harford on new regulations for affirmative action plan construction *June 18*
- Held a conference call with representatives of the CT Department of Agriculture regarding an upcoming joint application to the FDA Animal Feed Regulatory Program Standards (AFRPS) Cooperative Agreement Program *June 22*
- Traveled to Kunming University of Science and Technology in Kunming, China to give an invited lecture titled “Interactions between engineered nanomaterials and agricultural crops” (55 attendees) *June 23-30*

WILLIAMS, SCOTT C.

- With Megan Floyd, conducted a small mammal trapping demonstration and deer enclosure explanation to students in the Wildlife Management Techniques Class in the Department of Natural Resources and the Environment at the University of Connecticut (20 student participants) *September 8, 2014*
- Was interviewed about the deer management aspect of the Centers for Disease Control-funded Integrated Tick Management Study by Tony Spinella of the Redding Pilot *September 15*
- Gave the invited lecture “Deer Management Paradigms: Exploring the Deer Density Divide Between a Municipality and its Hunters” at the 19th Annual Pine Barrens Research Forum at Brookhaven National Laboratory in Upton, NY (120 attendees) *October 2*
- Was interviewed about deer and moose behavioral response to climate change by Madeline Bodin of the Northern Woodlands publication “The Place You Call Home” *October 15*

- Participated in the 51st meeting of The Connecticut Agricultural Experiment Station’s Institutional Animal Care and Use Committee in New Haven *October 23*
- As Executive Treasurer, participated in the 26th Annual Connecticut Urban Forest Council Conference and 10th Annual Forest Forum in Plantsville *October 29*
- Participated in a conference call of the annual conference planning committee of the Connecticut Urban Forest Council *November 18*
- Gave the invited talk “Deer Damage Management Options for the Home Gardener” to the Portland Garden Club in Portland (25 attendees) *November 19*
- Gave an invited lecture titled “Ticked Off! Invasive Plants, Ticks, Deer and Lyme Disease—A Surprising Connection” hosted by the Cherry Brook Garden Club, Canton (60 attendees) *January 13, 2015*
- Participated in a conference call meeting of the Executive Board of the Northeast Section of The Wildlife Society *January 29*
- Participated in a conference call meeting of the Executive Board of the Connecticut Urban Forest Council *January 29*
- Attended the Connecticut Conference on Natural Resources at University of Connecticut in Storrs *March 16*
- Met with Dr. Morty Ortega from the Department of Natural Resources and the Environment, University of Connecticut, to discuss collaborative research opportunities *March 19*
- Participated in the Executive Board meeting of the Connecticut Urban Forest Council in Middlefield *March 27*
- Gave a talk titled “Deer Damage Management Options” to the Spring 2015 Study Group of the Institute for Learning in Retirement in New Haven (7 attendees) *April 15*
- At the invitation of Dr. Goudarz Molaei, gave a blacklegged tick flagging demonstration and field lecture to graduate students class in the Biology of Disease Vectors class from the Yale University School of Public Health, Madison (9 attendees) *April 18*
- Hosted the Annual Meeting of the Executive Board of the Northeast Section of The Wildlife Society in Newport, RI *April 19*
- Hosted the Annual Meeting of the Northeast Section of The Wildlife Society in Newport, RI *April 20*
- Attended the 71st Annual Northeast Fish and Wildlife Conference, Newport, RI *April 19-21*
- Gave an invited lecture about environmental careers at Middlesex Community College in Middletown (10 attendees) *April 28*
- Participated in the Lyman Hall High School agricultural program compliance review in Wallingford *April 29*
- Hosted the St. Thomas’s Day School first grade class on a tour of CAES which included presentations by Dr. Gale Ridge, Mr. Mark Creighton, Ms. Jennifer Fanzutti, and Mr. Peter Thiel (20 students, 5 teachers) *May 6*
- Gave an invited lecture titled “Ticked Off!-Invasive Plants and Lyme Disease, a Surprising Connection” at the Annual Meeting of the North Branford Land Conservation Trust in Northford (45 attendees) *June 3*
- Working collaboratively with Dr. Anthony DeNicola of White Buffalo, Inc., met with Paul Lenz, Deputy Chief of New York City Environmental Protection and staff about deer management on NYC watershed lands (3 staff members attended) *June 5*
- Was interviewed by Melinda Wenner Moyer of Nature Magazine on small mammal trapping and residential blacklegged tick management in Redding *June 30*

XIAO, FENG

- Presented the lecture “Interactions of Biochars of Varied Meso- and Micro porosities with Charged and Neutral Heterocyclic Aromatic Compounds Including a Triazine Herbicide”; and co-chaired a

symposium titled Pyrogenic Carbonaceous Materials as Adsorbents of Inorganic and Organic Compounds: Fundamentals and Applications, at the 248th American Chemical Society National Meeting, Environmental Chemistry Division, in San Francisco, CA *August 10-14, 2014*

YI, PENG

- Presented a poster titled “Interactions between Cerium Oxide Nanoparticles and Biochar Nanoparticles” at the 248th American Chemical Society National Meeting, Environmental Chemistry Division, in San Francisco, CA *August 10-14, 2014*

ZARRILLO, TRACY A.

- Participated in the seminar “Presenting Data and Information” given by Edward Tufte in Hartford *October 20, 2014*
- Hosted Sam Droege during his visit to the Station. He visited her laboratory, helped with bee identification, and gave a Lockwood Lecture on April 29 *April 28-30, 2015*
- Met with Dr. John Ascher (University of Singapore) at the American Museum of Natural History in New York City to discuss our current manuscript and future collaborative research opportunities *June 2*

ZENG, QUAN

- Attended the annual meeting of the Connecticut Pomological Society in Glastonbury and discussed orchard sampling for fire blight during the upcoming season with fruit growers and extension personnel and prepared and distributed a CAES fact sheet regarding fire blight winter and early season management *December 2, 2014*
- Gave a presentation titled “Monitor and prevent streptomycin resistance in fire blight pathogen populations in New England” to the Northeastern Association of State Departments of Agriculture (NEASDA) at the Station, in which he gave an overview of fire blight, streptomycin resistance in fire blight populations in the United States, and recent findings of the streptomycin susceptibility test in fire blight pathogen populations in New England (50 adult attendees) *June 9, 2015*
- With Ms. Regan Huntley, attended the twilight meeting of the Connecticut Pomological Society at Norton Brothers Orchard in Cheshire and gave a presentation titled “Monitor and prevent streptomycin resistance in Connecticut,” in which he updated the fire blight disease situation in 2015 in New England, and summarized recent findings in streptomycin resistance survey. He also spoke with tree fruit growers and pollinator providers and answered their questions about fire blight and other tree fruit diseases <http://ipm.uconn.edu/documents/raw2/html/785.php?aid=785> (60 attendees) *June 23*

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	144
Department of Consumer Protection	258
Department of Energy and Environmental Protection	156
FDA, Health Depts., Cities/Towns, Misc. Foundations	59
Proficiency Test Samples	6
University Research Collaborators	2,166
CAES Departments	356
Grand Total	3,165

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, police departments, 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 analysis of feed and fertilizer products.

a. Animal Feeds:

- **Analysts:** John Ranciato, Craig Musante
- **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, 2014 to June 30, 2015, we received and completed analysis of 47 feed samples. These samples are analyzed for parameters such as 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 15 (32%). Analytical findings are turned over to the CT Department of Agriculture for regulatory response. Joint funding with the Department of Agriculture is currently being sought from the FDA; this would expand the feeds program and bring certain aspects under ISO accreditation.





b. Fertilizers:

- Analysts: John Ranciato, Craig Musante
- 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, 2014 to June 30, 2015, 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 collaborative project with the DoAg Bureau of Aquaculture has continued into a third year and 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, 2 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), and select heavy metals. Results are then reported to DoAg Aquaculture staff for a decision on regulatory action. All samples analyzed by our Department since program inception 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 in a timely fashion 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, Kittipath Prapayotin-Riveros, Michael Cavadini
- Summary: As part of a Market basket program, we

determine concentrations of agrochemicals in fresh and processed foods from local, domestic, and imported sources offered for sale in CT and assure compliance with established tolerances. Market basket survey samples are collected by DCP Inspectors and results are published in an annual Station Bulletin available by mail and at www.ct.gov/caes.

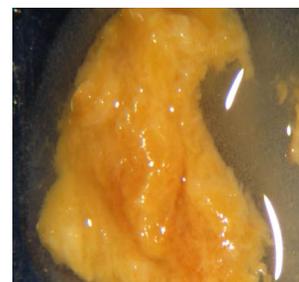
- Results: From July 1, 2014 through June 30, 2015, a total of 84 samples of food were analyzed for pesticide residues. Of the 84 samples analyzed, 46 (54.8%) contained a total of 119 residues. Of these 46 samples, there were 3 samples each containing one violative residue. There were 52 different pesticide active ingredients found at an average concentration of 0.143 $\mu\text{g}/\text{Kg}$, and the average number of pesticide residues per sample was 2.58.

- With US FDA funding and support, the Department has received new equipment and is now 4 years into a 5-year effort to bring the Market basket program under the scope of ISO 17025 Accreditation.

Impact: The Department of Analytical Chemistry's Market basket program 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
- Summary: From July 1, 2014 to June 30, 2015, 63 consumer complaint samples were submitted for analytical requests such as foreign material identification, as well as possible product adulteration or tampering. For some samples, we rely on the expertise in other CAES Departments, including Plant Pathology & Ecology, Entomology, and Forestry & Horticulture.



FDA FOOD SAFETY
MODERNIZATION ACT



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 4 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 of 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 or optical emission spectroscopy 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. Additional matrices this year included paint chips, cardboard, and Speedy-Dry.
- Summary: From July 1, 2014 to June 30, 2015, 25 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.



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. Water, vegetation, and soil samples can now be analyzed for glyphosate using liquid chromatography-mass spectrometry (LC/MS).
- Summary: From July 1, 2014 to June 30, 2015, 137 samples were analyzed under this program.



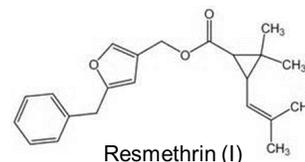
Impact: The analysis of samples collected from surveillance programs for soil, surface/groundwater and sediments, as well as those that are part of active misapplication



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

- **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 are jointly conducting a full method validation study. The study is currently underway, and once complete, the validated method will be applied to lobsters collected from Long Island Sound.



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 under a cooperative agreement that enables research and analyses on chemical contaminants such as pesticides, poisons, toxins, and heavy metals in food. The Department is currently participating in an FDA-led multi-lab validation of an inductively coupled plasma mass spectrometry method to determine arsenic and 9 other heavy metals in a range of food matrices. Staff scientists are also participating in FDA-lead Working Groups on the mycotoxins and chemotherapeutics; in both cases, the goals of the Working Groups are to develop more sensitive and robust analytical methods in food for the contaminants of concern. Lastly, Dr. Brian Eitzer and Ms. Terri Arsenault are both serving 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.



4.7 Inductively Coupled Plasma-Mass Spectrometric Determination of Arsenic, Cadmium, Chromium, Lead, Mercury, and Other Elements in Food Using Microwave Assisted Digestion

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, those unique resources are also directly applied to a range of 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, 2014 through June 30, 2015, Department staff analyzed 250 samples for municipalities or other groups. As in previous years, this included the analysis of soils from schools (Foodcorps) and various other locations (community gardens, municipal property) for heavy metals. In addition, we provided analytical support for a Quinnipiac University project analyzing for organic contaminants in a local stream. We



also analyzed a number of toy cars for the New Haven Department of Health. These toy samples were from the home of a child with high blood levels; our analysis showed lead at concentrations well below the regulatory limit.

Impact: The findings of low levels of lead in painted toys allow environmental health inspectors to focus their investigation on other potential sources of contamination. In addition, analysis of soil samples on elementary school grounds allows staff to make appropriate decisions about the location of student vegetable gardens.

6. ANALYSES ON BEHALF OF OTHER STATION DEPARTMENTS

a. Analyses related to pollinator decline - Department of Entomology

- Analyst: Brian Eitzer
- Summary: In research projects conducted in collaboration with Dr. Kim Stoner in the Department of Entomology, as well as State Bee Inspector Mr. Mark Creighton, we determine concentrations of agrochemicals in pollen, bees, and wax to ascertain possible relationship to bee health and colony decline. We have developed high resolution LC-MS methods for low level detection of specific pesticides of concern, including neonicotinoid insecticides. During the July 1, 2014 to June 1, 2015 period, 174 samples were analyzed during the current period. See the Research section below for additional details.

b. Analysis of pesticides in tobacco leaves - Valley Laboratory

- Analysts: Brian Eitzer
- Summary: A cooperative project with Dr. James LaMondia at the Valley Laboratory has continued into a third year; the focus is on assessing application strategies that will reduce pesticide residues on tobacco leaves while providing protection from pathogens of concern. More information on this project can be found in the Valley Laboratory section of this document.

c. Elemental Analysis - Department of Plant Pathology and Ecology

- Analyst: Craig Musante
- Summary: In conjunction with Dr. Wade Elmer of the Department of Plant Pathology and Ecology, elemental analysis of 204 samples of various crops grown in the presence or absence of nanoscale micronutrient amendments was conducted. 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 and the AAPCO Check Sample program (pesticide formulations) were completed during the reporting period. All of these testing regimes serve to ensure accurate and reliable laboratory results.

II. RESEARCH ACTIVITIES

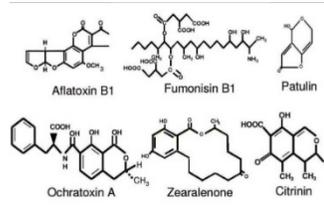
Research projects in the Department of Analytical Chemistry include applied and fundamental studies. Research is often stimulated by our service work and in turn, research results often impact service activities.

1. FOOD SAFETY

- Improvement of analytical methods for determination of pesticide residues in food

- **Investigators:** Brian Eitzer, Terri Arsenault, Walter Krol, Sanghamitra Majumdar, Craig Musante, Joseph Hawthorne, Arnab Mukherjee, Jason C. White

- **Summary:** We continue to participate in or lead several FDA coordinated research projects. Two of these projects involve validating the use of high resolution LC-MS platforms for screening applications, including both pesticides and FDA FERN methods for poisons and toxins. We have received a new GC-MS system this year and will be comparing its performance in chemical ionization mode to that of the GC-MS/MS system for the detection of pyrethroids in seafood. We are also continuing our pursuit of ISO Accreditation, which will be required for future FDA FERN participation. Lastly, we are involved in an FDA-lead research project on the use of LC-MS platforms for the detection of mycotoxins and chemotherapeutics in various food matrices. The overall goal of these projects is to develop robust and accurate methods that FDA could deploy



as part of large-scale surveillance programs.

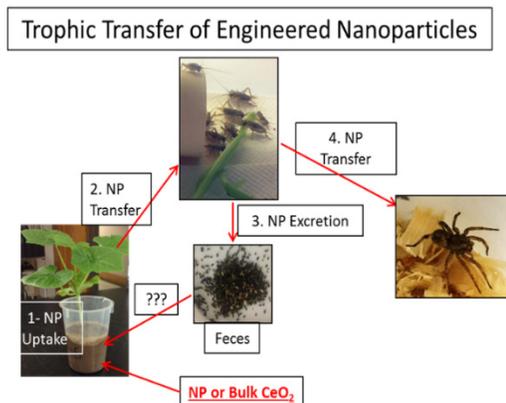
Impact: The development and validation of new, more sensitive equipment and analytical techniques will enhance pesticide surveillance activities in the state and serve to better protect the food supply against incidental or intentional adulteration.



Project 2: Nanoparticle fate in agricultural systems

- **Investigators:** Craig Musante, Roberto De La Torre-Roche, Joseph Hawthorne, Alia Servin, Jason C. White

- **Summary:** Nanomaterials (NM) have at least one dimension less than 100 nm (one billionth of a meter), and this small size results in unique physical and chemical properties not observed at the bulk scale. Nanotechnology takes advantage of these unique and useful nanoscale properties. Current nanomaterial use is ubiquitous; over 1600 NM-containing products are commercially available in areas such as electronics, health-care, cosmetics, agriculture, pharmaceuticals, and food processing. Of special concern to our laboratory is 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. From a regulatory perspective, nanomaterials are largely considered to have equivalent risk to that of corresponding bulk materials. However, recent data out of our laboratory and others have suggested that this assumption may not be true and that NM may behave differently in a toxicologically significant fashion with respect to food safety. A lack of understanding regarding the fate and effects of nanomaterials in agricultural systems is troublesome given that food crop contamination could be a significant uncharacterized pathway of human exposure. Two USDA National Institute of Food and Agriculture (NIFA) competitive grants are funding research to define 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 certain nanoparticles transfer through a terrestrial food chain (soil to zucchini to crickets to spiders) at significantly greater levels than does the equivalent bulk material. A visiting Post-doctoral Fellow from the University of Parma is conducting a transcriptomic study of several crop species exposed to copper, cerium, and lanthanum metal oxide nanoparticles in an effort to isolate sensitive biomarkers of exposure. Such biomarkers could then be



employed on a wide scale to provide meaningful information on NM distribution and effects in the environment. Additional co-investigators on this work 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, The Institute of Experimental Botany in the Czech Republic, Hasselt University in Belgium, and the University of Carthage in Tunisia.

Impact: Our research has previously demonstrated that the toxicity of nanomaterials to crop species can be significantly greater than that observed for the corresponding bulk material. Current investigations have also shown the nanomaterials 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 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 crop metabolism and health. In a series of collaborative experiments with investigators at Hasselt University in Belgium, endophytic bacteria were isolated from zucchini cultivars that had previously been shown to accumulate 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 currently underway, zucchini plants were inoculated with these unique microorganisms prior to planting in DDE-containing soils. The ability of these microbes to promote plant growth and contaminant degradation is currently being assessed.



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 into how honey bees get exposed to pesticides during foraging. As honey bees forage, they can be exposed to the pesticides used in residential areas or agricultural fields from which they collect pollen and nectar. During the past year, we have used traps to collect pollen balls from the bees as they return to the hive. These traps are



set out for the entire season, with pollen collection occurring at approximately two-week intervals. As might be expected, during the course of a season, pollen bees collect pollen from a wide variety of plants which can bloom at different times. The pesticide load in the pollen of those plants can also vary widely, both in which pesticides are found and how much of them are found. Long-term studies such as this provide baseline information, which allows us to understand how honey bee pesticide exposure changes with time.

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 role of pesticides. Samples of bees (multiple species), plant materials (nectar, pollen, flowers), and bee-collected pollen are being analyzed for pesticides. These results are then analyzed along with the other factors being monitored to assess synergistic or antagonistic effects.

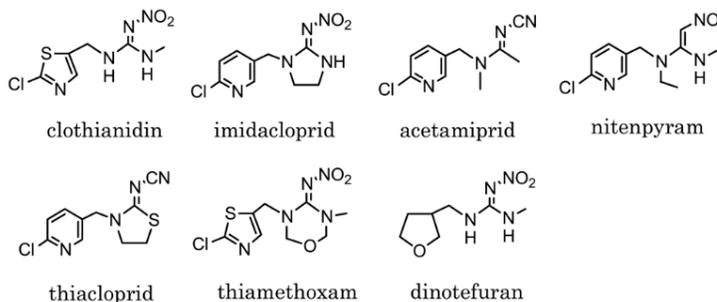


Impact: Knowledge of pesticide exposure to pollinator communities and the resulting ability of those communities to pollinate crops can be used to guide farmers in the proper use of pesticides to insure not only crop pollination but also protection from pests and pathogens.

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), Dr. Richard Cowles (Valley Laboratory), Dr. Douglas Dingman (Department of Entomology)

• **Summary:** This is a new project that has multiple funding sources. 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. However, there is a dearth of information on which nursery plants are visited by pollinators and how much of these pesticides may be present in the nectar and pollen of these plants under current agricultural practices. This study aims to fill this information gap, studying both the visitation of pollinators to nursery plants and examining how much of these pesticides can get into the nectar and pollen of model ornamental plants.



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 200-250 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 conduct 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 2014 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 (with summer assistant Ellie Clark).

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. During January of 2015, the Department of Entomology moved into the newly renovated and expanded Jenkins-Waggoner Laboratory. The Insect Information Office in the new addition has a laboratory, office, public reception, and a climate controlled collections room.

Service Activities

Insect Information Office: Dr. Gale Ridge assisted by Ellie Clark oversees the 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.”

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

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, housing authorities, museums, municipalities, libraries, state government, and the media. Between July 1, 2014 and June 30, 2015, the insect inquiry office handled at least 8,549 recorded inquiries (Table 1). In addition, as part of the CAPS summer trapping program, Dr. Ridge identified 8,000 bark beetles in the family Scolyidae. During the fall of 2014 there were unusually high yellowjacket and other wasp activity, due to an early dry spring allowing more overwintering queens to survive through to nest building. There were 947 categories of inquiries including insects, arachnids, animals, use of pesticides, insect damage, general entomology, and horticultural issues. Of these, 32% were related to man and medical issues, 65% natural resources, 2% food related, and 1% undetermined. Bed and bat bug inquiries remain the leading inquiry with 2,701 (31%) of the identifications performed by the office (Table 2). In order of numbers, the second highest query were wasps and bees, then beetles which included inquiries about the emerald ash borer, followed by gypsy moth, white grubs, termites, and ticks. This year, there was an outbreak of the gypsy moth causing widespread defoliation of several species of

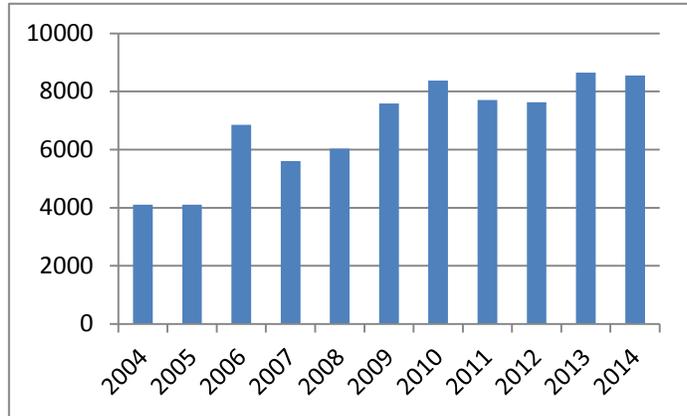


Table 1. Number of inquiries from FY 2004-2015.

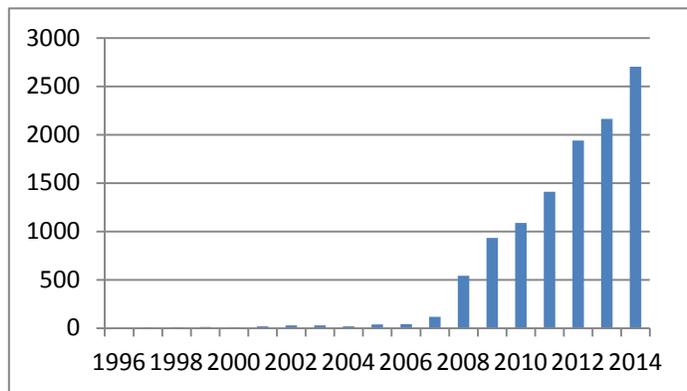


Table 2. Number of bed bug inquiries from 1996 – 2015.



Gypsy moth caterpillars killed by *Entomophaga maimaiga*.

trees, primarily oaks, throughout Connecticut. This was weather related, caused by two consecutive early dry springs during 2014 and 2015. This either prevented or reduced 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 Connecticut towns from Rhode Island compounded defoliation. In March 2015, Dr. Ridge identified the Southern pine beetle *Dendroctonus frontalis* Zimmermann, a destructive pest of primarily pine, collected from Wharton Brook State Park on the North Haven-Wallingford town line.

The office continued to lead in public outreach, introducing a new Spanish interpretation service. There were numerous state- and New England-wide presentations and training programs for bed bugs, the emerald ash borer, and the Asian longhorned beetle. The Connecticut Coalition Against Bed Bugs (CCABB), chaired by Dr. Ridge, continued to publish public education outreach material, provide a bilingual service, sponsor a bed bug bill board in Hartford, provide 550 statewide public transportation bus posters about bed bugs, and hold a bed bug forum number VIII, held in October 2014. 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. 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 United States. The Insect Information Office provides a vital service in the identification of new potential pests.

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 in 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 2015, 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 forest pests 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 Ccarelli 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 13 different butterfly species, 13 species of birds, and 15 other species around the garden on Plant Science Day August 6, 2014.

<i>Butterflies & Moths</i>	<i>Birds</i>	<i>Other</i>
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	Carpenter Bee

Common Sootywing
Pipevine Swallowtail (larva)
Pearl Crescent
Eastern Comma
Wild Indigo Duskywing
Monarch
Dunn Skipper
American Lady
Hummingbird Clearwing
Milkweed Tussock Moth
(larva)
Luna moth (larva)

Gray Catbird
Bluejay
Song Sparrow
Ruby-throated Hummingbird
Red-winged Blackbird
Osprey
House Finch
Rock Dove

Japanese Beetle
Carolina Locust
Black-mantled Gilder (dragonfly)
12-spot Skimmer (dragonfly)
Blue Dasher (dragonfly)
Horsefly spp.
Eastern chipmunk

Sponsored Meetings and Conferences: A Forest Health Workshop, organized annually by Dr. Victoria Smith, was held March 3, 2015 at Sessions Woods Wildlife Division Office, Burlington, CT. It consisted of a variety of presentations by Station Staff and the University of Connecticut Cooperators on various aspects of research and findings of concern to foresters in the Department of Energy and Environmental Protection, USDA-APHIS-PPQ, and the forest health community.

Tia Blevins, Katherine Dugas, Jeff Fengler, Steve Sandrey, Vicki Smith, and Peter Trenchard participated in the Eastern Chapter of the Horticultural Inspection Society Systems Approach to Nursery Certification exercise on September 30-October 1, 2014, at the Valley Lab of the Connecticut Agricultural Experiment Station (Windsor, CT) and Monrovia Nursery (Granby, CT). Thirty inspectors from nine states participated. On the evening of Sept. 30, participants met in the Gordon Taylor Auditorium of the Valley Lab, to discuss the goals of the exercise, and to meet our hosts at Monrovia, Vice-president Greg Schaan and production Manager Sali Borelli. At Monrovia on the morning of October 1, various teams were faced with mock situations in the nursery, such as pathogen finds or trace-backs, and they applied principles of the systems approach to each situation. At noon, teams met with Monrovia personnel, to discuss how the nursery would approach each situation. Following lunch at the Valley Lab, CAES researchers Dr. Sharon Douglas, Dr. Robert Marra, and Dr. James LaMondia discussed current findings on boxwood blight, development of best management practices, and management of the disease in nurseries. Participants also had the opportunity to examine actual infected boxwoods, to see the symptoms of disease first-hand.



Research Activities

Integrated Tick Management (ITM)

Dr. Kirby C. Stafford, Dr. Scott C. Williams (Forestry & Horticulture), Dr. Goudarz Molaei (Environmental Sciences), and postdoctoral scientist Dr. Laura E. Hayes began the third year of a field study in Redding, CT, 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. Treatments in the ITM study are 1) natural product application (rodent bait box distribution and the spray applications of the entomopathogenic fungus *Metarhizium anisopliae* under product name Met52), 2) management of white-tailed deer (*Odocoileus virginianus*) populations and 3) a combined treatment with both natural product application on individual properties and deer population management. David Whitman (Connecticut Tick Control, LLC) and Dr. Anthony J. DeNicola (White Buffalo, Inc.) undertook natural product application and deer population management, respectively, within assigned residential areas. Heidi Stuber and Michael Short assisted with sampling of black-legged tick (*Ixodes scapularis*) and white-footed mouse (*Peromyscus leucopus*) populations in the four residential areas where the field experiment is being conducted. Heidi Stuber is assisting with the laboratory testing of field-collected samples of ticks and white-footed mouse serum for evidence of pathogen exposure. Results from the first two years of the study showed the combined bait box and *M. anisopliae* applications reduced nymphal blacklegged tick populations on residential properties by an average of 78%. Effectiveness of deer population management and natural product application treatments, both alone and in combination on tick populations and disease parameters for the three years of interventions will be compiled and analyzed in the final project year. This project is funded by a cooperative agreement (i.e., grant) from the Centers for Disease Control and Prevention (CDC) for the period from 2012 through 2016.

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 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 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 11 home sites receiving the RTV bait, 10 home sites receiving the bait and applications of the entomopathogenic fungus *Metarhizium anisopliae* (Met52), 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 90% of the mice. Bait consumption in 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.



Fig. Open bait box with the RTV bait

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.

Quantifying exposure of honey bees and bumble bees to neonicotinoids in nectar and pollen of ornamental plants

Neonicotinoid insecticides are controversial because of their capacity to move throughout the plant, including into pollen and nectar, and because several of the insecticides in this class, including imidacloprid, clothianidin, thiamethoxam, and dinotefuran, are highly toxic to bees. Although this group of insecticides has a very wide range of agricultural and landscape uses, considerable recent attention has been focused on use on nursery and bedding plants, including public protest demonstrations at retailers of ornamental plants demanding labeling of plants treated with neonicotinoids.

Nursery and greenhouse growers have not been able to respond to this public attention to neonicotinoid insecticides due to a lack of information about the extent to which these insecticides move into nectar and pollen when applied according to current industry practices. A multidisciplinary team of CAES scientists, Dr. Kimberly Stoner, Dr. Richard Cowles, Dr. Brian Eitzer, and Dr. Douglas Dingman, assisted by Dr. Alejandro Chiriboga of the University of Connecticut, are conducting several interrelated studies to fill this information gap.

Among the studies being conducted are: measurement of imidacloprid in the pollen and nectar of rhododendrons treated according to current nursery practice, measurement of the effects of variation in rate and timing of application of neonicotinoids in the pollen of sunflowers and the nectar of milkweed (model plants for evaluating the movement and rate of decline of pesticide residues in herbaceous plants), and collection of pollen from bumble bee and honey bee colonies placed at three commercial nurseries in the state to evaluate pesticide exposure and to identify ornamental plants used by these bee species. These projects are funded by grants from the Connecticut Department of Energy and Environmental Protection and the Horticulture Research Institute.

Pollination of Pumpkin and Winter Squash in Farm Fields in Connecticut

Pumpkin and winter squash require insect pollination in order to set fruit. Female flowers are separate from male flowers, although both are borne on the same plant. Dr. Kimberly Stoner, assisted by Morgan Lowry and by seasonal workers, has measured pollen deposition on pumpkin or squash stigmas (female flower parts) on 67 sampling dates in 2011, 2012, 2013, and 2014 on 20 different fields, including organic and non-organic farms, and farms with and without honey bee hives on site. According to the scientific literature, 1500 to 2000 pollen grains per stigma are sufficient for complete fruit set and full fruit weight in pumpkins. Pollen deposition was higher than this range on all but one sampling date (at the Griswold Research Station in 2012), in a field that was lost to a plant pathogen soon afterwards. In 8 trials at our 3 research farms, we have confirmed that supplementing the natural level of pollen deposition on pumpkin stigmas does not increase fruit set, fruit weight, or seed number (which is generally correlated with fruit weight). This confirms that the natural level of pollination we are getting in Connecticut pumpkin and winter squash is more than sufficient for good yield.

The majority of bee visits to pumpkin and squash flowers were from bumble bees, particularly the common eastern bumble bee, *Bombus impatiens*, with 66% of overall visits, 64% of visits to male flowers, and 68% of visits to female flowers. The squash bee, *Peponapis pruinosa*, made 22% of visits to all flowers, 23% of visits to male flowers, and 16% of visits to female flowers, and the honey bee, *Apis mellifera*, made 11% of visits to all flowers, 9% of all visits to male flowers, and 21% of all visits to female flowers. We have found that the level of pollen deposition is more closely related to the number of visits of bumble bees to the female flowers than to several other variables (total bee visits, total bee visits to female flowers, and visits from the other two species), so we are currently studying behavior of bees at the female flowers in more depth using timed observations, video recording of bee behavior, and collecting bees of all three species visiting female flowers to determine how much pollen they are carrying.

Documenting Bee Diversity in Connecticut

Because of concerns about honey bee health and the recent drastic reduction in range and abundance of several species of bumble bees, there has been an upsurge in CAES projects surveying bee abundance and diversity in various environments, including our own research farms and campus, diversified vegetable farms, coastal habitats, and natural areas such as the White Memorial Conservation Center and the Salt Meadow Unit of the Stewart B. McKinney National Wildlife Refuge. As a result of this increased collection effort, Tracy Zarrillo, in collaboration with Dr. John Ascher of the National University of Singapore and the American Natural History Museum, Dr. Jason Gibbs of Michigan State University, and Dr. Kimberly Stoner of CAES, has identified 13 new state records – bee species not previously known to have been collected in Connecticut. In many cases, these new records indicate range extensions for species previously known from further south or west. In other cases, the lack of previous records may be due to previous taxonomic confusion, rarity, or restricted habitat.

Protecting honey bee hives from American Foulbrood Disease

Dr. Douglas W. Dingman, unassisted, continued investigations on the bacterium *Paenibacillus larvae*, causative agent of the disease American foulbrood (AFB) in larvae of honey bees (*Apis mellifera*), and on the microsporidial pathogens *Nosema apis* and *Nosema ceranae*. He continued examination of the genetic diversity (i.e., maternal lineage) of honey bees within Connecticut.

- *P. larvae* enolase proteins obtained from different genotypes, and demonstrating amino acid sequence differences, have been purified. Enzyme kinetic studies have shown no significant difference in activity rate (i.e., Km values) between enolases to support a role of the enzyme in virulence differences between the various genotypes.
- An investigation using qRT-PCR analysis of *P. larvae* enolase expression is being started.
- Mitochondrial DNA sequence analysis has continued for investigation of honey bee genetic diversity in Connecticut. Results remain at five mitochondrial profiles identified (Type C1, C11, C12, M4, and O2) with Type C predominating.
- A correlation of hemolytic activity to genotype of the various *P. larvae* isolates has been performed. Findings differ from recently published reports and are in agreement with older reports on phenotype/species association.
- Detailed analysis, via 16S rRNA gene sequencing, is being used to differentiate *Brevibacillus laterosporus* isolates from *Paenibacillus larvae* and *Paenibacillus pulvifaciens*. Several *B. laterosporus* strains have been identified as *P. larvae* in the literature and in stock repositories. This misidentification continues to cause confusion regarding phenotype/genotype associations.
- Workshops to train Connecticut beekeepers on microscopic analysis of honey bees for nosema presence, and for estimation of infection rate within a bee hive (sequential sampling), are continuing.
- Entry of registered Connecticut beekeepers into the multi-year database for years 2007-2013 has been completed. Apiary registrations for 2014 are being added to the database.

Impact: Diseases of honey bees, caused by bacterial and fungal infections (i.e., American foulbrood (AFB) and nosemosis, respectively) cause considerable economic loss to beekeepers and agriculture. Beekeepers, by being aware of the prevalence of these two diseases, can make informed decisions on control and treatment procedures of the diseased hives. Advancing knowledge pertaining to *P. larvae* provides information to aid development of approaches for lowering the impact of these diseases. An understanding of maternal lineage of bees helps to associate phenotypic traits to genotypes. This will make tracking, selecting, and propagating the genetics of healthy bees easier.

Molecular identification of plant pollen

Dr. Douglas W. Dingman, assisted by Brianna Williams (summer helper), has begun development of a simple molecular technique to easily identify plant pollen. This technique will employ the use of *in situ* hybridization by hybridization probes constructed for a specific plant based on the DNA sequence of the ITS2 region in the plant 45S rRNA gene.

- Sequences for the 45S rRNA gene are being gleaned from the DNA database GenBank and are being aligned to identify regions of unique DNA sequence.
- Genomic DNA is being extracted from known plant samples for construction and testing of hybridization probes.
- Oligonucleotide primers are being devised and constructed for 45S rRNA gene amplification and sequencing for plants lacking this sequence data.
- Synthesis of digoxigenin labeled hybridization probes is being performed.
- Construction and testing of a hybridization probe for plants in the genus *Rhododendron* is being started.

Impact: Accurate identification of plant pollen is important to many different scientific investigations. Development of an easy and accurate technique to identify pollen will improve the ability and speed with which plant pollen is identified. Currently, the standard method of identification is via microscopic examination and identification based on morphology by specially trained individuals.

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 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. We are in the 6th year of our Wasp Watcher program. Over the course of the program we have trained 125 watchers. In 2015, 36 watchers from previous years are signed-on, 10 for their 6th year, as well as 20 new watchers. Since 2010, Watchers have collected over 6,000 beetles and detected EAB in 15 new towns.



Wasp Watchers at White Memorial Conservation Center pose with the first Emerald Ash Borer detected in Litchfield, CT in July 2014

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 planipennis* 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, Michigan. In 2014, two additional sites were added, Sleeping Giant State Park in Hamden, and Sherman, CT. In 2015, releases were started at two more sites, Cromwell Meadows, in Cromwell and White Memorial Conservation Center in Litchfield, and releases were continued at Sleeping Giant and Sherman. Middlebury and Prospect were moved to the next stage of the project, which is recovery to determine if the parasitoids have established in Connecticut.



Mattutuck State Forest in Plymouth, CT showing ash trees being killed by emerald ash borer. This forest is the site of a new research project examining the potential for combining pesticide treatment with biological control to preserve more mature trees than biological control alone. This project is in conjunction with the University of Massachusetts, Michigan State University and USDA APHIS.

Pheromones of Japanese cedar longhorn beetle, *Callidiellum rufipenne* (Coleoptera: Cerambycidae).



Callidiellum rufipenne is an invasive longhorn which attacks members of the cedar family. First detected in 2008 by scientists at CAES, the beetle is a secondary pest of highly stressed arborvitae. This project focused on the chemical ecology of *C. rufipenne* in collaboration with Drs. Chris Maier, CAES, Lawrence Hanks, UIUC, and Jocylane Millar, UC Riverside. A male-produced pheromone was identified in 2007. The pheromone 3R-hydroxyketone is shared by several members of the subfamily Cerambycinae, for whom it acts as an aggregation pheromone. A second compound was detected this spring in studies in Japan that synergizes the pheromone. Trapping in spring 2015, by Drs. Rutledge and Maier has showed that the pheromone in combination with the synergist is highly attractive to both male and female *C. rufipenne*. This data will allow better detection of this invasive beetle as it continues to expand its range in North America.

Fig. A male (lower) and female Japanese cedar longhorn beetle on a trap baited with pheromone.

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 northwards from Honduras over the last 400 years. It was discovered in Long Island, NY last fall. A presentation to foresters from the Department of Energy and Environmental Protection at the Forest Health Workshop in March 2015 resulted in discovery of SPB in Connecticut on March 17, 2015 on Red Pine in Wharton Brook State Park. Since this initial discovery, we have detected SPB across the state except Tolland and Windham

counties and in five species of tree, Red Pine, Scotts Pine, Pitch Pine, Norway Spruce and White Pine. We are currently working to understand some basic questions about this beetle in Connecticut, where is it, how successful it is at overwintering, how many generations does it have here, what host species it is attacking, and how it is interacting with those hosts. This work is being done in collaboration with Dr. Adriana Arango, CAES.

Fig. 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.



Surveys for Invasive Insects

The brown marmorated stink bug (*Halyomorpha halys*) is an invasive bug from Asia that was first discovered in Connecticut in 2008. The nymphs and adults feed on many vegetable, fruit, nut, and legume crops. Severe crop damage from feeding by stink bugs largely has been restricted to the mid-Atlantic region and the Pacific Northwest. Dr. Chris T. Maier, with assistance from Morgan Lowry, Tracy Zarrillo, Katherine Dugas, Gale Ridge, and Rose Hiskes, is investigating the distribution of this invasive stink bug in Connecticut. Based on specimens brought or mailed to the Station and on those collected on the tree of heaven (*Ailanthus altissima*), they have determined that the stink bug has spread across Connecticut. This non-native stink bug now occurs in at least 118 towns. The abundance of stink bugs has increased steadily since 2008, and now the brown marmorated stink bug is considered to be a pest of fruit and vegetables grown in Connecticut.

Other new finds by Dr. Maier include a Russian wood-boring sawfly (*Xiphydria prolongata*) and a mostly western longhorned beetle (*Tetropium velutinum*). The exotic sawfly was reared from a dead branch of black willow (*Salix nigra*) that was collected in Canaan in 2014. The longhorned beetle, kindly identified by Serge Laplante, had been in the insect collection at the Experiment Station since 1989. The species was collected inside of a new house constructed with timber from the western United States. Apparently, the beetle hitchhiked to Connecticut in lumber from the West. To date, no established populations of the beetle have been found in Connecticut.

Wild Hosts of the Spotted Wing Drosophila

The invasive spotted wing drosophila (*Drosophila suzukii*) poses a serious threat to many fruit crops. The larval infestations of this vinegar fly can destroy especially small fruits, such as strawberries, raspberries, blackberries, and blueberries, which are commercially grown on Connecticut farms. Over the past 4 years, Dr. Maier, assisted by Morgan Lowry and Tracy Zarrillo, has sampled unsprayed fruits on wild and ornamental plants to discover which ones are infested by larvae. Thus far, they have reared adults of the spotted wing drosophila from 39 fruiting species distributed in 19 plant families. Large larval infestations typically occur in the fruits of American pokeweed (*Phytolacca americana*), autumn olive (*Elaeagnus umbellata*), blackberries and raspberries (*Rubus* spp.), and dogwoods (*Cornus* spp.). The wild hosts of the spotted wing drosophila may contribute to the buildup of populations that later injure valuable agricultural crops.

Impact of the Lily Leaf Beetle

The lily leaf beetle (*Lilioceris lili*) feeds upon Asiatic and Oriental lilies that are grown in flower gardens in 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 true 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*) and the Turk's-cap lily (*L. superbum*). Based upon the examination of populations of wild Canada lilies in July of 2014, the lily leaf beetle occurs in 83% of the wild stands.

In 2014, Dr. Maier, with assistance from Morgan Lowry and Tracy Zarrillo, conducted an experiment to measure the impact of feeding by the lily leaf beetle upon wild Canada lilies. In Canaan, Connecticut, they infested individual caged lilies with 10, 5, or 0 (control) newly hatched larvae in May and then recorded plant weight in late summer to reveal differences among experimental groups. Similar to the 2013 results, as few as five larvae sometimes defoliated individual plants. The final dry weight of plants was significantly higher in uninfested plants than in those provided with 10 or 5 larvae. Lilies initially infested with 10 larvae had a dry weight of only 24.4% of that of the controls, and those with 5 larvae had a weight of 55.3% of the controls. The bulbs also showed a very similar trend in weight reduction. Thus, feeding by the lily leaf beetle has a severe negative effect upon the weight of wild Canada lilies, particularly those with higher larval density. Experiments are being planned to determine the effect of infestation upon the flowering and the survival of wild lilies.



Cages with wild Canada lilies infested with the larvae of the lily leaf beetle.

Longhorned Beetles of Connecticut

Dr. Maier and his assistants continued to make progress in their long-term study of the identity, the distribution, and the host range of longhorned beetles (Cerambycidae). To gather biological data, they

capture native and non-native wood-borers in traps baited with sex pheromones or host volatiles, rear adults from wood infested by larvae, collect adults on flowers, and examine label data on adult specimens in museums.

In 2013-2014, they ascertained the seasonal flight activity of over 25 common species by capturing adults in baited traps and on flowers. To date, they have reared 92 species of longhorned from dead wood; the rearings have provided new state records for Connecticut and many new host records. They also have developed a database, which now has over 15,200 entries. Biological data compiled in this database will assist in developing management plans for destructive species of longhorned beetles. Ultimately, Dr. Maier will produce an annotated checklist to the longhorned beetles of Connecticut.



An adult of *Oeme rigida*, a borer of eastern red cedar (*Juniperus virginiana*) at Hammonasset State Park.

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 two 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, 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 35,686 plants to Canada in 2014.

Nursery Dealer Permits Nursery dealer permits were issued to 182 firms. One-hundred fifty of these companies operate individual outlets. The remaining businesses have more than one outlet each. In total, there were 597 outlets.

Phytosanitary Certificates Two-hundred seventy nine phytosanitary inspection certificates were issued covering the shipment of the following plant materials to destinations outside the United States:

<u>Product</u>	<u>Quantity</u>
Apples (Cartons)	6,000
Bulbs & Tubers (Dahlia & Gladiolas) (# Bags)	262
Bulbs & Tubers (Dahlia & Gladiolas) (Kilos)	9
Chinese Tree Peony (plants)	30
Greenhouse plants	
Rhizomes	122
Cuttings	102
Nursery stock	
Unrooted cuttings	231
Plants (B and B)	19,623
Bare root plants	14,773
Orchids (plants)	2,845
Perennials	
Bare root plants	1,037
Potted plants	12
Seeds (bags)	335
Seeds (kilos)	24
Seeds (pallets)	10
Seeds (vials)	1
Tobacco	
Bales	52,306
Bundles	25,946
Cartons	33,900
Pounds	100
Walnut shells (bags)	3,717
Walnut shells (drums)	332

Special Inspections Six inspections were made for 48 individual plants to assist homeowners moving out of state.

Ninety seven inspections were made to assist nurseries moving the following plants interstate:

<u>Product</u>	<u>Quantity</u>
Nursery stock (containers)	539
(bare root plants)	2,621
Greenhouse plants	1,151
Seed (# Bags)	50
Orchids	15

Biotechnology Regulatory Services Inspection Activity In cooperation with officers from the Wallingford USDA-APHIS-PPQ office, eight inspections were conducted in 2014 at facilities or laboratories working with recombinant or regulated organisms.

Permits to Move Live Plant Pests, Noxious Weeds, and Soil In 2014, there were sixty nine 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 three Controlled Import Permits issued.

Post Entry Quarantine In 2014, there were three facilities approved for Post Entry Quarantine.

Boxwood Blight Boxwood blight [*Calonectria pseudonaviculata* (syn. *Cylindrocladium pseudonaviculatum*)], was detected at one nursery on plants that originated in North Carolina. Plants were destroyed and the area disinfested. No boxwood blight was detected at any production nursery on plants originating in CT. Home owners continue to report boxwood blight on plants in landscapes. Efforts continue to educate landscapers about boxwood blight and its consequences.

Chrysanthemum White Rust In 2014, we inspected 133,855 plants for CWR, caused by *Puccinia horiana*. No positives were detected.

Gypsy Moth We observed defoliation due to Gypsy Moth on 1,337 acres, mostly in New Haven County, in 2014. In November and December 2014, a gypsy moth egg mass survey will be conducted in 80-95% favorable host sites on a 7-mile grid (102 sites) throughout Connecticut.

Asian Longhorned Beetle We conducted 120 inspections of 10,007 trees in all counties of Connecticut for presence or signs of ALB infestation. No evidence of ALB was found.

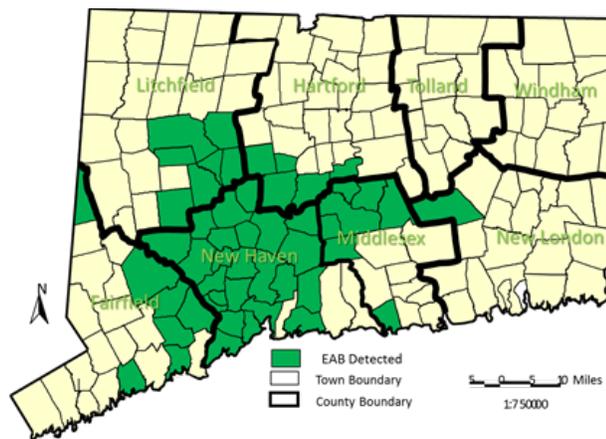
Hemlock Woolly Adelgid and Hemlock Scale This pest has been present in CT for many years, and continues to cause patchy damage and decline among the remaining population of hemlocks. Statewide in 2014, 186 acres were affected by HWA. Scale insects, such as elongate hemlock scale and circular scale, are increasing in some areas. Over 9,146 acres statewide were affected by elongate hemlock scale.

Ramorum Leaf Blight (*Phytophthora ramorum*) There were three trace-forward actions involving *P. ramorum* in CT in 2014. Potentially infested host material was shipped to many private home owners. A total of nine samples were collected; one was found to be positive. All positive materials were destroyed by disposal in the municipal waste stream, which leads to incineration.

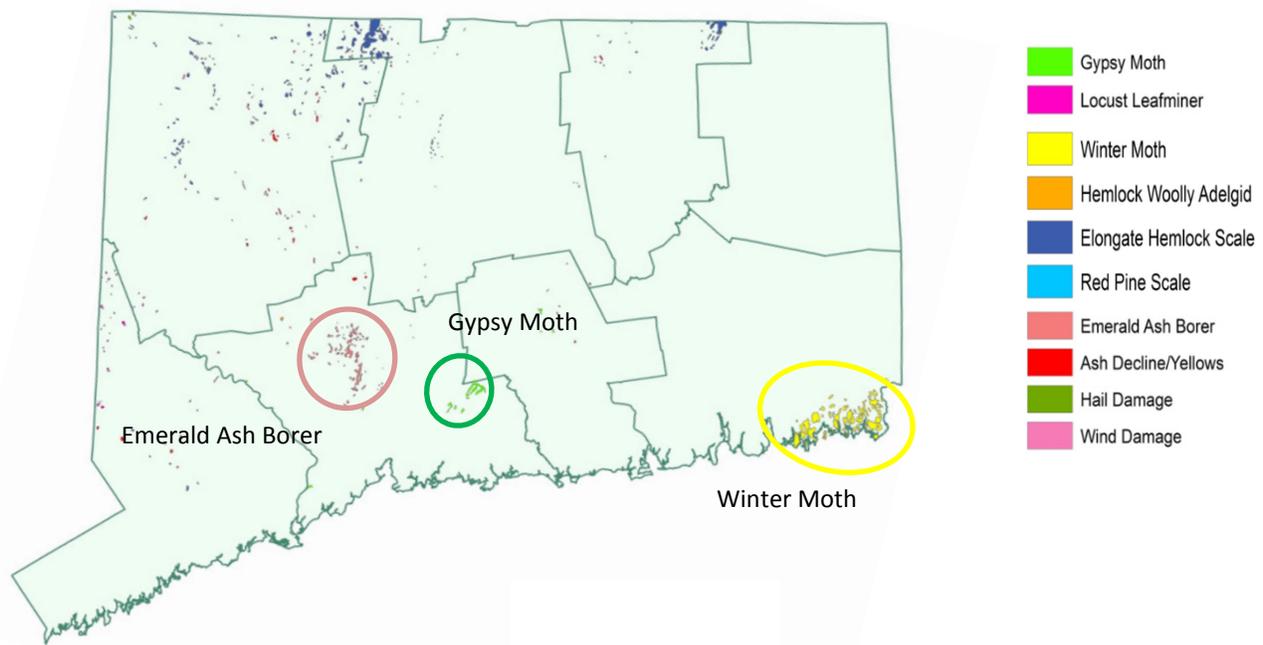
Daylily Rust During 2014 we surveyed daylilies in nurseries and garden centers for signs of daylily rust, caused by *Puccinia hemerocallidis*. Seventy six inspections (67,322 plants) were conducted.

Spotted Lantern Fly There was one trace-forward action involving spotted lantern fly (*Lycorma delicatula*). Stone and stone products from an area where SLF had been detected were inspected for presence of egg masses. Marble, slate, and granite stones were unpacked, carefully moved, and examined. Numerous dead brown marmorated stink bugs were found. Host plants of SLF in areas adjacent to stone yards were also inspected.

Emerald Ash Borer Emerald ash borer has been detected in six of eight counties; the quarantine for this insect was extended statewide to encompass all of Connecticut in December 2014. Detections efforts include trapping using purple panel traps and monitoring of *Cerceris* colonies. During aerial survey, we mapped 2,456 acres defoliated by EAB, and expect acreage and mortality to increase in the coming months and years.



Map of the distribution of EAB detected by town as of June 30, 2015.



Map of the forest health aerial survey for 2014 noting detectable defoliation in Connecticut by the emerald ash borer, gypsy moth, winter moth, elongate hemlock scale, among others.

Apiary Inspection There are currently one thousand eighty registered beekeepers maintaining 6,400 hives. In 2014, nine hundred fourteen hives were inspected. American foulbrood was detected in six 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 2014 was 39.45%. 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 2014, local beekeepers struggled to replace losses with package bees from southern states. Despite these challenges, beekeeping interest is still strong with over 700 new beekeepers being trained this winter. There were one hundred four Apiary Certificate of Health Inspections performed. Three certificates were issued for export out of Connecticut, and one hundred one certificates for interstate movement of honey bees.

Forest Health Survey During the summer and autumn of 2014, we examined 51 permanent, one-acre forest plots that were established to monitor forest health in Connecticut. These plots are located on state, Nature Conservancy, and municipal water company properties. We considered 25 pathogens for monitoring and determined which trees served as host plants. Within each plot, 20 to 30 trees were tagged for long-term studies. We evaluated signs of defoliation and disease, such as dead tree branches, limbs and crowns. Descriptions and determinations are designed to reflect increasing damage or tree decline. We measure the trees at Diameter at Breast Height (DBH) as an additional way to monitor their health. This year is the final year of this long-term study; forest health plots will be replaced by short-term (5 year) plots to examine the death/replacement of trees due to emerald ash borer.

Asian Longhorned Beetle Asian Longhorned Beetle was a target in the Wood Boring/Bark Beetle survey, through the CAPS Program in 2014. Visual surveys for signs of ALB were conducted at numerous locations statewide. We examined many thousands of trees in CT for signs of infestation. In addition, insects submitted by arborists and homeowners as possible ALB have been examined. All surveys and identifications, thus far, have been negative. About 100 inquiries from citizens have been answered via email concerning ALB (CAES.StateEntomologist@ct.gov). White spotted sawyer and western conifer seed bug are most frequently accused of being ALB.

Locust Leaf Miner The locust leafminer (*Odontota dorsalis*) is primarily a pest of black locust. Adults skeletonize and eat holes in the leaves; whereas, larvae mine the tissue between the upper and lower-leaf surface (mining damage is the most destructive). Under outbreak conditions, whole hillsides turn gray or brown, often suggesting fall color change. Outbreaks of the locust leafminer are generally more spectacular than destructive. In 2014, slightly over 460 acres were affected by locust leafminer, in Fairfield and Litchfield Counties.

Winter Moth Damage due to feeding by winter moth larvae has been concentrated in coastal New London County, and continues to increase. Over 7,440 acres were affected in 2014. 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.

Thousand Cankers Disease With a limited walnut resource in Connecticut, there is no monitoring program for Thousand Cankers Disease, even though this disease is the subject of a number of newly-enacted quarantine regulations for many states.

I. *Environmental Chemistry (Joseph Pignatello)*

A. Sorption of Contaminants to Environmental Particles

1. Interactions of Triazine Herbicides with Pyrogenic Carbonaceous Materials.

Triazine herbicides are used world-wide in agriculture to control broadleaf and grassy weeds. They have low to moderate tendency to adsorb to soil, moderate solubility in water, and low volatility, making them vulnerable to leaching. In the U.S., triazine herbicides, especially atrazine, simazine and prometon, are frequently detected in ground and surface waters at concentrations up to several hundred micrograms per liter. Exposure to some triazine herbicides can lead to adverse human health and ecosystem effects, including hormone disruption (atrazine) and damage to testes, kidneys, and thyroid (simazine). Effective approaches for mitigating the leaching of triazines from agricultural fields are clearly needed. Biochar, which is made by anaerobic pyrolysis of biomass wastes, has attracted attention as a soil amendment for reducing the physical and biological availabilities of soil-borne chemicals, among other functions. Because of its high porosity, biochar addition to soils increases adsorption of herbicide compounds, which can reduce their leaching, but also decrease their efficacy in weed control. Chars are also naturally present in soil as the charred products of fires.

The objective of this study was to systematically probe key physical-chemical properties of the biochar and key electronic and steric properties of the triazine herbicides that govern the overall rate and extent of adsorption. The study was aided by the use of reference compounds and reference adsorbents.

In one study (Xiao and Pignatello, *Water Research*, 2015, 80, 179-188) adsorption of triazine herbicides and several reference heterocyclic aromatic amines from water onto a temperature series of hardwood biochars (300 – 700 °C, labelled B300 – B700) was carried out. Adsorption on biochars correlated poorly with pyrolysis temperature, H/C atomic ratio, O/C atomic ratio, mean minimum aromatic fused ring size, surface area, microporosity (0–2 nm effective diameter), and mesoporosity (2-50 nm diameter), but correlated well with a weighted sum of microporosity and mesoporosity (Figure 1). Steric effects were evident by the negative influence of solute molecular volume on adsorption rate. Adsorption rate maximized for the biochar with the greatest mesoporosity-to-total-porosity ratio, suggesting that mesopores are important for facilitating diffusion into pore networks. The cationic forms of amines adsorb more slowly than the neutral forms. To further probe steric and electronic effects, adsorption on a biochar (B400) was compared to adsorption on graphite—a nonporous reference material with an unhindered, unfunctionalized graphene surface—in comparison with reference compounds (benzene, naphthalene, pyridine, quinoline and 1,3-triazine). Relative to benzene, the surface area-normalized adsorption of triazine herbicides was disfavored on B400 (favored on graphite) by 11–19 kJ/mole, depending on herbicide and concentration. It is estimated that steric suppression of B400 adsorption comprises 6 kJ/mol of this difference, the remainder being the difference in polar electronic effects. Based on the behavior of the reference amines, the difference in polar effects is dominated by π - π electron donor-acceptor (EDA) interactions with sites on polyaromatic surfaces,

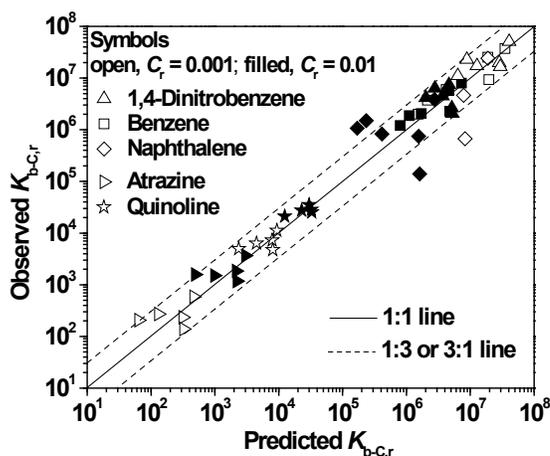


Fig. 1—Experimental versus predicted values of the reduced biochar carbon-normalized distribution coefficient $K_{b-c,r}$ by the weighted sum of microporosity and mesoporosity model.

which are more electropositive and/or more abundant on graphite. Overall, our results show that mesoporosity is critical, that adsorption rate is a function of solute molecular size and charge, that steric effects in the solute largely suppress equilibrium adsorption, and that π - π EDA forces play a role in triazine polar interactions with the biochar.

2. π^+ - π Interactions Between (Hetero-)aromatic Amine Cations and Graphitic Surfaces.

A study was done on triazine herbicides and industrial compounds of a class of ionizable compounds known as heterocyclic aromatic amines (Xiao and Pignatello, *Environ. Sci. Technol.* 2015, 49, 906–914). We found that these compounds at pH values where they are cationic can act as π acceptors in forming π^+ - π electron donor-acceptor (EDA) interactions with the π electron-rich, polyaromatic surface of pyrogenic carbonaceous materials (PCMs). PCMs encompass biochar, black carbon, and graphene. The π^+ - π EDA interactions combine a cation- π force with a π - π EDA force resulting from charge polarization of the ring's quadrupole. Adsorption on a biochar and reference adsorbent graphite was conducted of triazine herbicides, substituted anilines, heterocyclic aromatic amines, as well as amines whose charge is insulated from the aromatic ring.

When normalized for the hydrophobic effect (expulsion of nonpolar molecules from water), the adsorption increased with decreasing pH as the amines became ionized, even on graphite which has no significant fixed or variable charge. A potential cationic π acceptor (quinolinium ion) was competitively displaced more effectively by the π acceptor 2,4-dinitrobenzene than by the π donor naphthalene. The maximum electrostatic potential of organocations computed with density functional theory was found to be a strong predictor of the π^+ - π EDA interaction free energy component (Figure 2). The π^+ - π EDA interaction was disfavored by electropositive alkyl substituents and charge delocalization into additional rings. Amines whose charge was insulated from the ring fell far out of the correlation (more positive free energy). Identifying and characterizing this novel π^+ - π EDA interaction on PCMs will help in predicting the fate of organocations in both natural and engineered systems.

3. Competitive Sorption Used to Probe Strong Hydrogen Bonding Sites for Weak Organic Acids on Carbon Nanotubes.

In previous papers we proposed that exceptionally strong H-bonds, known as (-)CAHB, form between weak acid groups on a solute and acidic carboxyl or hydroxyl groups on a surface. These bonds are known as negative charge-assisted hydrogen bonds, (-)CAHBs. The reaction leading to their formation can be depicted as $A^- + H^+ + ^-O\text{-surf} = (A\cdots H\cdots O\text{-surf})^-$. Weak acid compounds are used in many technological, commercial, and agricultural applications, and their adsorption to carbonaceous surfaces often plays an important role in their fate, hazardous effects, and remediation in the environment. This paper advances understanding of the (-)CAHB for ionizable compounds on carbonaceous surfaces through the use of various techniques including competitive adsorption experiments.

In this study (Li, Gamiz, Wang, Pignatello, and Xing, *Environ. Sci. Technol.* 2015, 49, 1409–1417), we employed competition adsorption and other types of experiments to show that sorption of AH on carbon nanotubes (CNTs) can be described conceptually by a dual specific/non-specific domain model, where one domain involves (-)CAHB sites that can become saturated. The CNTs included carboxyl-enriched

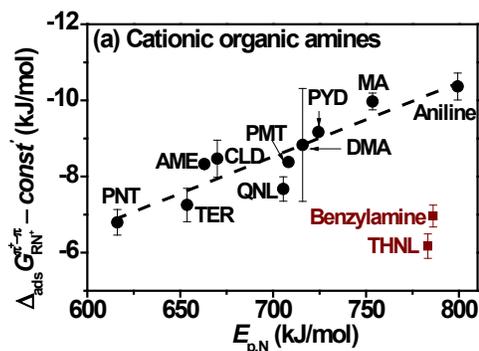
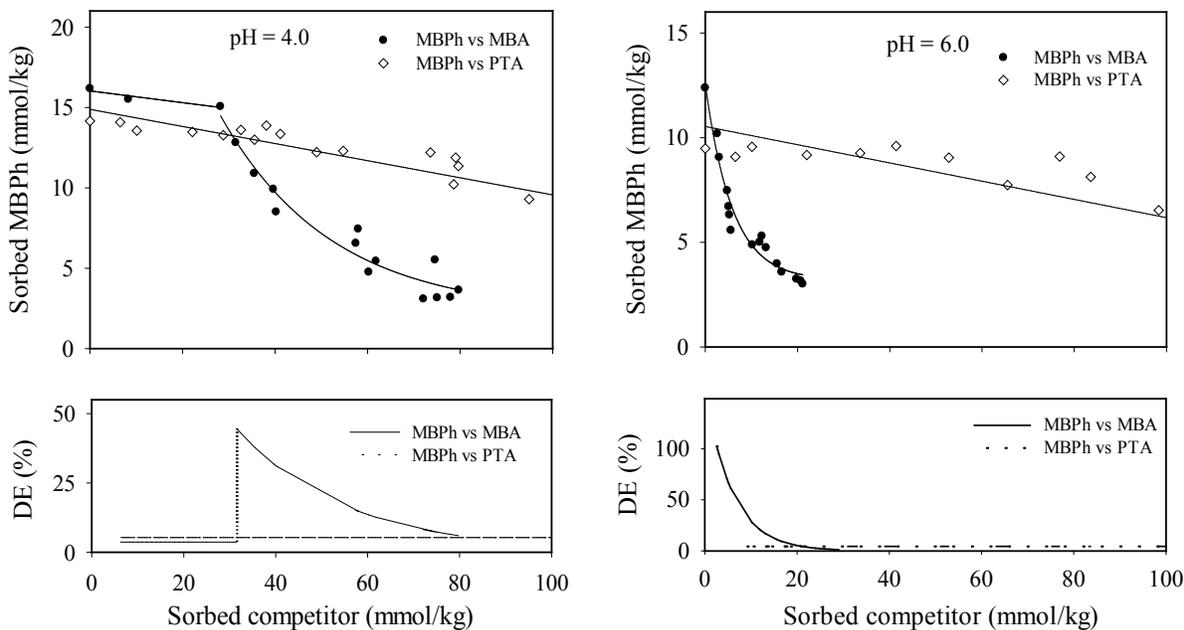


Figure 2. The change in the π^+ - π EDA component of the total Gibbs free energy of adsorption of organic amines on graphite as a function of their electrostatic potential $E_{p,N}$ computed at nitrogen.

(C-CNT), hydroxyl-enriched (H-CNT), and graphitized tubes (G-CNT). The trends observed in single-solute adsorption, including the stoichiometric release of hydroxide upon sorption of carboxyate or phenolate anions, were consistent with trends in the previous studies and pointed to the formation of (–)CAHB. It was shown that 3,4-dinitrophenolate formed (–)CAHB more efficiently than 2,6-dichloro-4-nitrophenolate due to alleviation of steric hindrance to approach by the ortho chlorines. Competition against a (–)CAHB-capable target compound was greater when the competitor was also (–)CAHB-capable than when it was not (e.g., benzoate as target vs 3,4-dinitrophenolate or nitrobenzene as competitor; mono-*n*-butyl phthalate as target vs methyl benzoate or *p*-tolyl acetate as competitor) (Figure 3). The findings will contribute to a better understanding of adsorption mechanism of ionizable



compounds on carbonaceous materials in both single- and multi-solute systems.

Figure 3. Competition experiments: comparing displacement efficiency (DE) of two co-solutes against a target solute, mono-*n*-butyl phthalate (MBPh), on C-CNT at pH 4.0 and pH 6.0. The competitors are 4-methylbenzoate (MBA) and *p*-tolyl acetate (PTA). In each pair of graphs, solid lines in the upper graph are best-fit exponential [$y = a + \exp(bx+c)$] or linear [$y = a + bx$] curves, and in the corresponding lower graph are the first derivatives of those curves.

B. Bioavailability of Contaminants in Environmental Particles.

1. Bioaccessibility of PAHs in Fuel Soot Assessed by an *in vitro* Gastrointestinal Model: Effect of Including an Absorptive Sink.

Soot or black carbon is a product of incomplete combustion of fossil fuels and biomass. It distributes widely in soil and sediments and is especially abundant in areas affected by frequent vegetation fires or near sources of intense fossil fuel burning. Soot, especially fuel soot, often contains high levels of PAHs, a well-known class of carcinogens. 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/d. 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.

In this study (Zhang, Pignatello, Tao and Xing, *Environ. Sci. Technol.* 2015, 49, 3905–3912), we investigated the bioaccessibility of 11 PAHs in a composite fuel soot sample using an *in vitro* digestive model that included silicone sheet as an absorptive sink during the small intestinal digestion stage. The sheet was meant to simulate the passive transfer of PAHs in lumen fluid across the small intestinal epithelium, which was postulated to promote desorption of labile PAHs from the soot by steepening the soot-fluid concentration gradient. We show that the presence of silicone sheet during a 4-h default digestion time significantly increased the apparent bioaccessible fraction (B_{app} , %), defined as the sum in the sheet and digestive fluid relative to the total PAH determined. The ability to increase B_{app} for most PAHs leveled off above a sheet-to-soot ratio of 2.0 g per 50 mg, indicating that the sheet is an effective absorptive sink and promotes desorption in the mentioned way. Enhancement of B_{app} by the sheet correlated positively with octanol-water partition coefficient (K_{ow}), even though the partition coefficient of PAH between sheet and digestive fluid (which contains bile acid micelles) correlated negatively with K_{ow} . It was hypothesized that PAHs initially in the soot exist in labile and nonlabile states. The fraction of labile PAH still sorbed to the soot residue after digestion and the maximum possible (limiting) bioaccessibility (B_{lim}) could be estimated by varying the sheet-to-soot ratio. We show conclusively that the increase in bioaccessibility due to the presence of the sheet is accounted for by a corresponding decrease in fraction of labile PAH still sorbed to the soot. The B_{lim} ranged from 30.8 to 62.4%, independent of molecular size. The nonlabile (i.e., biologically inaccessible) fraction of individual PAHs, which ranged from 69.2 to 37.6% in this case, is quite large and needs to be taken into account in risk assessment.

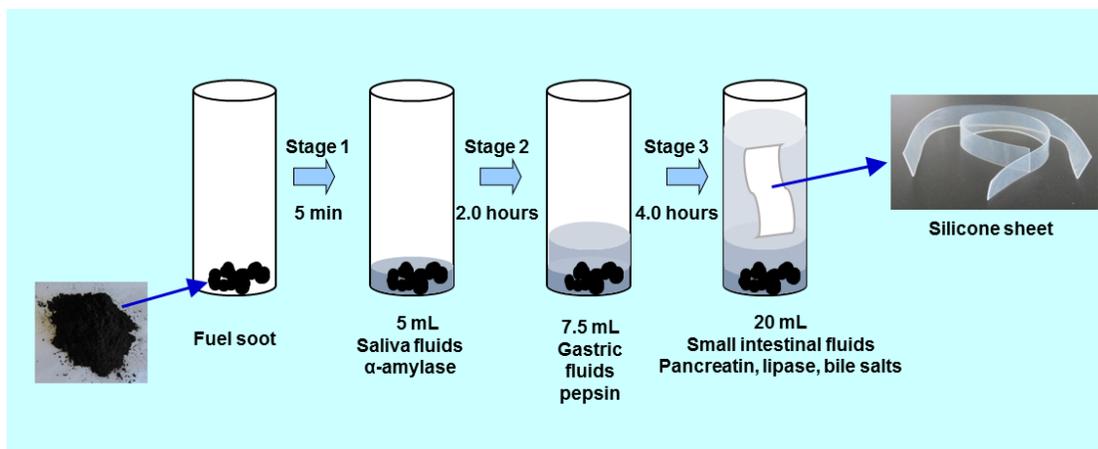


Figure 3. The *in vitro* human digestive model for measuring bioaccessibility of chemicals in ingested soot and soil particles.

C. Pollution Prevention and Remediation

1. Reduction of Nitroaromatics Sorbed to Black Carbon by Direct Reaction with Sorbed Sulfides.

Black carbon from soot deposition and wild fires is abundant in sediments and an important sink for organic contaminants. Previous research has suggested that black carbons (graphite, activated carbon, biochar) mediate the degradation of nitrated compounds by sulfides by at least two different pathways:

reduction involving electron transfer from sulfides through conductive carbon regions to the target contaminant (nitroglycerin) and nucleophilic substitution by sulfur-based intermediates formed by sulfide oxidation (RDX). In this study (Xu, Pignatello, and Mitch *Environ. Sci. Technol.* 2015, 49, 3419–3426), we evaluated the applicability of black carbon-mediated reactions to a wider variety of contaminant structures, including nitrated and halogenated aromatic compounds, halogenated heterocyclic aromatic compounds, and halogenated alkanes. Among these compounds, black carbon-mediated transformation by sulfides over a 3-day timescale was limited to nitroaromatic compounds. The reaction for a series of substituted nitroaromatics proceeded by reduction, as indicated by formation of 3-bromoaniline from 3-bromonitrobenzene, and an inverse correlation of $\log k_{\text{obs}}$ with energy of the lowest unoccupied molecular orbital (E_{LUMO}). The first-order rate constant $\log k_{\text{obs}}$ was correlated with sorbed sulfide concentration, but no graphite mediated reduction of 3-bromonitrobenzene was observed in the presence of sulfite, thiosulfate or polysulfides. No reduction occurred in an electrochemical cell containing sheet graphite electrodes in which the reagents were placed in separate compartments. The results suggest that black carbon-mediated reduction of sorbed nitroaromatics by sulfides involves electron transfer directly from sorbed sulfides to sorbed nitroaromatics rather than electron transfer through conductive carbon regions, as was observed in a previous study for nitroglycerine. Further research will be required to determine the precise role of graphene surface in mediating this oxidation-reduction reaction.

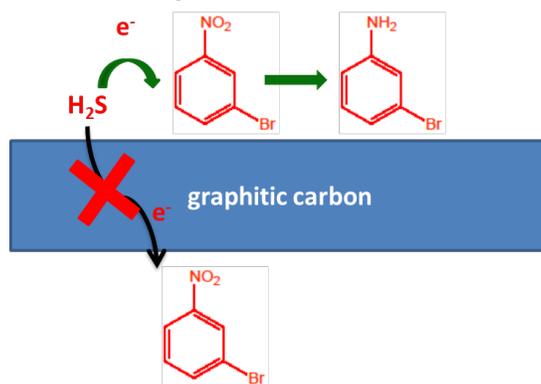


Figure 4. Graphite surface-mediated redox reaction between sulfide ion and nitroaromatic compounds. The electron is apparently not transferred long distances along or through the graphite sheets.

2. Re-oxidation of Photo-reduced Polyoxotungstate by Different Oxidants in the Presence of a Model Pollutant—Kinetics and Reaction Mechanism.

Polyoxometalate ions (POMs) have been widely studied as photo-oxidation catalysts for organic and inorganic pollutants due to their effectiveness and stability. The combination of light, the catalyst, and a bulk oxidizing agent, such as oxygen gas or hydrogen peroxide, leads to the generation of reactive oxidant species such as hydroxyl radicals that degrade the pollutant. Little attention has been paid to the step involving reaction of the bulk oxidant with the one-electron reduced form of POM, i.e., POM^- . Electron transfer between POM^- and a bulk oxidant (or substrate) is also an important step in many processes besides water purification, including selective redox reactions, electrochemical catalysis, and photocatalytic water splitting.

In this study (Yang, Pignatello, Qu, and Xing, *J. Phys. Chem. A*, 2015, 119, 1055–1065), photoreduced phosphotungstic acid ($[\text{PW}_{12}\text{O}_{40}]^{4-}$; “ POM^- ”) was reacted with bulk oxidants, XOOX, including hydrogen peroxide (HP), peroxyacetic acid (PAA), peroxymonosulfate (MS), peroxydisulfate (DS), and dioxygen (O_2), in the presence of the model pollutant 2-propanol (“RH”) under various conditions, and the stoichiometries and rate laws were established. A unified chain reaction is proposed (Figure 5) in which the rate-limiting step is outer-sphere one-electron transfer to XOOX to yield $\cdot\text{OX}$ ($\cdot\text{OH}$, $\text{SO}_4^{\cdot-}$ or

CH_3CO_2^-). This step is found to be proton-assisted when the leaving group OX^- is a strong base (OH^-), but independent of $[\text{H}^+]$ when the leaving group is a weak base ($\text{O}_2^{\cdot-}$, SO_4^{2-}). The rate of this step follows the order, $\text{PAA} > \text{MS} > \text{O}_2 > \text{HP} > \text{DS}$ at pH 1.3, but $\text{O}_2 > \text{PAA} > \text{MS} > \text{HP} > \text{DS}$ at pH 4.1. The chain includes a number of POM-regenerating steps that, with some bulk oxidants (especially MS and DS), leads to further consumption of bulk oxidant and transformation of pollutant. These steps were identified through effects of conditions on reaction stoichiometry, order with respect to $[\text{POM}^-]$, and suppression by POM. Chloride ion “short-circuits” the chain by reducing $\cdot\text{OX}$ and forming $\text{Cl}_2^{\cdot-}$, which scavenges POM^- . The results provide insight into POM-catalyzed redox reactions in water purification and selective redox applications and will lead to intelligent choices of bulk oxidant for POM-photocatalyzed water purification.

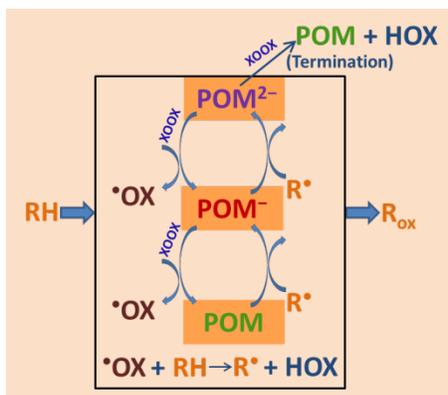


Figure 5. Reaction mechanism for converting a pollutant RH to an oxidized pollutant R_{ox} .

3. Synthesis and Application of a Quaternary Phosphonium Polymer Coagulant to Avoid N-Nitrosamine Formation.

Dissolved organic matter (DOM) in drinking water sources reacts with chlorine disinfectants to produce halogenated disinfection byproducts (DBPs), such as trihalomethanes and haloacetic acids that are carcinogenic. Quaternary ammonium cationic polymers such as poly(diallyldimethylammonium chloride) (polyDADMAC) are widely used for coagulating and removing negatively-charged particles such as DOM from drinking water. Their use, however, has been linked to the formation of potent carcinogens, *N*-nitrosamines as byproducts during chloramine-based drinking water disinfection. In this study (Zeng, Pignatello, Li, and Mitch, *Environ. Sci. Technol.* 2014, 48 (22), 13392–13401), a novel quaternary phosphonium cationic polymer, poly(diallyldiethylphosphonium chloride) (polyDADEPC), was synthesized such that the quaternary nitrogen (N) atom of polyDADMAC was substituted with a phosphorus (P) atom. Formation potential tests revealed that even under strong nitrosation conditions polyDADEPC and related lower order based compounds formed oxygenated and not nitrosated products. Bench-scale jar tests using three different source waters further demonstrated that polyDADEPC achieved coagulation performance comparable to commercial polyDADMACs for particle and DOM removals within the typical dose range used for drinking water treatment. This work highlights the potential use of a phosphonium coagulant polymer, polyDADEPC, as a viable alternative to polyDADMAC to avoid nitrosated byproduct formation during chloramination.

Mosquito Trapping and Testing Program (Dr. Philip Armstrong, Dr. Theodore Andreadis, John Shepard, Michael Thomas, Michael Misencik, 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 2014, statewide mosquito trapping was conducted from June 2 through October 15. 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.



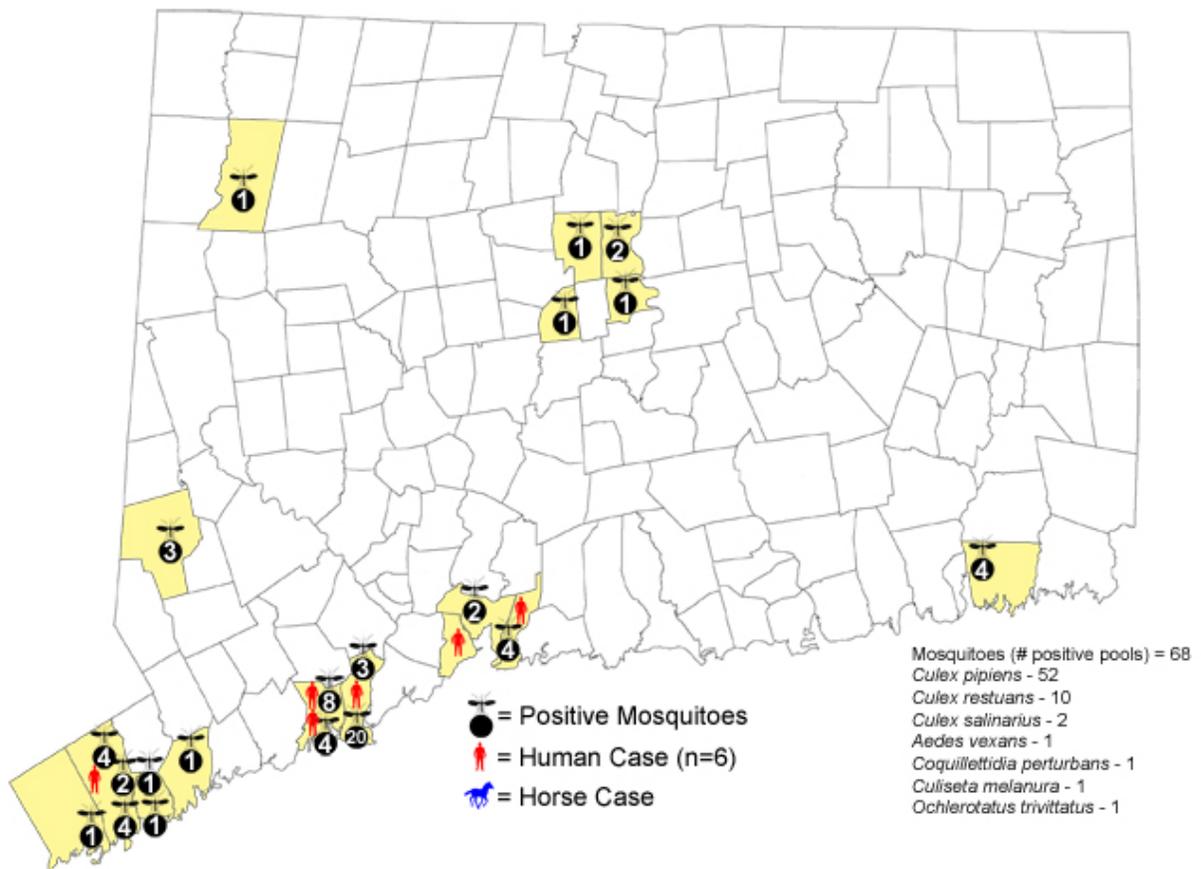
Mosquito trapping was conducted with CO₂ (dry ice)-baited CDC miniature light traps equipped with aluminum domes, and gravid mosquito traps baited with a lactalbumin-yeast-hay infusion. Traps were placed in the field in the afternoon, operated overnight, and retrieved the following morning. Trapping 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°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 2014, a total of 229,097 mosquitoes (12,678 pools) representing 39 species were trapped and tested from 91 locations statewide. A total of 68 isolations of WN virus were made from 7 mosquito species:

Culex pipiens = 52, *Cx. restuans* = 10, *Cx. salinarius* = 2, *Aedes vexans* = 1, *Coquillettidia perturbans* = 1, *Culiseta melanura* = 1, *Ochlerotatus trivittatus* = 1, collected at 20 sites in 15 towns in 5 counties (Fairfield, Hartford, Litchfield, New Haven, and New London). The first positive mosquitoes were collected on July 10, and the last on October 8. The majority of WN virus activity was detected in densely populated urban and suburban regions in southern Fairfield county. Six cases of WN were locally acquired (3 = encephalitis/meningitis, 3 = fever) with no fatalities. The age range was 23 to 63 years, and the median age was 46 years. Date of onset ranged from August 18 to October 6. Human cases were temporally and spatially consistent with WN virus isolations from mosquito pools. No horse cases of WN 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: Cache Valley (CV) = 25 isolates from 7 species (July 28 – October 8); Jamestown Canyon (JC) = 23 isolates from 9 species (June 5 - August 18); Trivittatus Virus (TVT) = 1 isolates from 1 species (July 30).

2014 West Nile Virus Activity



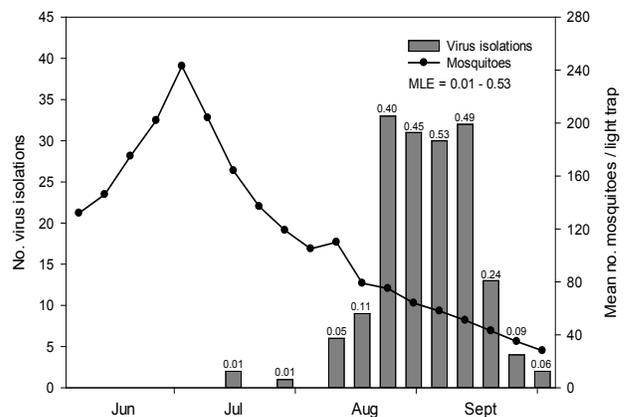
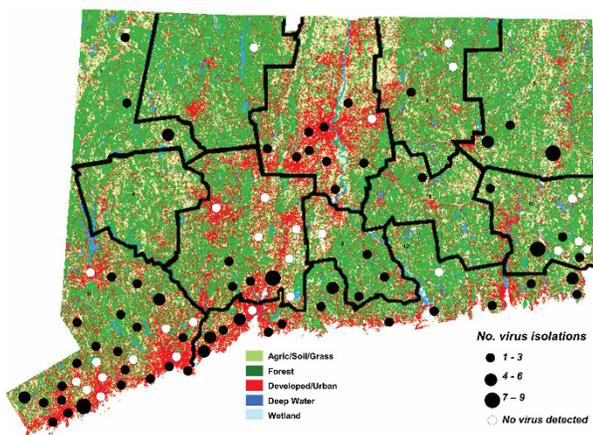
Participation in the statewide surveillance program provides timely information about levels of virus activity in the mosquito population which is used to monitor virus amplification within enzootic transmission cycles, and assess risk of human infection. This information is used to inform the public 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

I. Spatial-Temporal Analysis of Cache Valley Virus (Bunyaviridae: *Orthobunyavirus*) Infection in Anopheline and Culicine Mosquitoes (Diptera: Culicidae) in the Northeastern United States, 1997-2012 (Theodore G. Andreadis, Philip M. Armstrong, John F. Anderson, Andrew J. Main)

Cache Valley (CV) virus is a mosquito-borne bunyavirus (family *Bunyaviridae*, genus *Orthobunyavirus*) that is enzootic throughout much of North and Central America. White-tailed deer, *Odocoileus virginianus* have been incriminated as important reservoir and amplification hosts and the virus has been found in a diverse array of mosquito species but the principal vectors are unknown. Dr. Theodore Andreadis, Dr. Philip Armstrong and Dr. John Anderson conducted a 16-year study to identify the primary mosquito vectors in Connecticut, quantify seasonal prevalence rates of infection and define the spatial geographic distribution of CV virus in the state as a function of land use and white-tailed deer populations which have increased substantially over this period. CV virus was isolated from 16 mosquito species in 7 genera, almost all of which were multivoltine and mammalophilic. *Anopheles punctipennis* was incriminated as the most consistent and likely vector in this region based on yearly isolation frequencies and the spatial geographic distribution of infected mosquitoes. Other species exhibiting frequent temporal and moderate, spatial geographic patterns of virus isolation within the state included *Ochlerotatus trivittatus*, *Oc. canadensis*, *Aedes vexans* and *Ae. cinereus*. New isolation records for CV virus were established for *An. walkeri*, *Culiseta melanura*, and *Oc. cantator*. Other species from which CV virus was isolated included *An. quadrimaculatus*, *Coquillettidia perturbans*, *Culex salinarius*, *Oc. japonicus*, *Oc. sollicitans*, *Oc. taeniorhynchus*, *Oc. triseriatus* and *Psorophora ferox*. Mosquitoes infected with CV virus were equally distributed throughout urban, suburban and rural locales, and infection rates were not directly associated with the localized abundance of white-tailed deer possibly due to their saturation throughout the region. Virus activity in mosquitoes was episodic with no consistent pattern from year to year and fluctuations in yearly seasonal infection rates did not appear to be directly impacted by overall mosquito abundance. Virus infection in mosquitoes occurred late in the season that mostly extended from mid-August through September when adult mosquito populations were visibly declining and were comparatively low. Findings argue for a limited role for vertical transmission for the perpetuation of CV virus as occurs with other related bunyaviruses.



B. Emergence of a New Lineage of Cache Valley Virus (*Bunyaviridae: Orthobunyavirus*) in the Northeastern United States (Philip M. Armstrong, Theodore G. Andreadis, John F. Anderson)

Cache Valley virus (CVV; Family Bunyaviridae, Genus Orthobunyavirus) is a mosquito-borne zoonosis that frequently infects humans and livestock in North and Central America. In the northeastern U.S., CVV transmission is unpredictable from year-to-year and may derive from the periodic extinction and reintroduction of new virus strains into this region. To evaluate this possibility, we sequenced and analyzed numerous CVV isolates sampled in Connecticut during an 18 year period to determine how the virus population may change over time. Phylogenetic analyses showed the establishment of a new viral lineage during 2010 that became dominant by 2014 and appears to have originated from southern Mexico. CVV strains from Connecticut also grouped into numerous sub-clades within each lineage that included viruses from other U.S. states and Canada. We did not observe the development and stable persistence of local viral clades in Connecticut which may reflect the episodic pattern of CVV transmission. Together, our data support the emergence of a new lineage of CVV in the northeastern US and suggest extensive dispersal of viral strains in North America.



Cache Valley virus occurs throughout much of North and Central America where it frequently infects humans and livestock. The development of severe disease occurs rarely in humans but is potentially life-threatening with symptoms ranging from fever to encephalitis. In addition, CVV is responsible for epizootics in sheep, causing fetal death and congenital defects in these animals. Despite its importance as a medical and veterinary pathogen, little is known about the genetic relationships of CVV variants circulating in nature. In this study we sequenced and compared the phylogenetic relationships of over 70 isolates of CVV sampled from Connecticut over an 18 year time period. This approach allows us to track the origin, spread, and persistence of viral strains in the northeastern US, information that may help us develop more effective public health interventions against the virus.

C. Performance of Real-time RT-PCR Assays to Detect West Nile virus in Mosquito Pools (Nicole Herman and Philip M. Armstrong)

Mosquito surveillance for West Nile virus (WNV) provides an effective early warning system to assess environmental risk of human infection and guide mosquito control and other disease prevention efforts as needed. Many surveillance programs use only real-time RT-PCR assays to screen mosquito pools for West Nile virus infection. To evaluate the performance of these molecular assays, we tested 90 WNV positive mosquito pools and 90 controls using three assays in a blinded-comparison. WNV-positive mosquito pools that failed to amplify were sequenced to identify any mutations in the primer or probe binding sites. Of the three assays, the assay by Tang et al. 2006 had the highest sensitivity and specificity. Only one strain that failed to amplify had mutations in the critical primer/probe binding regions, so most false negatives are likely due to other factors. The three assays performed well but with one assay outperforming the other two.

WNV has emerged as the dominant mosquito-borne viral disease in North America since its introduction into the New York City area in 1999. In response to this disease threat, mosquito-based surveillance programs have been implemented to track virus distribution, and assess risk of human infection. This activity is accomplished by collecting mosquitoes from endemic sites, sorting them into pools by species, and testing pooled specimens by either cell culture and/or molecular assays. Viral cell culture is the gold standard for detection of virus in tissue samples. However, many labs performing arbovirus surveillance do not have the resources for cell culture and instead rely exclusively on molecular techniques such as real-time PCR. Formally comparing West Nile virus cell culture results from the Connecticut Mosquito Surveillance Program to results of the more commonly used real-time PCR diagnostic techniques will provide useful information on test sensitivity and specificity. Concrete data on PCR sensitivity can advise public health organizations with recommendations for best practices and can be used to help estimate the burden of false negative test results.

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 (Goudarz Molaei, Theodore G. Andreadis, Michael Thomas, John Shepard)

Eastern equine encephalitis virus (EEEV) (*Togaviridae*, *Alphavirus*) causes a highly pathogenic mosquito-borne zoonosis that 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 extraordinary 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.

B. Dynamics of Vector-Host Interaction and the Role of Avian Species as Superspreaders of Eastern Equine Encephalitis Virus as an Emerging Public Health Threat in the Northeastern United States (Goudarz Molaei, Michael C. Thomas, Tim Muller, Jan Medlock, John J. Shepard, Philip M. Armstrong, Theodore G. Andreadis)

Detailed knowledge of the vector-host interactions of mosquito populations in nature is essential for evaluating their vectorial capacity and for assessing the role of individual vertebrates as reservoir hosts involved in the maintenance and amplification of zoonotic agents of human diseases. We studied host associations of *Cs. melanura* in four EEEV foci in the northeastern U.S., identified vector host

preferences as the most important transmission parameter, and quantified the contribution of preference-induced contact heterogeneity to enzootic transmission. This study identified a few avian species that may serve as superspreaders of EEEV. Our study elucidated spatio-temporal host species utilization by *Cs. melanura* in relation to avian host community. This research provided a basis to better understand the involvement of *Cs. melanura* and avian hosts in the transmission and ecology of EEEV and the risk of human infection in various virus foci.

C. Vector-Host Interactions of *Culiseta melanura* in a Focus of Eastern Equine Encephalitis Virus Activity in Southeastern Virginia (Goudarz Molaei, Philip M. Armstrong, Charles F. Abadam, Karen I. Akaratovic, Jay P. Kiser, Theodore G. Andreadis)

The mid-Atlantic region remains an important focal area for EEEV transmission since the initial discovery of the virus in 1933, during an equine epizootic in Virginia and neighboring states. A number of freshwater swamp complexes are located throughout this region that support dense populations of *Cs. melanura* mosquitoes and large aggregations of migratory and permanent bird species. This includes the Great Dismal Swamp and surrounding communities, which constitute an established EEEV focus in southeastern Virginia. Residential and commercial developments have fragmented much of the swamp perimeter, leaving large pockets of swamp habitat interspersed with human populations. This landscape provides ideal conditions for human infection by bringing virus-infected mosquitoes from swamp habitats into close proximity with residential areas. An earlier investigation in southeastern Virginia found that *Cs. melanura* comprised >95% of EEEV-positive mosquito pools during a five-year surveillance period. Despite its importance as a vector, the blood-feeding patterns of *Cs. melanura* have not been evaluated in this region by molecular methods. Such analyses are critical to identify specific avian hosts involved in enzootic cycling of virus and to evaluate the potential for *Cs. melanura* to act as an occasional vector of EEEV to mammalian hosts. We investigated the transmission cycle of EEEV in southeastern Virginia by determining the host-feeding patterns of *Cs. melanura* during a season of intense virus transmission.

D. Insights into the Recent Emergence and Expansion of Eastern Equine Encephalitis Virus in a New Focus in Northern New England, USA (Goudarz Molaei, Philip M. Armstrong, Alan C. Graham, Laura Kramer, Theodore G. Andreadis)

Vermont is a newly emergent region for EEEV activity that is located on the northern boundary of the geographic range of the virus. EEEV was first isolated in Vermont during a 2011 outbreak on an Emu (*Dromaius novaehollandiae*) farm in Rutland County. The first confirmed human cases of EEE occurred in state during the subsequent year and the virus was also detected in 10 *Cs. melanura* pools from the same region of Vermont. Neutralizing antibodies to EEEV were also found during serosurveys of white-tailed deer (*Odocoileus virginianus*) and moose (*Alces americanus*) sampled throughout Vermont. Otherwise, little is known about the ecology of the virus in this region of the U.S. A collaborative research project was undertaken to 1) characterize the host-feeding patterns of *Cs. melanura* and evaluate its role in enzootic maintenance of EEEV in wild bird populations during an epidemic in Vermont, 2) assess the potential involvement of *Cs. melanura* in epidemic/epizootic transmission to humans and equines, and 3) identify key avian species as hosts for mosquitoes which also support amplification of EEEV.

E. An Integrated and Individual Tick Management Program to Reduce Risk of Lyme Disease in a Residential Endemic Area (Kirby C. Stafford III, Goudarz Molaei, 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 Connecticut. The primary aim of this CDC-funded project is to develop, implement, and evaluate individual and integrated tick management (ITM) approaches to reduce the entomological risk of LD. In addition, an enhanced LD decision support system will be constructed by incorporating the new findings obtained from the proposed project. The primary Objectives of the 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.

F. Evaluation of a Lyme disease Vaccine (Rodent-Targeted Vaccine, RTV) in an Integrated Pest Management Framework (Kirby C. Stafford III, Goudarz Molaei, 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). Baseline tick and mouse data has been collected during May-June 2014. We have started delivering RTV, using bait boxes to study properties. We will repeat the RTV application in the final year of the study, 2016. Spray applications of Met52 are also underway on the study properties in the RTV+Met52 neighborhood (experimental plot), for comparison purposes.

Tick Testing Program (Goudarz Molaei, Saryn Kunajukr)

Tick-associated illnesses, including Lyme disease (LD), pose a major threat to human health in Connecticut. LD is the most prevalent arthropod-associated disease in the U.S., with an estimate of 300,000 cases per year. In 2013, Connecticut had the 5th highest number of confirmed cases of LD and 4th highest incidence rate of 58.7 per 100,000 persons in the U.S. In 2014, Connecticut has had 1705 confirmed and 641 probable cases of Lyme disease. In addition, 170 and 76 human cases of babesiosis and anaplasmosis, respectively, have been reported. The blacklegged tick, *Ixodes scapularis*, is the most important species in transmitting *Borrelia burgdorferi*, *Babesia microti*, and *Anaplasma phagocytophilum*, the causative agents of LD, babesiosis, and anaplasmosis, respectively.

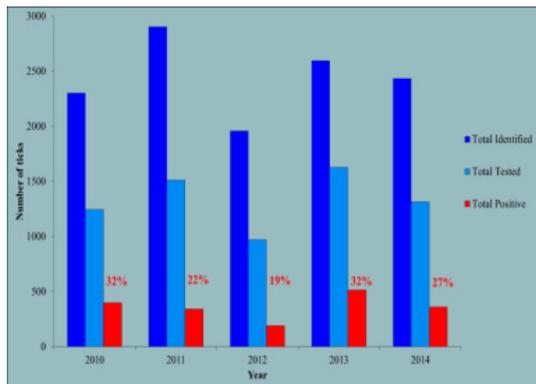


The Tick Testing Program at The CAES was established in 1990 as a service to local health departments and districts. The objectives of this program are to: 1) examine ticks for evidence of infection with tick-associated pathogens in order

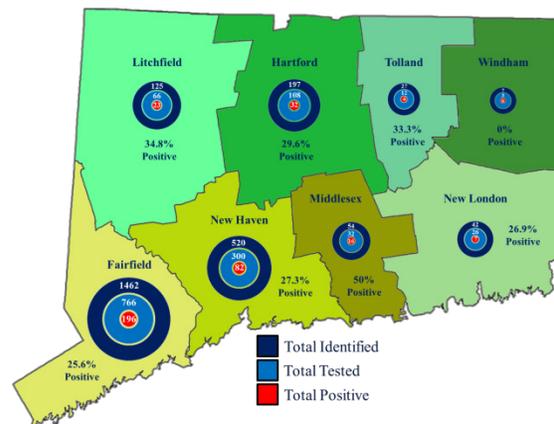


to better understand epidemiology of tick-associated illnesses in Connecticut, 2) inform residents of any potential health risk as a result of tick bites, and 3) assist physicians and residents concerning treatment.

In the past, testing was limited to the LD agent, but in view of increasing human cases of tick-related illnesses in the state, testing has been expanded to include *Babesia microti* and *Anaplasma phagocytophilum* in addition to LD pathogen. This represents a significant enhancement of the tick testing services. Molecular methods are used to test ticks for evidence of infection with pathogens. Genomic DNA is isolated from engorged nymph and adult ticks and screened by taking advantage of three diagnostic genes, Flagellin, 16s ribosomal DNA, and osp A (outer surface protein A). Each year an average of 3,000 ticks are submitted for testing. From July 2014 until the end of June 2015, the Tick Testing Laboratory has received 2879 ticks, representing 5 species, the majority of which were blacklegged ticks, *Ixodes scapularis*. Of 1950 ticks tested, 612 (31.4%) were tested positive for LD agent.



Number and Percentage of *Ixodes scapularis* Ticks Tested for infection with *Borrelia burgdorferi* Connecticut, 2010-2014



Tick Testing Result By County in Connecticut, 2014

Invasive Aquatic Plant Program (Gregory Bugbee)

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 219 Connecticut lakes and ponds (Figure 1). A total of 38 water bodies have been resurveyed at least five years later to determine how invasive plants are changing the quality of lakes overtime. In fiscal 2014-15, Greg Bugbee and Jennifer Fanzutti (Figure 2) mapped native and invasive aquatic vegetation in seven new and 12 previously surveyed water bodies (Table 1). In addition, Lake Candlewood, Connecticut's largest lake, was surveyed for the eighth 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*). Lake Zoar, was surveyed for the fifth time to track changes in the population of invasive species. We established transects in each water body, using global positioning systems to quantify changes in native and invasive aquatic species abundance and distribution. 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 water bodies to certain invasive species.

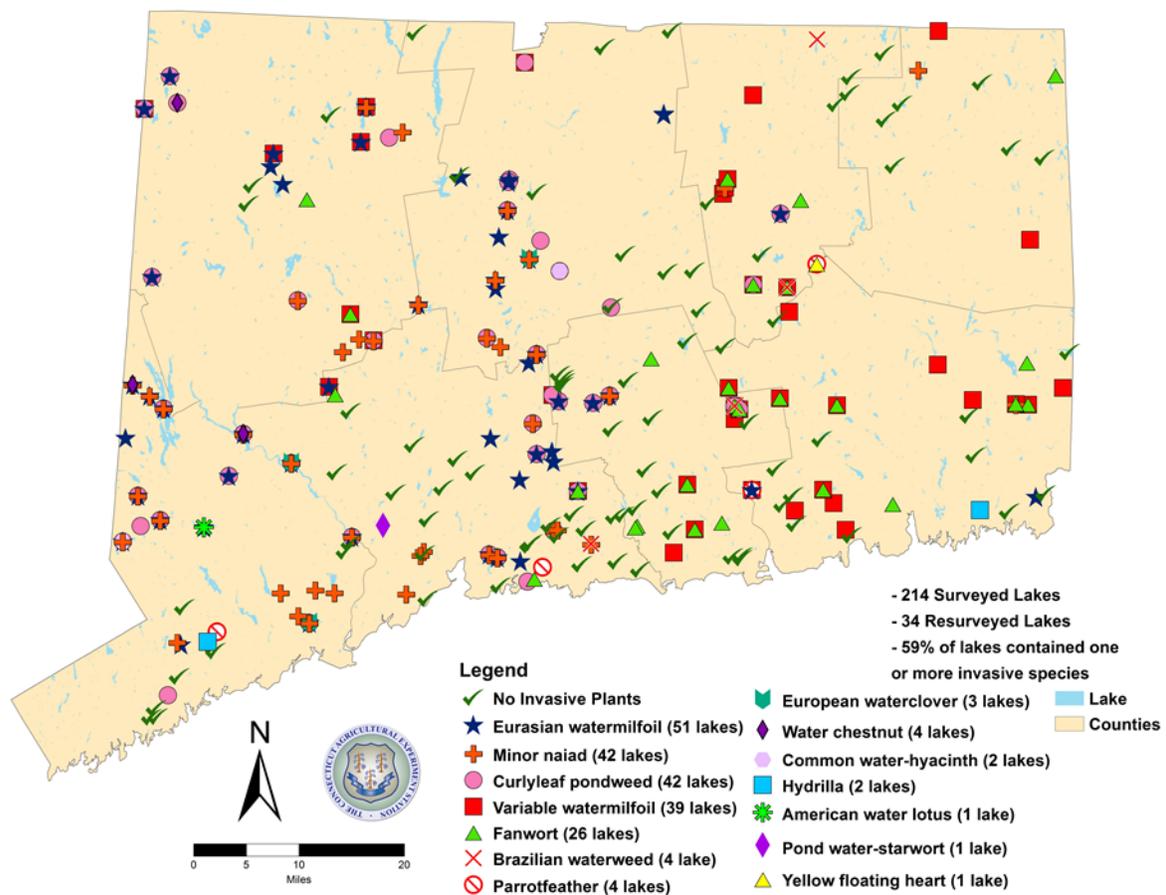


Figure 1. Locations of invasive plants in Connecticut's lakes and ponds as found in CAES IAPP surveys from 2004 - 2014.

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 water bodies contain 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 Gardner Lake.

Our surveys provide one of the most complete aquatic plant and water chemistry databases available. This has allowed us to model the risk of invasion for water bodies that currently do not contain specific invasive species. This model can be used by resource managers and policy makers to improve monitoring protocol and early detection and rapid response efforts. When we group lakes by the presence on invasive aquatic plants we found they occurred in two distinct groups: This model was further refined with addition of 1) fanwort and variable watermilfoil and 2) curlyleaf pondweed, minor naiad, and Eurasian watermilfoil. When we compared the occurrence of each group with water chemistry we detected highly significant differences. The fanwort and variable watermilfoil group preferred lakes with lower conductivity, alkalinity, and pH than the curly leaf pondweed, minor naiad, and Eurasian watermilfoil group. Finally, we developed a mathematical model based on lake water chemistry that could predict which lakes contained the invasive species with nearly 80 percent accuracy. Hydrosol characteristics such as organic matter content, pH and conductivity to suggest the first filter to invasion is water chemistry followed by the make-up of the hydrosol.

Table 1. Lakes and ponds surveyed by CAES IAPP in fiscal 2014-15 (* = resurvey).

Lake Name	Town	Acres
Avery Pond*	Preston	35.7
Bashan Lake*	East Haddam	273
Black Pond*	Meriden, Middlefield	76
Candlewood Lake*	Sherman	5400
Coventry Lake*	Coventry	373
Dodge Pond*	East Lyme	30
Dooley Pond*	Middletown	15
Fence Rock Lake*	Guilford	16.9
Hansens Pond	Mansfield	40
Jeep Pond	Hamden	4
Lake Lillinonah*	Newtown	1547
Lake Quonnipaug*	Guilford	99
Lake Zoar*	Newtown	920
Private Pond, East Haddam	East Haddam	5
Private Pond, Pawcatuck	Pawcatuck	1
Staffordville Reservoir*	Stafford Springs	149
Town Pond	West Haven	1
Von Wettberg Pond	Oxford	1
Wataba Lake	Ridgefield	41

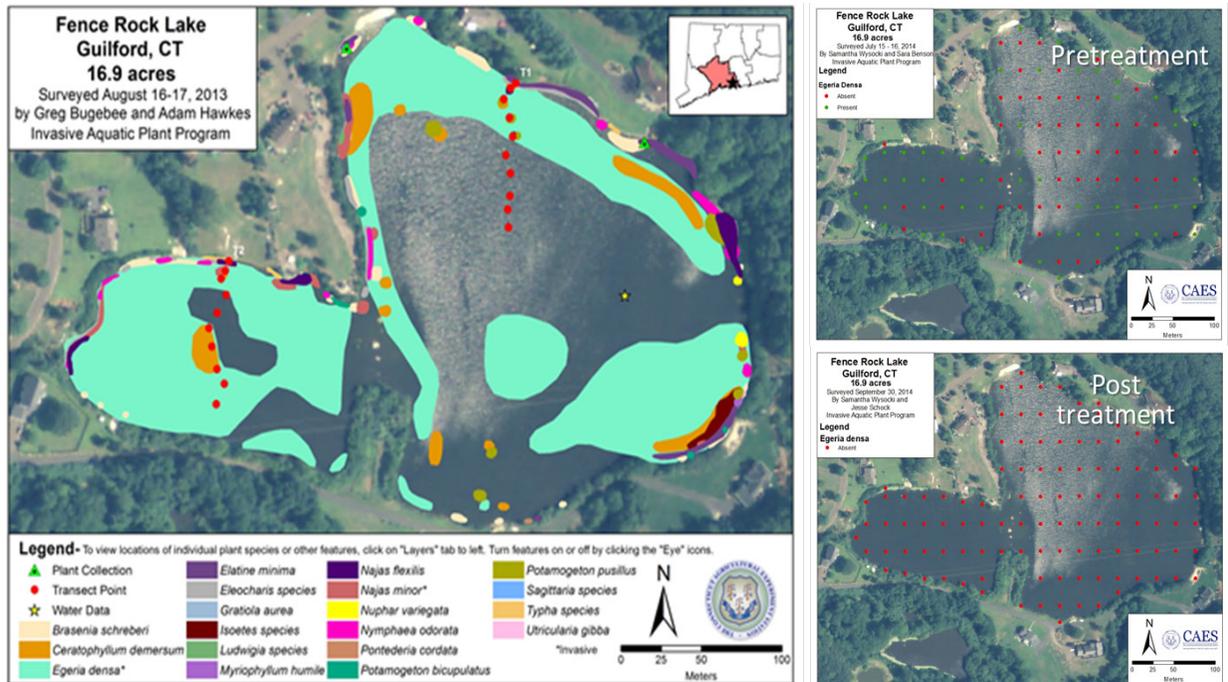


Figure 3. Brazilian waterweed in Fence Rock Lake in 2013(top left), pretreatment (top right) and post treatment (bottom right) in 2014 (top right).

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) investigate non-chemical management options such as winter water level drawdown.

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 14th 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 desirable native species from 12 to 19. Lowering of the lake by 18 feet in late 2014 for dam repairs and the prospect for the refilling take up to two years, leaves the future conditions in question, however our work has documented past conditions for comparison.

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-dihydrodipyrindo (1,2-a:2',1'-c) pyrazinedium dibromide) in the summer of 2014. The herbicide was applied by bottom injection to the shoreline areas of the lake in July. Pre and post treatment vegetation surveys on over 100 georeferenced points in September (Figure 3, right) found 100% control. A survey in July 2015 will determine long term efficacy on both the Brazilian waterweed and nontarget desirable native plants.

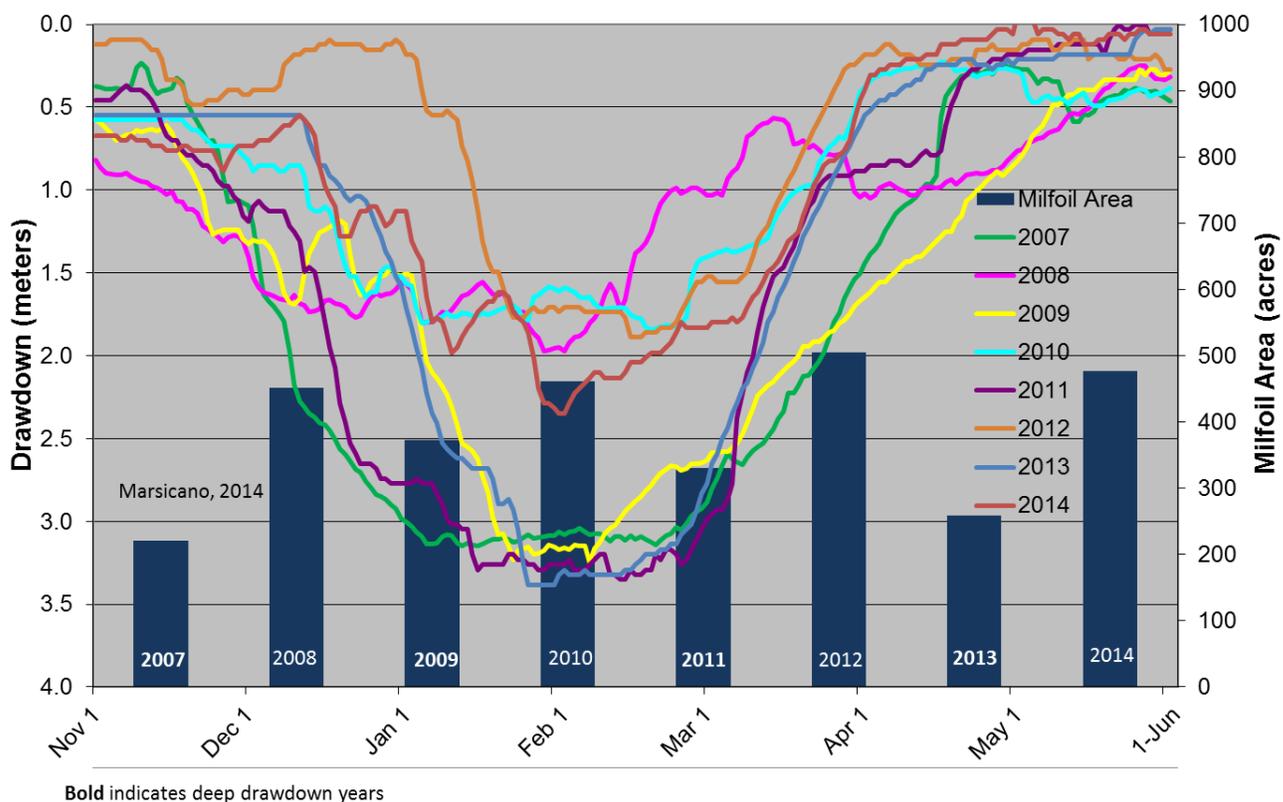


Figure 4. Effects of duration and depth of winter drawdown on coverage of Eurasian watermilfoil in Candlewood Lake 2007 - 2014.

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 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



Figure 5. Greg Bugbee removing data loggers from exposed sediment in Candlewood Lake.

provide data that is crucial for making decisions on future drawdown practices for Connecticut's largest lake.

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 Northeast Aquatic Plant Management Society and the Connecticut Invasive Plant Working Group, 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 (Figure 6). Included are all our digitized interactive lake maps, our complete herbarium and publications (<http://www.ct.gov/caes/IAPP>).



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

Soil Testing



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 5,481 samples 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.

Evolutionary Biology

Virus Genome Analysis Reveals Control of Oak Silkworm Development (Dr. Charles Vossbrinck)

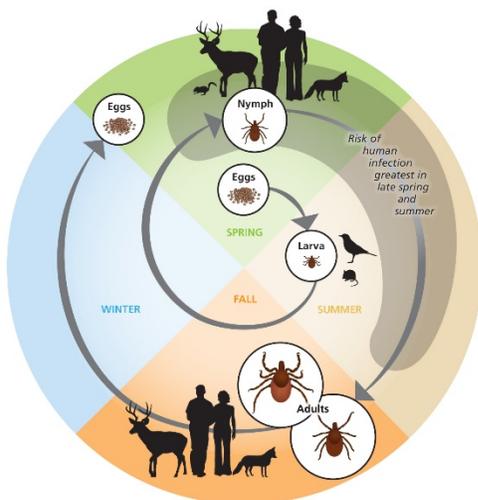
Antheraea pernyi nucleopolyhedroviruses (AnpeNPVs) causes epizootic outbreaks in populations of the oak silkworm *Antheraea pernyi*. Comparative genomics of NPVs has focused on differences in the genomic structure among species and very little about genetic diversity within the AnpeNPV is known. To examine the genetic diversity of geographical AnpeNPV strains we sequenced the genome of an AnpeNPV (AnpeNPV-H) isolated from Henan province, China and performed a comparative analysis with two previously sequenced isolates (AnpeNPV-L and AnpeNPV-Z) from Liaoning province. The AnpeNPV-H strain is 125,605 bp and contains 146 open reading frames of which 95 are identified as

functional proteins and 51 are annotated as hypothetical proteins. The three strains have the same gene composition except that seven of the unidentified ORFs are complete in some isolates but not in others. There are more than 200 SNPs between AnpeNPV-H and other two strains, 85% of which were found in coding regions. Non-synonymous changes of three protein-coding genes (*odv-e56*, *p94*-like, and *egt* protein) have higher evolutionary rate (i.e., $dN/dS > 1$), suggesting that they might have experienced positive selection or have undergone a relaxation of purifying selection. Finally, we show evidence of genetic recombination between AnpeNPV strains. This study reveals the level of intra-species variation and lends insights into the dynamics of the genomic architecture within strains of the *Antheraea pernyi* nuclear polyhedrosis virus (AnpeNPV).



Virus-Vector Interactions

A. Deer Tick Virus Population Dynamics during Infection of *Ixodes scapularis* Ticks (Dr. Doug Brackney, Dr. Phil Armstrong, Dr. John Anderson, 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, 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 vaccines 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.

Mosquito Microbiota

A. 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.

Environmental Microbiology

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



Figure 1. SVD affected site in Hammonasset Beach State Park, CT.

Recently, cases of sudden vegetation dieback (SVD) have been observed across coastal wetlands of the North Eastern 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.

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 CO₂.

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 soil carbon cycling as well as characterizing how the soil microbial communities respond to SVD. Our preliminary data indicates that SVD alters both the composition and functioning of the microbial communities. We have found that sites of SVD have an increased colonization by algae, suggesting that microbial populations are providing compensatory photosynthesis to the wetlands. However, this is unlikely to redress for the amount of carbon fixed by the plants. We have also found that specific bacterial groups, namely bacteria in the phylum Bacteroidetes, are significantly less abundant in SVD sites. 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 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. Development of Molecular Tools to Monitor Freshwater Algal Blooms (Blaire Steven)

A freshwater algal bloom is a visible increase in the photosynthetic biomass in a freshwater body (Figure 2). These blooms have dramatic effects on water quality, recreation, and ecology. In certain circumstances, the bloom organisms produce toxins that can affect animal or human health. Clearly, the ability to monitor and predict the development of algal blooms will be critical to managing Connecticut's freshwater resources.



Figure 2. An algal bloom in Candlewood Lake, CT. (Photo courtesy of Greg Bugbee, CAES).

The term “algae” refers to a diverse group of organisms. Algae encompasses all photosynthetic biomass in the water column. This ranges from small macroscopic plants all the way down to cyanobacteria (formerly referred to as blue-green algae). Thus, characterizing the populations that make up a bloom requires taxonomic knowledge across a broad range of organisms and a wide-ranging knowledge of biology. Furthermore, traditionally the characterization of alga blooms was performed through microscopic investigation of algal cells. This required specialized taxonomists with extensive training in algal identification and often resulted in discrepancies in algal characterization between investigators. Molecular methods for algal identification offer robust, reliable, and standardized methods to identify algal species. Additionally, through genetic means it will be easier to identify those species capable of producing toxins and that may therefore pose a threat to health. Finally, and most importantly, molecular methods are extremely sensitive and can detect algal biomass at exceedingly low concentrations. This is critical to predicting the composition of algal blooms before they happen rather than responding to them after they have occurred.

We are developing methods based on sequencing conserved algal genes to identify and characterize the algae that occur in Connecticut freshwaters. To our knowledge this will be the first freshwater algal inventory performed in the state and the first molecular based survey performed anywhere. With developments in high-throughput sequencing we will be able to build comprehensive characterizations of the algae occurring in Connecticut's freshwaters and build a better framework for predicting and managing freshwater algal blooms.

C. Mapping the arboreal microbiome and determining the metabolic pathway for in-tree methane production (Blaire Steven and Robert Marra)

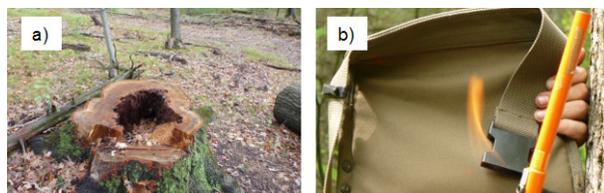


Figure 3. (a) Heart rot revealed after felling a timber tree, (b) microflaring of trunk methane released from an upland oak during tree coring. (Photo courtesy of Kris Covey, Yale University)

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 3). 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. We are currently performing work to associate the bacterial and fungal populations from recently felled trees to levels of heartwood rot to better understand the interactions between bacteria, fungi, and trees.

DEPARTMENT OF FORESTRY AND HORTICULTURE

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.

Southern Pine Beetle Expanding into New England

The recent outbreak of southern pine beetle (SPB; *Dendroctonus frontalis* Zimmermann) and its associated pathogenic fungi such as *Ceratocystis minor* in Long Island (NY) opened the bridge for SPB expansion into New England forests where several native and planted pine species are growing. SPB in Long Island primarily attacks pitch pine (*Pinus rigida*); however, reports in New England have shown beetle attack also in red pine (*P. resinosa*), white pine (*P. strobus*), scots pine (*P. sylvestris*), and Norway spruce (*Picea glauca*).

SPB is a serious pest of pines adapted to the southern United States; the furthest north this beetle had previously been recorded was Pennsylvania and New Jersey. However, changes in precipitation and temperature associated with climate change might be playing an important role in SPB population dynamics and expansion. Since SPB was detected on Long Island in October 2014 and in Connecticut in March 2015, it has been found in Massachusetts and Rhode Island in summer 2015. The presence of SPB in New England represents a serious potential health threat to conifers that could have ecological impacts in forest and urban areas.

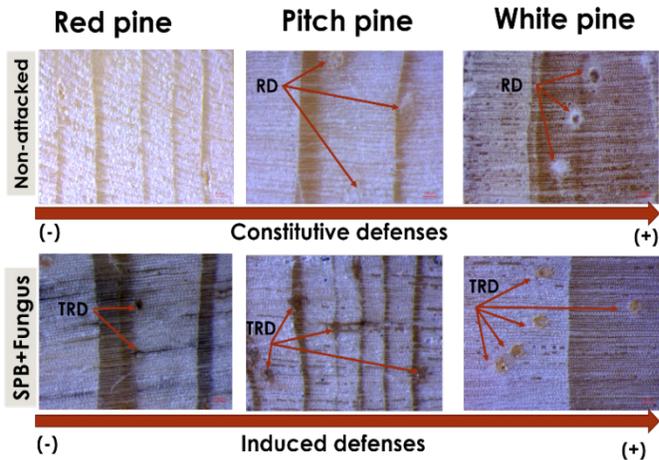


Healthy pitch pine forest in Lyme.

The southern pine beetle is a bark beetle that is a primary pest that can attack and overcome healthy vigorous trees when its population is large, and a secondary pest of weakened trees when beetle populations are low. Upon attacking a tree, SPB introduces several fungal species to the host phloem tissue to overcome tree resistance by disrupting water and nutrient movement within the tree. As beetles attack, trees attempt to defend (induced defense) by releasing resin flow (primary response) to pitch out the beetles, followed by a hypersensitive response (necrosis around the infection site) to contain fungal growth, and finally periderm formation for wound healing. These modifications are primarily modulated by chemical changes in monoterpene composition, phenolic and hormone accumulation, which highly vary between and within species, and are strongly dependent on the physiological status of the tree.

Understanding plant defense mechanisms of our native and introduced conifer species is crucial for species conservation and beetle control. Although some mechanisms are constitutive, i.e., always present, others are induced in response to beetle feeding and/or pathogen infection. It is likely that anatomical and biochemical responses to insects are crucial in the defense process, since plant responses often coincide with physiological processes for plant resistance. Thus, Drs. Adriana Arango and Claire Rutledge began a study of different anatomical (resin ducts formation) and chemical responses of red, white, scots and pitch pines, and Norway spruce attacked by SPB. In addition they will examine whether there is a correlation between changing climate conditions and SPB range expansion. This experimental work was

conducted during spring and summer 2015 in several infested areas of Connecticut and Long Island. Anatomical and physiological characteristics were characterized by collecting core borer samples and inner bark for determination of monoterpenes and hormones content. Surveys of beetle presence and survival across Connecticut have been recorded in order to determine beetle success in northern climatic conditions.

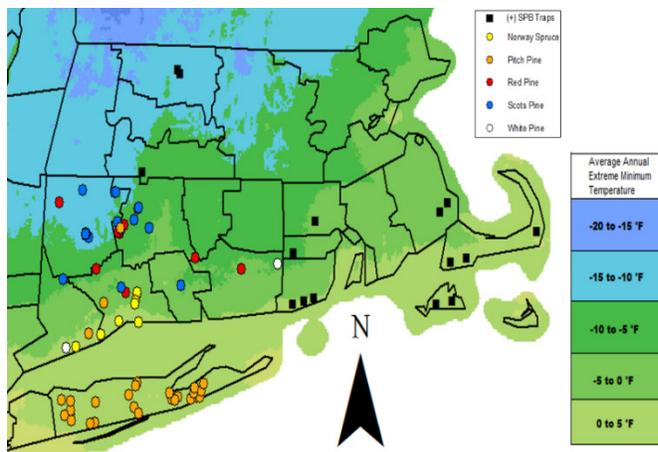


Cross sections of secondary xylem showing annual rings and vertical resin ducts.

Preliminary results show differences in resin ducts occurrence in the secondary xylem of mature established trees. High amount of preformed (RD) and induced resin ducts (TRD) were found in white pine, followed by pitch and red pine respectively. Presence of resin ducts can be correlated to higher resin flow that can prevent beetles from becoming established in the tree.

Previous studies have shown that even though beetles are not pitched out immediately after arrival to the tree, the rate of gallery construction is related to the amount of resin encountered by the beetles. Accordingly, and based on our field observations, we can hypothesize that red pine might be the more sensitive species to SPB under low beetle populations. Compared with Long Island, where nearly 1,500 acres of pitch pine have been devastated, beetle populations in Connecticut seem low and scattered throughout the state, with about 250 attacked trees. This could be related to the lower temperatures encountered in Connecticut during the last winter. Although SPB was first spotted in March 2015, SPB probably arrived in fall 2014.

SPB under low beetle populations. Compared with Long Island, where nearly 1,500 acres of pitch pine have been devastated, beetle populations in Connecticut seem low and scattered throughout the state, with about 250 attacked trees.



New England areas showing SPB attacks in different conifer species (circles), and positive traps for Massachusetts and Rhode Island (squares).

However, more surveys of SPB presence and phenotypical studies of these conifers are necessary to determine the possible permanent establishment of SPB in New England. In addition, basic questions such as the number of beetle generations per year, and the probability of new infestations remain unanswered.



Soil sample collection at 1 and 5 meters from the road. Soil collected at 40 cm depth around tree roots.

Deicing and Salt Toxicity in Urban Trees

Salt application, mainly sodium chloride along with calcium and magnesium chlorides, spread as moistened salt or mixed with sand, is a common practice for deicing roads in southern New England. Between 40-80 tons of salt per lane mile are applied on highways, from which 75-90% enters roadside soils by runoff, splash, or airborne mist. As the salt content increases in the soil, soil structure changes and compaction can occur. Although maximum salt concentration is within 10 m distance from the road, airborne salt spray can directly cause plant damage up to 50 m distance from roadsides. Using these rates and assuming the salt settles within 10 m of the highway, salt loading could average 2.3-3.4 kg/m².

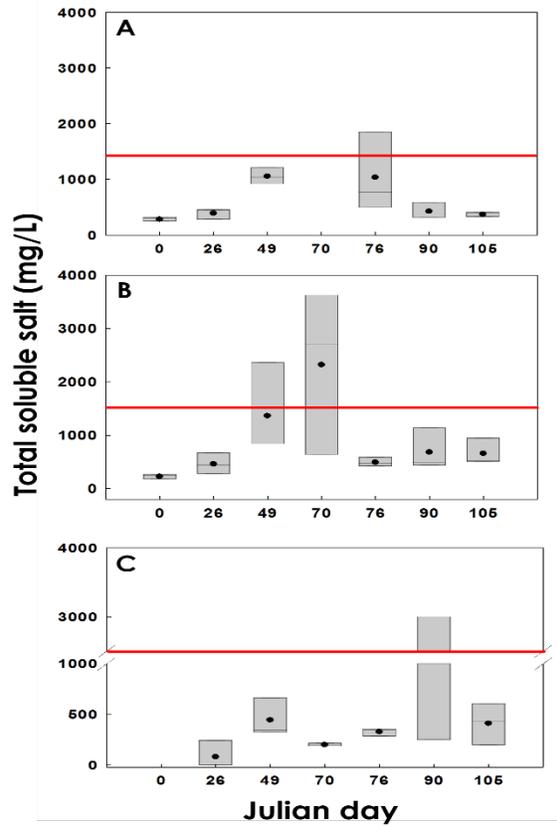
Many important trees and shrubs species growing in street and highway roads (e.g., sugar maple, red maple, flowering dogwood, American sycamore, pin oak, honey locust, and eastern white pine) are very sensitive to high salt concentrations. Several studies suggest that mycorrhizal fungi and biochar applications might alleviate salt stress in plants by numerous mechanisms that improve rhizospheric and soil conditions, enhance nutrient acquisition, alter physiological and biochemical properties of the host, and increase water absorption capacity.

Considering that species growing in urban settings are often closer than 10 m distance from the road where salt concentrations are highest, it is crucial to determine to what extent roadside trees are impacted by salt application, and to assess the potential ability of mycorrhizae and biochar to facilitate tree establishment and survival on saline or salt-affected sites. Based on these assumptions, Drs. Adriana Arango, Blaire Steven, and Wade Elmer are studying the impact of deicing application by evaluating soil salt concentration and microbial population to determine salt effect on plant performance.

Three urban sites in New Haven with 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), were chosen using sugar maple (*Acer saccharum*) as plant model. At each location, soil samples (1 and 5 meters away from the road) were collected before, during and after snow fall to estimate soluble salt concentration. In addition to soil, roots were collected to analyze microbial population and determine salt effect after deicing applications. Beginning in summer 2015, physiological analyses of sugar maple response to salt toxic conditions will be examined and the effectiveness applying biochar and mycorrhizas for salt detoxification capacity will be evaluated.

It has been shown that soluble salts higher than 1500 mg/L can cause salt toxicity in trees by inducing physiological drought and plant damage. In our study, preliminary results of soil total soluble salt found concentrations higher than 1500 mg/L after deicing applications for all three sites. Highest concentration of salt occurred during March (Julian days 70 to 90) when snow banks melted. This high concentration may have a toxic effect on root development as the tree prepares for spring growth.

This study will continue during the winter of 2015-2016. It will also include an examination of microbial populations and phenotypical analyses that are needed to correlate soils salinity levels with plant development in urban areas. Examination of a suitable mycorrhizal and biochar applications may allow us to develop better care practices for trees growing near roads where salt is used for deicing.



Salt concentration in mature sugar maple in Whitney Avenue (A), New Haven Country Club (B) and Criscuolo Park (C). Red line denotes salt toxicity levels.



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 trees line many Connecticut roads and highways.

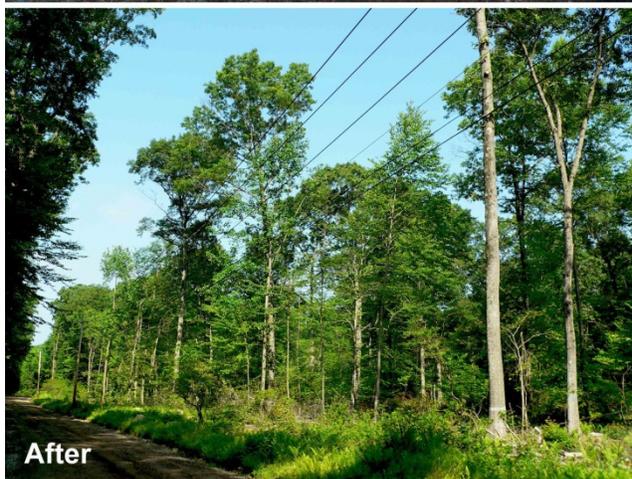
Roadside Forest Management

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 accidentally 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 and 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 is being 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.

Similar adaptive management protocols to manage trees in roadside forests were developed by the State Vegetation Management Task Force (SVMTF) led by Thomas Degnan and Jeffrey Ward, and by faculty at UConn. The proactive approach of Stormwise is to foster healthy, storm-resistant roadside forests by melding arboricultural (individual tree care) and silvicultural (forest management) practices. 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.

Eight study areas have been established along 5 km of roadside forests. Lessons learned on tree selection and coordination from implementation at three areas are being incorporated into treatments scheduled at the remaining sites. 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 not 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 (PCT), indeed any crop tree release, is the inevitable partial release of trees other than selected crop trees (i.e., non-crop trees). While the response of released crop trees is increasingly understood, few studies have examined the response of the 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. Each area had nine 26 ft x 26 ft plots for each of two treatments: PCT and unmanaged controls. Sixty-three crop trees per acre were released by cutting all stems that had crowns adjacent to the crop trees. This resulted in the inadvertent partial release of 380 upper canopy, non-crop trees per acre. Diameters and crown classes of all stems (DBH > 0.8 inches) were measured annually (n=4,828). For those stems in upper canopy at canopy closure, partial release did not increase the proportion that remained in the upper canopy, excepting a small increase for red maple. Partial release increased proportion of both intermediate and suppressed oaks that ascended into the upper canopy. Partial release reduced mortality of both oaks and birches in the intermediate and suppressed crown classes. Partial release had no (oak) or minimal (<0.4 inch for red maple, birch) effect on 25-year diameter growth. Precommercial crop tree release can be used to increase survival and growth of quality oak saplings without deleteriously impacting stand diversity and growth.

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. One year after fences were erected, there were 111 stumps that had viable sprouts. Stumps that were not fenced averaged more resprouts/stump (17) than did unfenced stumps (10). However, the average height of resprouts inside fences (59") was nearly double those that were not fenced (32"). 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.

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. Plots have been sampled for herbaceous species cover in spring of 2006 - 2015. Late summer sampling was conducted from 2005 – 2014 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 2015. Results from this study will reveal plant species composition and growth rates in the absence of browsing deer.

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.



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 m² 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.

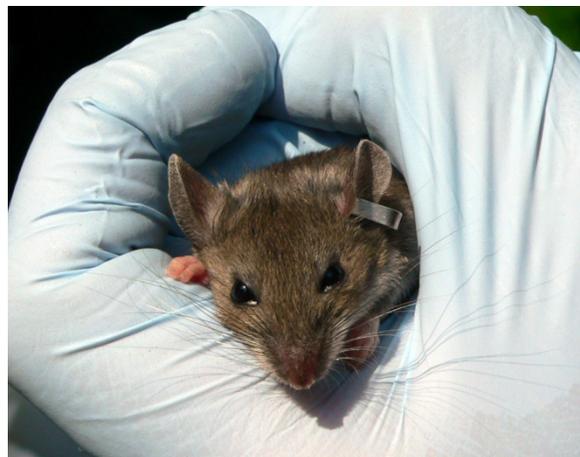
Our results suggest that deer at high densities function as keystone herbivores that create underutilized growing space by intensively browsing susceptible species, especially native shrubs. Invasive shrubs initially establish as passengers in degraded systems. The invasive shrubs were able to become 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 2,134 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 (6.1 larvae/mouse). Adult tick densities in dense barberry (230/acre) were higher than in both controlled barberry (118/acre) and no barberry (68/acre) areas. Ticks sampled from full barberry infestations and controlled barberry areas had similar infection prevalence with *B. burgdorferi*, 53 and 49% 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 148 *B. burgdorferi*-infected ticks/acre in dense barberry,



69/acre where barberry was controlled, and 40/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, 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.

Deer Repellent Trial

Herbivory by white-tailed deer (*Odocoileus virginianus*) can be the source of significant agricultural, nursery, and managed landscape damage. Where deer cannot be managed by regulated hunting, repellents may be a reasonable alternative. Dr. Scott Williams, assisted by Michael Short, is testing a repellent formulation (Bobbex®) on produce that is often grown in backyard vegetable gardens including beans, tomatoes, and bell peppers. Commercial deer repellents currently available are not registered for use on produce meant for human consumption due to potential allergens included in formulations. However, this experimental formulation does not contain these allergens.

Two garden plots utilizing raised bed construction were located in residential areas with a known large local deer population based on aerial survey data and homeowner reports. One plot is on private property near Mulberry Point in Guilford, CT and another on Gallows Hill Road in Redding, CT. At each location, there are three treatments: positive control (fenced plants), negative control (no treatment), and treated plants (sprayed with repellent as dictated). At each location, there are 4 plants each for each treatment. Tomato, pepper, and bean plants were germinated in a greenhouse at the appropriate time, hardened off in a cold frame at Lockwood Farm, and transplanted to field study plots. Plants will be treated with the repellent formulation as dictated throughout the study. The experiment will run for 60 days, through June and July and into August if needed. Plants will be checked weekly, or as needed to rate damage. Marketable produce will be harvested once a week or as needed. Count and weight of marketable produce will be determined in the field with harvest continuing through August. Field plots at each location will measure approximately 12' x 16' (192 ft²) with approximately 4' spacing between treatments. Repellent effectiveness will be defined as the dry mass difference for each cohort for each treatment.

Impact: Browse damage from overabundant herds of white-tailed deer cause the Connecticut nursery and landscape industry \$1.5-\$2 million in direct damages to plants prior to sale at nurseries and garden centers as well as \$1 million in lost sales to homeowners discouraged by repeated deer damage annually. Formulations to limit deer damage could limit Connecticut nursery losses by \$1.1-\$1.5 million and could improve sales by \$750,000 annually.

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 143 farmers' markets in 2013, attended by over 400 farmers compared to 87 markets in 2007, a 64% 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's 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.



Specialty Pepper Trials: Specialty peppers include both hot and sweet varieties of unusual shape, size, or color. Colored peppers have extra flavor, nutrition, and aesthetic appeal, and therefore command a higher market price. Most colored peppers are obtained by leaving the fruits on the bush until they reach mature color (red, yellow, orange). Others, such as banana pepper, are pale yellow even when immature. Green bell peppers are high in vitamin C (one medium green bell pepper contains 177 percent of the RDA for vitamin C). As they mature and sweeten (turn color), the vitamin A content rises 9-fold while the vitamin C content doubles. In 2014, Dr. Maynard evaluated 10

varieties of specialty peppers on yield and quality at Windsor and Lockwood Farm.

Impact: King Arthur's Hybrid (red) (6.4 lbs/plant) had the greatest yields followed by Early Sunstation (yellow) (5.6 lbs/plant), Lilac (red) (4.6 lbs/plant), and Golden Calwonder (yellow) (4.3 lbs/plant). At a retail price of \$2.49/lb, there is a potential crop value of \$101,233/acre. The long-term benefits of growing specialty peppers include an additional product and revenue for growers who attend farmers' markets or have their own roadside stands. In addition, there may be health benefits for those who consume colored bell peppers. Fifty-three percent of Connecticut vegetable farmers responding to our survey are now growing specialty peppers.

Specialty Melons Trials: Specialty melons may be defined as members of the cucurbit family whose fruit may be large, have unique flavors, and command a high price in the marketplace. In commercial trade, specialty melons are often referred to as "mixed melons" and include canary, Crenshaw, casaba, Christmas, and Persian melons. In 2014, Dr. Maynard evaluated the yield and quality of eleven cultivars of specialty melons at Windsor and Lockwood Farm. Included in the trials were three galia cultivars, two canary cultivars, two Crenshaw cultivars, and one charentais cultivar. Three honeydew cultivars were also included because they demand higher prices in the marketplace than cantaloupe.

Impact: Early Dew (honeydew) (19.1 lbs/plant), Arava (galia) (12.5 lbs/plant), Tweety (canary) (12.2 lbs/plant), Early Hybrid (Crenshaw) (16.6 lbs/plant), and Savor (charentais) (9.4 lbs/plant) had the greatest yields. Cultivar selection can dramatically increase yields and profits for the grower. For honeydew melons, by growing the cultivar Early Dew instead of Honey Brew, the grower can produce 18,876 more pounds per acre or 4,390 more melons per acre. At a retail price of \$2.50/melon, the grower could potentially gross almost \$11,000 more per acre by growing Early Dew instead of Honey Brew. The long-term benefits of growing specialty melons 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 melons.

Broccoli Trials: Broccoli is one of the most popular vegetables all over the world and has long been regarded as one of the super foods packed with tremendous health benefits. Cultivar trials of broccoli were first conducted at the Experiment Station in 1986-1988 with additional trials in 1993-1995 and 2000-2002. In these trials, over 100 cultivars were evaluated. Most of the cultivars tested are no longer available from seed companies. To evaluate yield and quality of broccoli cultivars released since 2002, Dr. Maynard evaluated the yield and quality of ten cultivars for spring harvest at Windsor and Mt. Carmel.

Impact: Maximo (1.3 lbs/head), Avenger (1.3 lbs/head), Blue Wind (1.2 lbs/head), and Imperial (1.2 lbs/head) had the greatest yields. At a retail price of \$1.99/lb, there is a potential crop value of \$25,508/acre. Cultivar selection can dramatically increase yields and profits for the grower. By growing Avenger instead of Concord, the grower can produce almost 8,500 more pounds per acre to gross almost \$17,000 more per acre. The long-term benefits include additional revenue for farmers in the spring, especially those who attend farmers' markets in urban areas. Over half of all vegetable growers in Connecticut grow broccoli.

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 2014, 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 (92%) 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 2014, Dr. Maynard evaluated the yield and quality of eleven cultivars of kabocha squash. Included in the trials were 8 short-vined and 3 long-vined varieties as well as 3 personal-sized varieties.

Impact: Geisha (17.2 lb/plant) and Gold Nugget (12.8 lb/plant) had the greatest yields. Cultivar selection can dramatically increase yields and grower profits. By growing Geisha instead of the traditional Autumn Cup, the grower can produce 71,874 more pounds per acres. At a retail price of \$0.69/lb, the grower can gross almost \$50,000 more per acre by growing Geisha. 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 field

Sweet Potato Trials: A 1998 Connecticut Department of Agriculture survey noted that sweet potato is one of the most popular specialty vegetables. Sweet potato is called yam in the South. North Carolina and Louisiana are the leading US producers, but we have found that they can easily be grown in Connecticut. This crop has both a high market value and an expanding market. In addition, it is very nutritious, with high values of beta carotene (vitamin A) and vitamin C. In 2014, Dr. Maynard evaluated four cultivars that have short maturities (90 days) at Windsor and Lockwood Farm.

Impact: Beauregard (2.3 lbs/plant) averaged the greatest yields with 77% of the tubers rated at number 1 or Jumbo in size. This is in comparison to the other cultivars where only about half of the tubers were rated number 1 or Jumbo. At a retail price of \$0.79/lb, there is a potential crop value of \$26,565/acre. Beauregard is the most popular cultivar grown in Connecticut with forty-one percent of the surveyed vegetable growers including sweet potatoes at their farms. 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.

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 2014, 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. The greatest eggplant yields were from plots amended with oak leaves (12.4 lbs/plant) followed by plots amended with maple leaves (9.7 lbs/plant) and the unamended control plots (7.6 lbs/plant). Onion yields from the plots amended with oak leaves were greater (5.4 lbs /10 ft row) than yields from plots amended with the unamended control (3.7 lbs/10 ft row) and maple leaves and (2.4 lbs/10 ft row). Lettuce yields from the leaf-amended plots were virtually the same (0.8 lbs/head) compared to the unamended control (0.7 lbs/head).

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. Robert E. 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 assessment of the extent and magnitude of internal decay in living trees. 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. Last year's field work at Great Mountain Forest (GMF), in Norfolk, CT, was completed in early July of 2014, where Dr. Marra and co-PI Dr. Nicholas Brazee of the University of Massachusetts, Amherst, performed tomography at three cross-sectional levels (50, 100, and 150 cm above ground) on approximately 18 trees of each of the three principle northern hardwood species – American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), and yellow birch (*Betula alleghaniensis*). After the trees were felled and “cookies” cut at the tomographic cross-sections, the cookies were air-dried for several months. With assistance from Mr. Michael Ammirata, the cookies were then planed, sanded, and photographed, for direct comparison to tomographic images (Figure 1). From each cookie, wood was volumetrically sampled along three transects, taking samples that represented different levels of decay as indicated by SoT color category (Figure 2). Over 500 wood samples were analyzed by Gas Chromatographic Elemental Analysis (GCEA) for carbon (C) content, which was used to calculate C density (concentration of C by volume), the data from which allowed us to confirm the hypothesis that C density decreases with sonic velocity, and that tomography alone (i.e., without destructive sampling) can be used to estimate C loss.

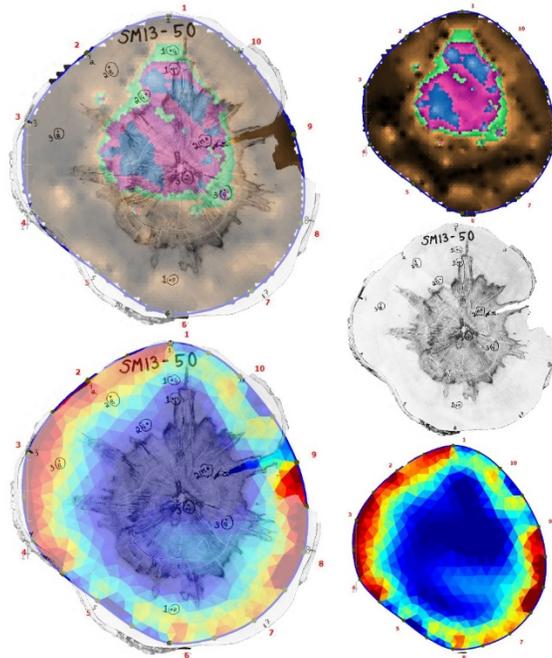


Figure 1. SoT (top right), ERT (bottom right) images, and photograph of the cookie associated with the tomography (middle right) from the 50cm level of a sugar maple sampled at the Great Mountain Forest research site. Images in upper left and lower left show the tomograms overlaid with a semi-transparent version of the cookie photograph. Colors in the SoT image progress from dark brown, which indicates high sonic velocities typical of dense, nondecayed wood, through decreasing velocities represented respectively by green, magenta, and blue. Colors in the ERT image progress from red, which indicates high resistance to electrical current, to dark blue, which indicates a low level of resistance to current.



Figure 2. Technician M. Ammirata drilling wood samples for GCEA analysis.

Dr. Shawn Fraver, a forest ecologist and dendrochronologist at the University of Maine, and co-PI on this project, estimated the ages of a subset of the trees used in this study. Based on his analysis of tree rings, the trees on the site ranged in age from 68 years old (a yellow birch) to 192 years old (a sugar maple). The tree ages will be used to calculate a lifetime rate of C loss.

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.

Bacterial and Fungal Community Diversity Associated with Internal Decay

The goal of this project is to use next-gen sequencing and metagenomics to characterize the bacterial and fungal diversity associated with a temporal gradient of decay. The hypothesis is that the microbial communities will change along the gradient. This project takes advantage of the many tree stumps remaining after the tree removals described in the “Internal Decay” project described above.



Figure 3. A sugar maple stump used in sampling for a metagenomics study of microbial (bacterial and fungal) diversity associated with internal decay. Sampling occurred along three transects, A, B, and C, extending from areas with no (or little) evident decay near the perimeter (“1”) to more advanced decay (“4”).

In November 2014, Dr. Marra returned to the Great Mountain Forest site to take wood samples from each of three sugar maple stumps. After removing 1-2 cm from the exposed surface, samples were obtained by drilling deeply into the stumps along radial transects that ranged from wood with no visible signs of decay near the perimeter, towards the center and more advanced stages of decay (Figure 3). DNA has been extracted from these wood samples; nex-gen sequencing and bioinformatics will be completed in collaboration with Dr. Blaire Steven. This preliminary study will be used to provide “proof-of-concept” data for a grant proposal that will address a larger sample that includes, in addition to sugar maple, yellow birch and American beech.

Impact: Little if anything is known about the ecology and diversity of the microbial communities associated with internal decay in trees. This “pilot” project will be the first to explore this uncharted territory, using the tools afforded by next-gen sequencing and bioinformatics.

Species Diversity of *Fusarium* found on *Spartina alterniflora* in North America, China, and South America.

Dr. Marra completed an extensive phylogenetic analysis of 24 *Fusarium* isolates cultured by Dr. Wade Elmer from *Spartina alterniflora* growing in salt marshes in North America, South America, and China (*S. alterniflora* is native to only eastern North America). The Maximum Likelihood 1000-bootstrap analysis used partial gene sequences of DNA-directed RNA polymerase II subunits 1 (*RPB1*) and 2 (*RPB2*), together comprising nearly 4 kilobases of informative sequences; these gene regions are well established for their informativeness in phylogenetic placement at higher taxonomic levels. Included in this alignment and analysis were sequences from nearly 800 isolates, provided by Dr. Kerry O'Donnell, USDA-ARS.

The 24 isolates from *S. alterniflora* were chosen based on their phylogenetic placement in an earlier study using morphology and partial sequences from the translation elongation factor (*EF-1a*) gene. Nine of these isolates were previously identified as *F. palustre*, the pathogen of *S. alterniflora* recently identified by Elmer and Marra. Each of the remaining 15 isolates was chosen as representative of an *EF-1a* clade whose phylogenetic placement was ambiguous. The *RPB1*/*RPB2* analysis revealed several important findings: (i) two of the putatively *F. palustre* isolates (one from Connecticut, the other from China) are actually *F. armeniacum*, and another, from Louisiana, is likely a new species; (ii) an isolate from China that clustered with, but is distinct from, *F. kyushuense*, is likely a new species; (iii) an isolate from a Connecticut saltmarsh that clusters near to, but distinct from, *F. palustre*, yet is morphologically distinct from *F. palustre*, is likely a new species; (iv) of the seven isolates from Argentina, each representing a different *EF-1a* clade, at least three isolates likely represent a new species, while the other four belong to well-established but poorly resolved species complexes.

Impact: These findings reinforce the growing understanding that the *Fusarium* genus is exceedingly complex, and that morphology alone cannot identify species richness within the genus. Furthermore, while highly conserved genes such as *EF-1a* are considered appropriate for species resolution, within the *Fusarium* genus it is not necessarily sufficient for this purpose.

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 project focuses on the ecology and genetics of the causal agent of perennial target canker, the fungal pathogen, *Neonectria ditissima*. The goal 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.

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.

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, with assistance from M. Ammirata, has for the past year been focusing on the transcriptomics of fungicide resistance. The ultimate goal of this project is 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-oxidase inhibitors (QoIs)—used in the control of boxwood blight. This work has been predicated on observations of reduced sensitivity to select DMIs and QoIs reported for a European clade of *C.ps.* known as G2, which has since been elevated to separate species status, and named *C. henricotiae* (Ch). The reported fungicide sensitivity differentials are being tested in the laboratory using in vitro radial growth assays on solid media amended with the target fungicide at different concentrations (Figure 4). Results have confirmed that among the DMIs tested to date, Ch has reduced sensitivity,

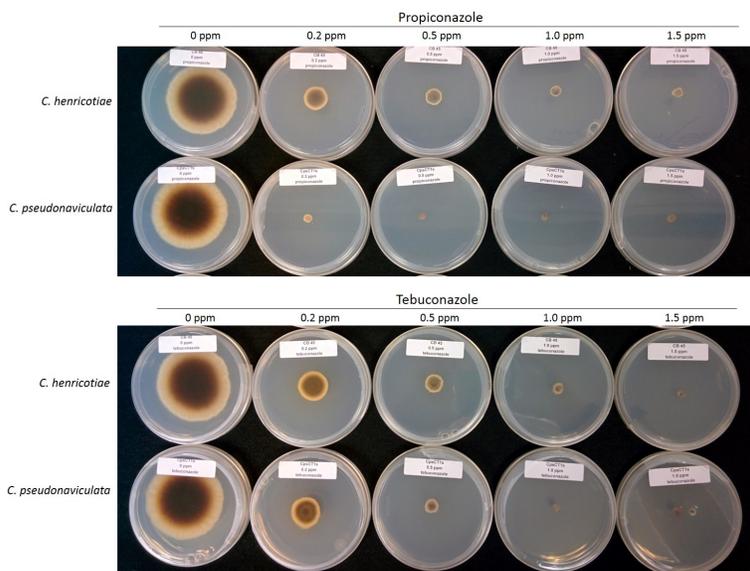


Figure 4. Sensitivity of *C. henricotiae* (Ch) and *C. pseudonaviculata* (Cps) to increasing concentrations of the DMI fungicides, propiconazole (top) and tebuconazole (bottom). Ch has reduced sensitivity to propiconazole, but not tebuconazole, demonstrating the absence of cross-resistance within the DMI class of fungicides.

relative to Cps, to tetraconazole and propiconazole, but not tebuconazole, and among the QoIs tested, reduced sensitivity to kresoxim-methyl but not pyraclostrobin. The absence of “cross-resistance”—reduced sensitivity to all fungicides within a class based on identical modes of action within the class—for both DMIs and QoIs suggests 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, Dr. Marra along with colleague Dr. Jon Hulvey at the University of Massachusetts Amherst took a comparative genomics approach to explore the relationship between *CYP51A* and *CYP51B* gene sequences and differential sensitivity to tetraconazole and propiconazole. An important finding from this research is that *CYP51A* in *Cps*, but not *Ch*, has an internal stop codon, and is therefore nonfunctional. Therefore, only the *CYP51B* gene product is expressed in *Cps*. Since both genes are known to have redundant functions, the expression of only *CYP51B* in *Cps* may partially explain the increased sensitivity to tetraconazole and propiconazole. The *CYP51B* gene is not implicated in the observed differential sensitivity because the amino acid sequences of the *CYP51B* protein are identical between *Cps* and *Ch*. However, it is possible that differences between *Cps* and *Ch* in *CYP51B* expression levels may play a role in differential sensitivity between the two species.

In anticipation of the need to explore the entire transcriptome for differences in gene expression related to fungicide sensitivity, Dr. Marra and M. Ammirata have been experimenting with reliable methods for extraction of RNA of a quality suitable for next-gen sequencing. A valuable conclusion from these efforts has been the importance of how the fungal tissue is handled prior to extraction.

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. Francis J. Ferrandino is continuing the project, “Coordinated winegrape 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). 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



Figure. A storm in October 2014 with wind gusts exceeding 40 mph destroyed the netting used to protect grapes from birds

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 USDA/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. The maintenance of the 1-acre plot at Lockwood Farm in Hamden has presented some logistic difficulties.

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.

Modeling for Plant Diseases

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

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



Anemometers measure wind information in a 'Pinot gris' vineyard at Lockwood Farm in Hamden, CT.

Remote-Sensing Weather Stations

Dr. Ferrandino has maintained three remote-sensing weather stations located on the CAES research farms (Hamden, Windsor, and 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 CAES farms and Gouveia Vineyards are available at: <https://www.hobolink.com/s/d0696313715dd96f86b25f3552cc1f47>.



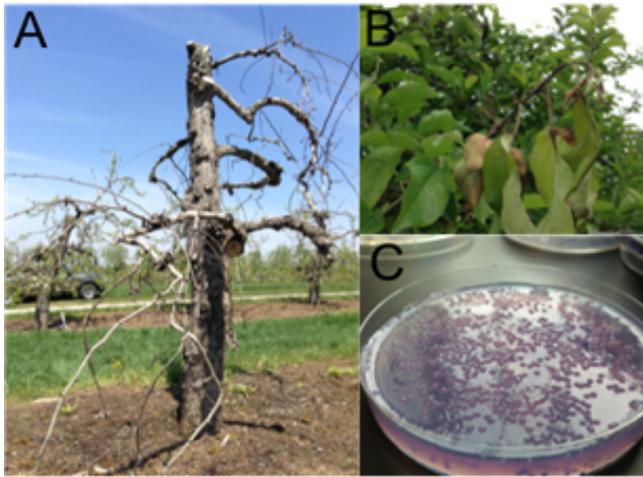
Weather station at Newport, RI.

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. 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.

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.

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



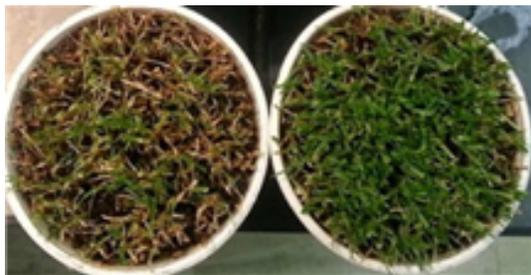
A. Pear tree killed by fire blight in New London County, CT. B. Typical “Shepherd’s crook” symptom of fire blight. C. Fire blight pathogen *E. amylovora* colonies on CTT medium.

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 the 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, Dr. Quan Zeng is performing a regional survey to understand the streptomycin susceptibility of the fire blight pathogen populations in New England. Fifty-two fire blight diseased samples as well as 55 apple and pear flower samples were collected and tested for the presence of *E. amylovora* and the streptomycin resistance gene *strA-strB*. Our results suggested that all *E. amylovora* isolates collected from CT, MA, VT, ME, RI, and NY are susceptible to streptomycin. However, 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*.

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 made to prevent and restrict the spread of streptomycin resistance in *E. amylovora* populations through grower education.

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



Creeping bentgrass with bacterial etiolation and decline (left) and healthy creeping bentgrass (right).

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*). However, how this disease was started and spread was unknown. Two possibilities are: 1) The pathogens are dispersed from contaminated grass seeds from a single source, and 2) The pathogens emerged from parallel evolution at various geographical locations. Dr. Zeng, in collaboration with Dr. Paul Giordano and Dr. Nathaniel Mitkowski, collected 28 *Aaa* strains from diseased creeping bentgrass from 14 states in the U.S. Draft genomes of 12 *Aaa* strains were sequenced, assembled, and annotated. From the genome sequences, we demonstrated that numerous gene insertion, inversion, and mutation events occurred in all 12 strains isolated from various geographical locations. This suggests that the disease likely emerged through parallel evolutions at different geographical locations. Using multilocus sequence typing (MLST) and comparative genomics methods, we identified that the 12 turf pathogenic *Aaa* isolates are closely related with maize pathogenic and rice pathogenic *Aaa* isolates, with a significantly lower number of type 3 secretion effectors (*Aaa* turf average effector number: 6.7; *Aaa* maize: 10; *Ac* melon: 19), an important virulence factor of bacterial pathogens. This suggests that the *Aaa* strains that infect turf may share the same ancestor as *Aaa* strains that infect maize and rice. The small number of effectors also suggests that the turf pathogenic *Aaa* strains are likely at the emerging stage of the pathogen evolution. This observation is consistent with the much earlier cultivation time of maize and rice compared to turf grass, large scale cultivation of which didn't start until the early 1900s when golfing gained its popularity in the United States.

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.

Purine and Pyrimidine Transport in Plants

Dr. Neil P. Schultes, assisted by Regan Huntley, investigates the movement of nucleobases (purines and pyrimidines) across biological membranes. Nucleobases are important 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.

Our research characterizes the biochemistry of nucleobase transporters by determining which purines and pyrimidines are moved and how efficiently. Transporters from the nucleobase-ascorbate transporter (NAT), and nucleobase-cation symporter1 (NCS1) and Aza-guanine (AZG) transporter families are investigated. The function of the plant transporters is determined through an experimental technique known as heterologous complementation. In this procedure the plant gene encoding the transporters are cloned into DNA vectors (plasmids) that are engineered to express in brewer's yeast (*Saccharomyces*

cerevisiae). Once expressed in yeast, a series of experiments testing the ability of the engineered yeast to take up or transport radio-labeled nucleobases are performed. 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 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 complement the ongoing research in structure-function and three dimensional structural studies of NCS1 transporters actively pursued in fungal and bacterial systems.

We are investigating the function of eight of the Arabidopsis NAT transporters and AZG transporters from *A. thaliana* and *Zea mays* using similar techniques. 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.

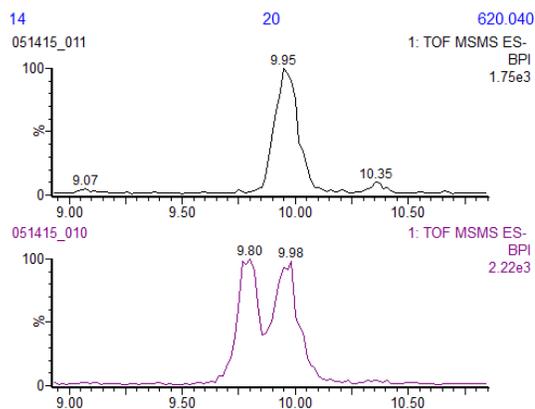
Our last associated project characterizes four similar nucleobase transporters from the bacterium *Paenibacillus larvae* – the causal agent of American Foul Brood in Honey Bees. Two recent developments render this project worthwhile to pursue. First, a recent report has shown that *P. larvae* spores 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.

Impact: Purines and pyrimidine biochemistry play important roles in all living organisms. Although narrow in scope, our research on nucleobase transport addresses important issues in nucleobase metabolism. Future engineering of plants for increased productivity or managing biotic and abiotic stresses will require a greater understanding of metabolic processes. Many anti-cancer drugs and anti-microbial agents utilize nucleobase derived compounds for treatment. Therefore, results from our work will not only directly impact researchers in plant biochemistry, but also researchers in human disease processes and drug development.

Plant Bacteriology

Dr. Lindsay Triplett and Dr. Teja Shidore, post-doctoral researcher, are investigating the role of the *Xanthomonas* effector AvrRxo1 as a toxin-antitoxin system with collaborators at Colorado State University and Virginia Polytechnic Institute. This project has discovered that *Xanthomonas* pathogens, including those causing bacterial spot of tomato and pepper in Connecticut, secrete a toxic protein that can modify and inactivate the metabolic intermediates of bacteria, fungi, and 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 activity in this family of proteins will



Chromatography methods were used to identify new compounds produced in the presence of active AvrRxo1 (bottom) but not by an inactivated AvrRxo1 (top).

help us identify ways to disrupt this protein as a strategy to fight bacterial disease.

Dr. Triplett, assisted by Regan Huntley, is also investigating the contribution of toxin-antitoxin systems to bacterial plant disease. This project is focused on identifying the roles of numerous different toxin-antitoxin systems in bacterial plant disease. Genomic analysis was used to identify thousands of these genes in the genomes of bacterial plant pathogens, and a few of these will be chosen to investigate their antibiotic properties and role in plant disease in the last two years of the project.

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.

With collaborators at Yale and Cornell University, Dr. Triplett initiated a project aimed at 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. Funding is being sought to identify the specific gene.

Impact: The resistance activity 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. Once the specific gene is identified, it could be harnessed for resistance against a wide variety of crop diseases.

Biochar in Plant Disease Control

Biochar is a fine-grained, charcoal-like product that has soil enhancing properties (Figure 1). It also suppresses plant diseases by absorbing toxins, increasing colonization of beneficial mycorrhiza fungi, and increasing densities of beneficial bacteria in the rhizosphere. These beneficial microbes help to suppress disease through antibiosis, competition, or induction of systemically acquired resistance mechanisms.

Delivering biochar to lower soil horizons presents an obstacle in perennial plants and it was hypothesized that earthworms may help in distributing biochar in soils. Drs. Wade H. Elmer and Joe Pignatello used earthworms to determine if the type of the biochar influences their ability to remove surface biochar. Substantial differences were found among nine different biochars, indicating that biochar can vary in their attractiveness to earthworm and this may, in turn, affect their efficacy in soils.

Dr. Elmer, in collaboration with Amber Fearnly, a high school student at the Sound School in New Haven, CT conducted a greenhouse study to examine the impact of biochar on Verticillium wilt of eggplant (Figure 2). Results of these experiments showed that biochar was ineffective in suppressing this important disease of eggplant.



Figure 1. Sample of biochar.



Figure 2. Amber Fearnly conducting her senior project on the role of biochar on Verticillium wilt of eggplant.

Impact: Biochars are becoming more widely commercially available to the general public. These studies should caution consumers that biochars differ in their properties and may not reduce diseases for all plants.

Silicon and Partial Saturation for Disease Suppression in Ornamentals

Ebb & flow recycled watering systems have been used with increasing frequency in Connecticut to save water and to manage moisture deficits. However, a major disadvantage of recycled watering is the potential for disease outbreaks and the development of fungicide-resistant pathogens. Previous research from a joint project with Drs. Wade Elmer, Martin Gent, Rich McAvoy (University of Connecticut), and Joe Geremia (Geremia Greenhouse, Yalesville, CT) demonstrated that partial saturation resulted in smaller, healthier, and more marketable plants than full saturation.

Our latest research project explored the possible role of silicon, a nonessential element that has disease suppressive properties when absorbed by certain plants, to determine if soluble silicon applications with partial saturation would act synergistically and provide more protection against foliar and root diseases. Poinsettias and zinnias were grown on partial and full saturation with and without silicon applied as potassium silicate. Potassium carbonate (K_2CO_3) was used in the control pots to factor against the effect of potassium. Poinsettias were exposed to *Pythium* root rotting pathogens and zinnias were allowed to become infected with powdery mildew. We observed marginal suppression of *Pythium* root rot of poinsettias when silicon was applied to plants receiving full saturation, but no suppression on partial-treated plants. Alternatively, we observed that powdery mildew was more severe on zinnia grown under partial saturation than full saturation. However, the application of silicon significantly suppressed powdery mildew on partial saturation plants when compared to the K_2CO_3 control (Figure 3).

Ornamental grasses like *Hakonechloa* grass are susceptible to a wide variety of foliar and root problems. A joint study with Margery Daughtrey of Cornell University examined the response of *Hakonechloa* grass to increasing rates of silica slag grown in soilless potting soil. It found that root growth responded best when a rate of 4 metric tons of silica slag/ha was used (Figure 4).

Impact: Silicon nutrition offers an inexpensive strategy to boost plant health and reduce fungicide usage. Partial saturation allows growers to suppress *Pythium* diseases and save fertilizer and fungicides. In cases where moisture stress from partial saturation increased powdery mildew, as in the case of zinnia, the inclusion of silicon nutrition provided a cost-effective method to reduce disease without fungicides.



Figure 3. Powdery mildew of zinnia grown with silicon (right panel) compared to control (left panel).

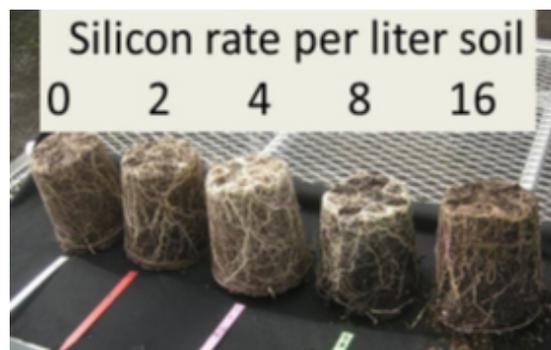


Figure 4. Root systems of *Hakonechloa*, an ornamental grass, treated with increasing rates of silicon. The rate of 4 g/liter was superior to other rates.

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 5). *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.

Dimethylsulfoniopropionate (DMSP) has been proposed as a putative physiological indicator of health in *S. alterniflora* and is reported to be in lower levels in SVD sites. In addition, others have reported that concentrations of several heavy metals are in higher concentrations in plants from SVD sites. Drs. Elmer served as a thesis advisor for Ms. Magali Bazzano, a master's candidate at the University of New Haven, who investigated the hypotheses that DMSP and elemental levels were affected in marshes where SVD was present. Special attention was also given to Si because this element has been linked not only to stress resistance in plants, but also to herbivore resistance. In general, it was found that the concentration of DMSP was variable within the marsh, but mean values were significantly higher in the healthy marsh compared to the SVD site. The elemental concentrations of Fe, K, and Si in plants at the SVD site were significantly higher, while Cu was lower. These findings were consistent with other reports in southern U.S. marshes. These data imply that physiological stress, along with biotic stress from disease and herbivory, are contributing to SVD.

We also examined the role of silicon in salt marsh health and its effect on grazing by the crab. Greenhouse experiments and field plots in crab-infested creek intertidal banks were established. We found that silicon nutrition was ineffective in preventing disease from *F. palustre* or herbivory from the purple marsh crab.

Drs. Elmer and LaMondia compared the salt tolerance of two salt marsh pathogens, *F. palustre* and the root-knot nematode, *Meloidogyne spartinae*, to genetically related terrestrial species to determine if the salt marsh pathogens had acquired tolerance to saline conditions or if salt tolerance was comparable among *Fusarium* and *Meloidogyne* species. We observed that *F. palustre* was significantly more tolerant to NaCl than terrestrial species and that *M. spartinae* survived at all NaCl concentrations tested, whereas terrestrial nematodes did not survive. These findings provide evidence that *F. palustre* and *M. spartinae* pathogens evolved in saline conditions and are not recent introductions from terrestrial niches.

Impact: Understanding the physiological parameters associated with *S. alterniflora* and the pathogens associated with SVD may reveal knowledge gaps where scientists might understand why Connecticut's salt marshes are declining and what marshes may be threatened in the future by dieback. In addition, 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). The literature clearly demonstrates enhanced availability and transport of NP as a function of their minute particle size. We hypothesized that NP of Cu, Mn, and Zn (essential micronutrients) applied foliarly may allow a slow release of ions that may be loaded into the phloem for transport to susceptible root tissues. In



Figure 5. Effect of nanoparticles of CuO applied to a healthy watermelon plant compared to the control.

collaboration with Dr. Jason White, Dr. Elmer compared NP of Cu, Mn, and Zn oxides to their larger bulk equivalents or to sulfate salts for effects on the growth and yield of eggplants grown in soil infested with *Verticillium dahliae*. In both greenhouse studies and two years of field experiments, we observed that NP of CuO increased growth and yield by 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 5). Field studies are in progress to assess the effect of NP of CuO rate on Verticillium wilt of eggplant and other forms of Cu.

Impact: These studies show positive and negative 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 a promising alternative to conventional pesticides.

Disease Survey

Drs. Yonghao Li and Sharon M. Douglas, assisted by Ms. Lindsay Patrick, diagnosed a wide range of fungal, bacterial, viral, nematode, and phytoplasma diseases on trees, shrubs, flowers, lawn grasses, fruits, and vegetables during the past year. The prolonged and extreme cold winter of 2014-2015 caused severe physical injuries on trees and shrubs, especially on arborvitae, boxwood, rhododendron, and holly.

Herbaceous and Woody Ornamentals:

A severe epidemic of tomato spotted wilt virus on potted chrysanthemum plants was found in a field that was close to greenhouses. Impatiens downy mildew was found in late summer, but did not cause severe epidemics in the season. Impatiens necrotic spot virus (INSV) remained a major virus disease problem in greenhouse bedding plants, especially on begonia. Pythium root rot was found on many annual flowers, such as impatiens, calibrachoa, gerbera daisy, and begonia. Phytophthora root rot was problematic on lavender in landscapes that had poor drainage. Powdery mildew was prevalent on peony, begonia, beebalm, and phlox. Thielaviopsis root rot was found on salvia and Lobularia.



Tomato spotted wilt virus on chrysanthemum.



Pythium root rot of gerbera daisy.

A rose sample from a public rose garden was positive for rose rosette virus, which was the first official confirmation of rose rosette disease in the state. Lilac witches'-broom, associated with the phytoplasma '*Candidatus Phytoplasma fraxini*', was detected in lilac samples submitted from a nursery. Fungal leaf spots of mountain laurel remained a major problem that reduced plant aesthetics and caused significant defoliation. Boxwood blight, *Volutella* canker, and *Macrophoma* leaf spot were major diseases that caused severe damage to boxwood plantings in landscapes. Several *Gymnosporangium* rusts were identified on different hosts, including apple, pear, quince, serviceberry, and cedar. Canker diseases contributed to dieback of many woody ornamentals, such as *Botryosphaeria* cankers of ash, crabapple, and rhododendron; and *Phomopsis* cankers of juniper, maple, black pine, and rhododendron. *Verticillium* wilt was a recurring, serious problem on Japanese maple trees. *Volutella* blight and Alfalfa mosaic virus were major diseases on pachysandra. An increased incidence of *Diplodia* blight and *Ploioderma* needlecast on two-needle pines was noted. *Rhizosphaera* and *Stigmina* needlecasts and *Chrysomyxa* repeating needle rust were noteworthy foliar disease problems on spruce. Swiss needlecast and *Rhabdocline* needlecast continued to be problematic for Douglas-fir in Christmas tree farms and landscapes.



Stigmina needlecast of spruce.



Rose rosette disease.

Vegetables:

Cercospora leaf spot of beet was found on greenhouse bedding plants in early spring. Downy mildew was diagnosed on potted basil plants from a greenhouse in early summer of 2014. Basil downy mildew was also found in home gardens in late summer in 2014. On tomatoes, *Septoria* leaf spot continued as the

most common disease followed by bacterial leaf spot, Fusarium wilt, anthracnose, powdery mildew, leaf mold, and Botrytis blight. Powdery mildew, bacterial angular leaf spot, and bacterial wilt were common problems of cucurbits in both commercial farms and backyard gardens. Thielaviopsis root rot was identified on a zucchini sample from a commercial grower. Tobacco mosaic virus was detected on pepper seedlings that were collected from a greenhouse. Xanthomonas bacterial leaf spot was commonly observed in pepper fields.



Cercospora leaf spot of beet.



Downy mildew of basil.

Tree and Small Fruit:

Black rot, powdery mildew, anthracnose, and downy mildew remained the major disease problems of grape. In a commercial winery, Phomopsis canker was identified on several grapevines. On peach trees, the two major diseases were leaf curl and brown rot. Outbreaks of fire blight, a devastating disease of apple and pear was widespread in many orchards throughout the state during the summer of 2014.



Black rot of grape.



Fire blight of apple.

Turf:

Prolonged snow cover last winter caused severe epidemics of gray snow mold on lawn grasses. Brown patch, summer patch, red thread, powdery mildew, slime mold, anthracnose, rust, and Pythium root rot were common diseases of lawn grasses.

Weeds:

Running bamboo continued to be the topic of increasing public concern because it is difficult to control and 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, ground ivy, wild violets, wild garlic, creeping bentgrass, bittercress, chickweed, clover, foxtail, garlic mustard, mugwort, nightshade, nutsedge, purslane, spurge, red sorrel, and speedwell.

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, inspectors from the Bureau of Regulation and Inspection of the Connecticut Department of Agriculture collect official samples of vegetable, crop, and lawn seeds for analysis. Samples are submitted to The Connecticut Agricultural Experiment Station, since it is the official seed testing laboratory for Connecticut. The Department of Plant Pathology and Ecology performs the germination and purity analyses that are required for compliance with Connecticut Seed Law Regulations and the Federal Seed Act. In 2015, 323 vegetable, 5 lawn, and 9 crop seed samples were submitted to Dr. Douglas for testing. Pamela Sletten, with assistance from Lindsay Patrick, tested all seeds following strict protocols designated by the Association of Official Seed Analysts (AOSA). Seedlings are carefully examined, since they must appear “normal” (i.e., free from decay, have well-developed primary root systems, have well-developed and intact hypocotyls and/or epicotyls, and have healthy cotyledons). Vegetable seeds are tested for germination, and as of the date of this report, tests for 138 of the 323 vegetable seed samples were completed and five seed samples failed label claims for germination. Some failures were not retested because of insufficient amounts of seed. Seed samples were examined for prohibited noxious weed seeds and three vegetable samples contained weed contaminants that are being identified. Lawn seeds are tested for both germination and purity. One of the five lawn seed samples tested met label claims for both purity and germination. Four samples failed purity claims, but passed germination claims. None of the 2015 lawn samples contained seeds of noxious weeds. Crop seeds are also tested for both germination and purity. Five of the nine crop seed samples tested passed label claims for purity and germination. Four samples failed claims for germination (with retests), but passed label claims for purity. One sample did not state a label claim for purity, but was found to contain *Rumex* seeds, a restricted weed. 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 22 samples from the Connecticut Department of Consumer Protection at the request of the Department of Analytical Chemistry of the Experiment Station.

Citizen Inquiries

Plant Disease Information Office

Drs. Li and Douglas, assisted by Ms. Patrick, answered 4,002 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 (16%) and turf grasses (3%), were also well represented. A moderate percentage of inquiries fell into the miscellaneous category (13%), which included identification of plants and poison ivy control and identification. Although the majority of inquiries were from Connecticut homeowners (58%), there were many inquiries from commercial growers and plant care professionals (35%). Inquiries from cooperative extension, health, news, agricultural personnel, and other (7%) remained consistent with previous years. A further breakdown of inquiries showed that 35% of the questions came in by phone, 15% came in by mail, 12% came as email, and 38% were brought in person. The number of physical samples handled by the PDIO (53%) continued to exceed the number of phone calls and emails (47%)—this is a trend that has been observed for the past 5 years. Over 1,014 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. Most of the miscellaneous questions were concerned with identification, human toxicity, and control of poison ivy and other poisonous plants, identification of various plants and weeds, mushroom identification for health officials, and information about pesticides and their relationships to health and environmental concerns.

Additional Inquiries from Stakeholders

Dr. Elmer made 7 site visits to growers and answered 19 phone calls and 5 emails. Dr. Ferrandino answered 19 phone calls and 18 emails, tested 23 samples, and made 7 site visits. Dr. Li made 5 site visits. Dr. Zeng answered 5 questions and made 20 site visits.

Impact: During the period covered by this Report, over 4,149 Connecticut residents had plant disease problems accurately diagnosed by members of the Department of Plant Pathology and Ecology. In many cases, the plant health problems diagnosed did not require fungicides for control, contrary to the initial perception that fungicides would be required. Staff worked closely to educate professionals and homeowners to develop disease management programs that were compatible with the environment that incorporated cultural practices, sanitation, and genetic resistance prior to pesticide use. Accurate diagnosis of plant health problems, educated citizenry, and implementation of integrated disease management strategies reduce pesticides introduced into the environment and water of Connecticut.

VALLEY LABORATORY

Scientists at the Valley Laboratory conduct multidisciplinary 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 shade and broadleaf tobacco continues today, the research mission has greatly expanded to reflect the diverse agriculture present in the State. In addition to research, scientists and staff 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.



Activities on the farm

There were a total of 50 experimental plots at the Windsor research farm during the past year. Three Windsor-based scientists had 25 of these plots; six New Haven-based scientists were using 15 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 Lab 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 the adelgid is a major long-term national strategy for reducing the impact and spread of invasive hemlock woolly adelgid (HWA) threatening eastern hemlocks. *Sasajiscymnus tsugae* (Coleoptera:Coccinellidae), originating from Honshu, Japan, and discovered by a CAES scientist, is one of the primary biological control agents released for HWA management.

Evaluation of Volatiles as Possible Attractants for *Sasajiscymnus tsugae*, Introduced Predator of the Hemlock Woolly Adelgid

Dr. Carole Cheah, in collaboration with Dr. Allen Cohen of North Carolina State University, Insect Rearing Program, conducted olfactometer testing of *S. tsugae* responses. An improved bioassay was developed in 2014 which allowed 24 hour data gathering of adult *S. tsugae* male and female responses to different colors and revealed gender differences and preferences for colors which will be used in designing monitoring traps. Humidity differences did not influence *S. tsugae* attraction to odors and

validated the responses to volatiles in a 2 way olfactometer. Also, in small tent cages, *S. tsugae* males and females did not preferentially choose to land on infested seedlings of *T. sieboldii* over *T. canadensis*.

HWA status in Connecticut 2014

Dr. Carole Cheah's field surveys of state lands where hemlocks occurred in 2013 had previously shown that HWA has dramatically increased and spread after 2 consecutive warmer winters following a long period of patchy low populations. However, the winter of 2014 was severe and the polar vortex event in early January resulted in widespread winter mortality of HWA throughout Connecticut. Minimum daily temperatures of -7 to -9°F occurred in the three climatic regions (National Oceanic and Atmospheric Administration) of Connecticut. Mean HWA mortality was 84% with more variability for the whole of Connecticut in 2014 but was particularly high in coastal areas. But in 2015, Connecticut experienced the coldest February on record and HWA winter mortality was very high throughout the state, averaging 90.3%, with minimum winter temperatures dropping to -13 to -16 °F in northern areas and -5 °F along the coast. Locally, HWA has resurged during the summer progrediens generation in 2015 but infestations remain patchy.

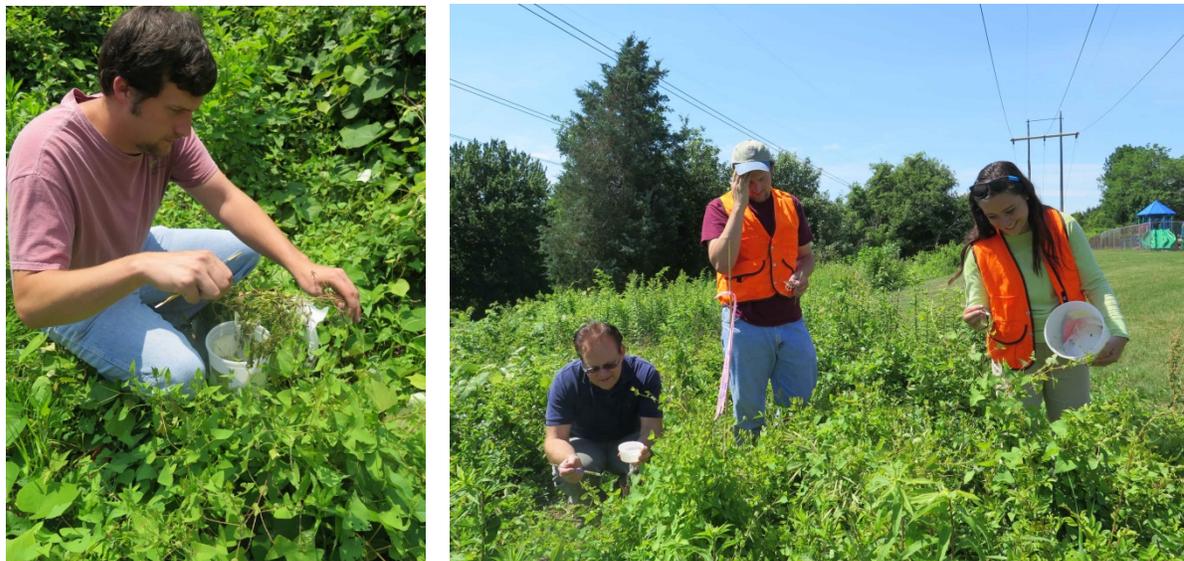
Impact: State, water company municipal foresters and natural resource managers as well as the general public were informed in the spring of the high winter mortality of HWA in 2015, resulting in reduced need for chemical control of HWA in spring 2015.

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 an 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. 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. In a collaborative project between the CAES and the University of Connecticut funded by USDA APHIS PPQ, in cooperation with the New Jersey Department of Agriculture Phillip Alampi Beneficial Insect Laboratory, the University of Rhode Island and the University of Delaware, nearly 44,000 weevils have been released to date in 19 towns from 2009-2015. To date, 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) and Wallingford (2015). Further releases are being implemented in more towns in 2015. Dr. Cheah has participated in the releases and monitoring of all the release sites since 2009. Weevils have been established at all previous release sites, survived six diverse Connecticut winters, severe spring and summer flooding, and reproduced with multiple generations. High feeding impact has been recorded in the late summer at several sites. Dispersal of weevils has also been recorded at least 18 miles from the nearest release site in 2014. In 2015, GIS mapping of MAM distribution and weevil dispersal is being undertaken by Emmett Varricchio, summer research assistant at the Valley Laboratory.

Impacts: Weevils released to control mile-a-minute weed in the western and eastern portions of the state overwintered successfully again in Connecticut following the severe winter of 2015, with the coldest February on record. Ample snow cover is thought to have supported weevil overwintering. Weevils are starting to impact and reduce local populations of MAM at several release sites.

Dispersal and spread of weevils from their original release sites has been observed. Establishment and spread 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 right-of-ways, agricultural lands, bird refuges, etc.



Releases of weevils in Fairfield and Wallingford 2015.

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 Connecticut with heavy elongate hemlock scale infestations have shown thinning crowns and declining health, leading to pre-emptive hemlock salvage in forest management. Preliminary sampling in EHS-dominated Connecticut stands in 2010 by Dr. Cheah has indicated increased numbers of the twice-stabbed lady beetle, *Chilocorus stigma*, which is a native and widespread omnivorous scale predator, but *C. stigma* has not been mass-reared and is not available commercially. The objective of this project, funded by USDA APHIS PPQ, 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. In 2014-2015, Dr. Cheah continued to survey for EHS in Connecticut and also recorded the rise in native hemlock scale, *Abgrallaspis ithacae*, especially in western and southwestern parts of the state. Collections of *C. stigma* were made during the fall of 2014 and maintained on EHS on hemlock. When supplemented with the artificial CC diet, adults readily oviposited in the fall on EHS on hemlock in the laboratory for several months but rearing in unheated greenhouse conditions was not successful. Cultures of Florida red scale, *Chrysomphalus aonidum*, (FRS) were originally obtained from the University of Florida/IFAS at the Southwest Florida Research and Education Center in Immokalee, FL, were transferred and maintained on butternut squash through the year. After overcoming squash rot diseases, the scale culture on butternut squash was amplified considerably in 2014-2015 and this is the 3rd successive year of continuous FRS culture on butternut squash. In 2015 experiments, adult *C. stigma* fed readily and oviposited viable eggs on an acceptable artificial substrate, on squash cultures of FRS. Resultant eggs hatched and larvae fed and developed successfully to adult on FRS squash cultures. This is the first record of *C. stigma* reared successfully under laboratory conditions on a squash culture of scales.



Larva (left) and adult (right) of *Chilocorus stigma* reared on Florida red scale on butternut squash.

Surveys in 2014-2015 showed that eastern hemlocks continued to decline in certain regions, especially in the northwest corner, due to heavy EHS infestations, in either single or joint infestations with HWA. Thinning crowns and increased incidences of hemlock borer, a native secondary pest that attacks stressed trees, were observed in marginal sites. Aerial surveys by the CAES confirmed that in 2014, 9,000 acres of eastern hemlock in northwestern Connecticut were in serious decline and defoliation from EHS infestations. In 2015, elongate hemlock scale winter mortality was much higher than in 2014. In 2014, mean winter mortality of EHS was 54.8% in northern sites (n=6) and 34% in southern sites (n=2) but with high variability. The winter temperatures of February 2015 were the coldest in Connecticut since records began and this impacted EHS winter survival. In the northwest corner, average EHS winter mortality was 74%, (n=7), 66% (n=6) in central region and 52% (n=4) in coastal areas. In contrast, winter mortality of the native hemlock scale was much lower, as expected.

Impacts: Currently there is no effective non-chemical control of elongate hemlock scale and the range is expanding northwards 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.

Insect Management

Since discovering spotted wing drosophila (SWD) in Connecticut in 2011, Dr. Richard Cowles has focused on developing low environmental impact and IPM-compatible approaches for managing this pest. Field tests of behavioral approaches to manage SWD coordinated by Dr. Cowles were replicated in five states, but resulted in no observable benefit from use of mass trapping at a density of 100 traps per acre, utilizing the best available traps and baits at the time (red cup trap, combined with kombucha or Suzukii Trap baits). Trapped fields had the same degree of fruit infestation, whether traps were present or not. Compared with the red cup trap, a more efficient trap can be made from a 2-liter soda bottle. The top of the bottle is cut off and the cut edge inverted into the bottle to form both a funnel at the bottom of the trap for flies to enter, and a reservoir within the trap to hold the liquid bait (which also kills the flies by drowning them). This modified McPhail design of trap is equally effective as commercial traps using the same basic trap design, but costing approximately \$12 apiece.



Traps for capture of spotted wing drosophila

Strawberry sap beetles continue to be a damaging pest for strawberries, particularly where they are grown next to blueberry plantings. Adult sap beetles are difficult to control, because they arrive when there are ripe fruit and they immediately burrow into the underside of fruit where there is contact with soil. Insect pathogenic nematodes may be useful for limiting the ability of strawberry sap beetle to increase in numbers. Dr. Cowles conducted a laboratory bioassay of three species of insect pathogenic nematodes, *Steinernema carpocapsae*, *S. feltiae*, and *H. bacteriophora*, revealed that larvae reared in the laboratory of strawberry sap beetles were highly susceptible to infection by these nematodes. This is an especially promising approach, because there is always soil contact of fruits infested by sap beetle larvae, and the larvae undergo an extensive wandering stage prior to pupation in soil, which will increase the likelihood of infection by nematodes.

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. Concerns about their use in ornamental crops has led to mandatory labeling of plants treated with these insecticides in one state (Minnesota) and a large retail chain (Home Depot), and another retail chain (Lowes) is demanding the discontinuation of their use on plants sold at their stores within two years. In order to assist interested parties to interpret whether there is risk to pollinators from plants at nurseries, a team consisting of Drs. Kim Stoner, Brian Eitzer, and Rich Cowles are measuring concentrations of imidacloprid found in rhododendron nectar and pollen, as well as determining which nursery plants are used as pollen sources from bees colonies placed in cooperating nurseries (this work is detailed by Dr. Stoner elsewhere in this Record of the Year). 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 for their abundant production of nectar or pollen.

Dr. Cowles, along with Dr. Anthony Lagalante of Villanova University and Kyle Lombard of the NH Department of Natural Resources, applied imidacloprid to mature sugar maples in 2013, following the USDA APHIS Asian longhorned beetle quarantine protocol, to determine the degree to which this insecticide would later be detected in harvested sap and syrup. Imidacloprid residues continued to be detected in some sap samples from treated trees in 2015, which would make sap from treated trees unmarketable. These residues are not greatly affected by heat, and so are concentrated when sap is converted to syrup.

Some neonicotinoid insecticides, in particular imidacloprid, are noted for inducing spider mite outbreaks following their use. The strongest support for various mechanisms proposed to explain this phenomenon has been for the role that these insecticides have for inducing the SAR pathways in plants, because these insecticides' metabolites are potent agonists of salicylic acid, the key natural signaling compound that triggers this pathway. Induction of the SAR pathway may prevent induced defenses in plants to spider mite feeding, thus maintaining their palatability to mites and increasing mite survival and fecundity. In collaboration with Dr. Elizabeth Cowles, Eastern Connecticut State University, we have found a model plant system (*Pachysandra terminalis*) amenable for testing the effects of systemic insecticides and standard SAR elicitors on two spotted spider mite fecundity and polyphenol oxidase and peroxidase enzyme level expression in treated plants.

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 successful infection of roots by Phytophthora zoospores, which are known to be much less tolerant of acid soils than are the true fir host plants. 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, with a proper negative control.

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

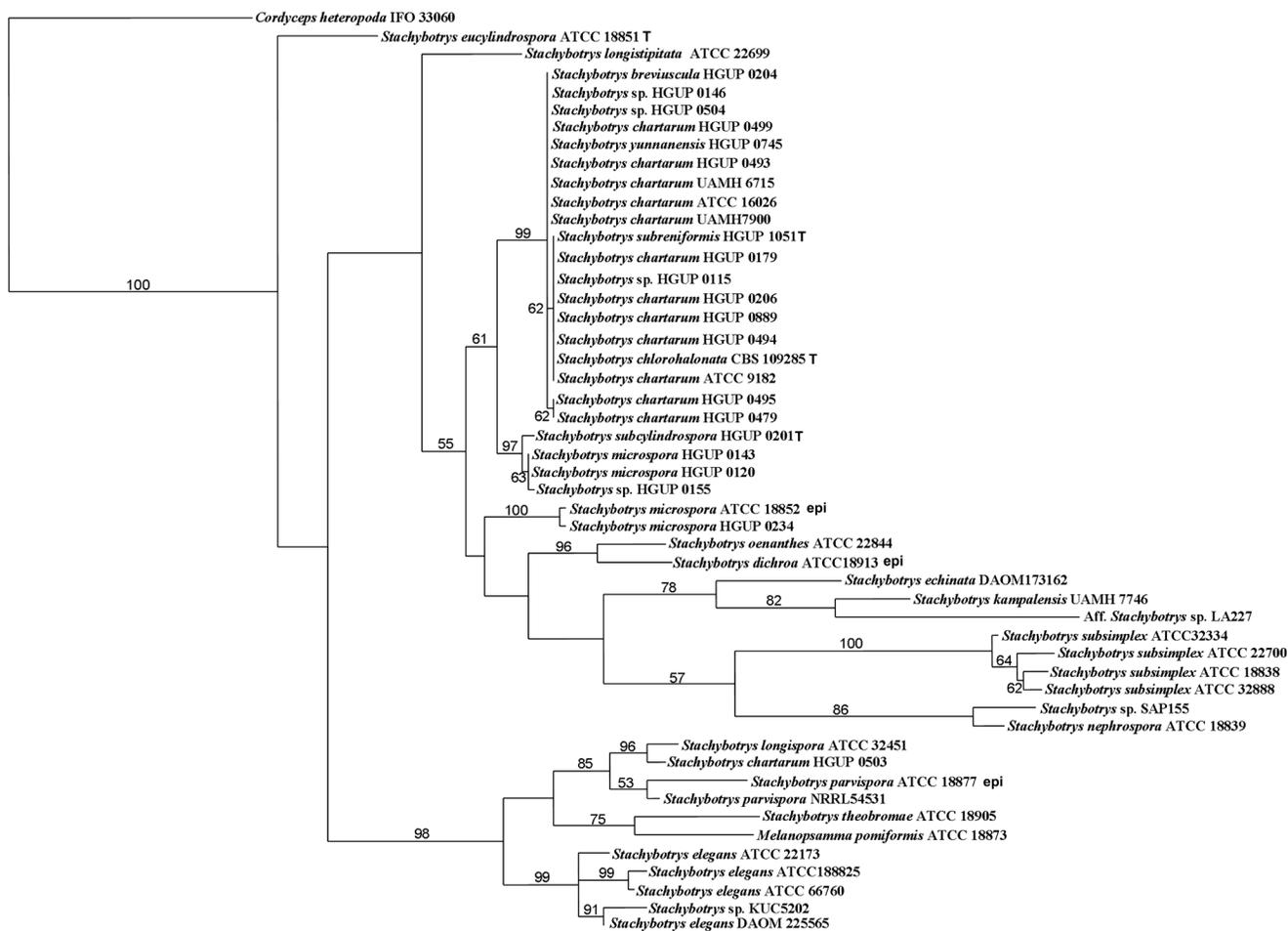
Mycology Research

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 study

Dr. Li published a monographic paper on *Stachybotrys* and *Memnoniella*, which included at least seven species-clades. *Memnoniella* was determined to be a synonym of *Stachybotrys*. The sexual genera *Ornatispora* and *Melanopsamma* were also determined to be synonyms of *Stachybotrys*. Seventy-four accepted *Stachybotrys* species were discussed and illustrated, while eight species are considered to belong to other genera or are doubtful species. Twelve new combinations and one new name were proposed. Each species was discussed in detail and a key to the accepted species of *Stachybotrys* is provided. Several sequences of ITS and LSU of *Stachybotrys* isolates have been sequenced in collaboration with Neil Schultes of Plant Pathology and Ecology.

Impact: This is the first use of molecular data for the monographic study of *Stachybotrys*. The phylogenetic position of *Stachybotrys* was clarified and the intensive nomenclatural study on the types of related genera has determined that *Stachybotrys* is the current name (protected name) among all competitive names: *Stachybotrys*, *Memnoniella*, *Ornatispora*, and *Melanopsamma*. The keys produced in previous studies only covered limited species. The key provided by the current study includes all accepted species. This research will help identify species of the medically important genus *Stachybotrys*.



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The ITS phylogenetic tree of *Stachybotrys* spp. based on MP method with *Cordyceps heteropoda* (IFO 33060) as outgroup. Bootstrap values $\geq 50\%$ are indicated above the branches. Ex-type strains were labeled with “T” after strain number. Epi-type strains were labeled with “epi” after strain number (Table S1).

Global diversity of the *Ganoderma lucidum* complex study:

Species of the *Ganoderma lucidum* complex are used in a number of popular health products in Asian countries and as diet supplement products available in the US. Dr. Li participated in a collaborative study on the *Ganoderma lucidum* complex to clarify the chaotic taxonomic situation of this species complex, its usage and research on their health effects. Thirty two collections of the complex from Asia, Europe and North America were studied from both morphological and molecular phylogenetic perspectives. The concatenated sequence dataset comprised 33 ITS, 24 tef1a, 24 rpb1 and 21 rpb2 sequences, of which 19 ITS, 20 tef1a, 20 rpb1 among which 17 rpb2 sequences were newly generated. Thirteen species of the complex were determined in the multilocus phylogeny. Clade A comprised *Ganoderma curtisii*, *G. flexipes*, *G. lingzhi*, *G. multipileum*, *G. resinaceum*, *G. sessile*, *G. sichuanense* and *G. tropicum*, Clade B comprised *G. lucidum*, *G. oregonense* and *G. tsugae*, and Clade C comprised *G. boninense* and *G. zonatum*. A key to the 13 species and a synoptic table with their major morphological characters from basidiospores, context, cuticle cells, and pores were developed. The epitypification of *G. sichuanense* is rejected based on type materials.

Impact: *G. lingzhi* has been used as a traditional Chinese medicine for over 2,000 years and reported in many Chinese classic works. What has been used in diet supplement products is actually *G. lingzhi*, not *G. lucidum* as previously reported. *G. lucidum* is a species common in Europe and North America. The present study provided additional evidence to segregate *G. lingzhi* and clarified the species concepts within the species complex. These results will allow the pharmaceutical industry to fine-tune their research on the active chemical compounds which are beneficial to human health and characterize the pharmaceutical properties of this important species complex.

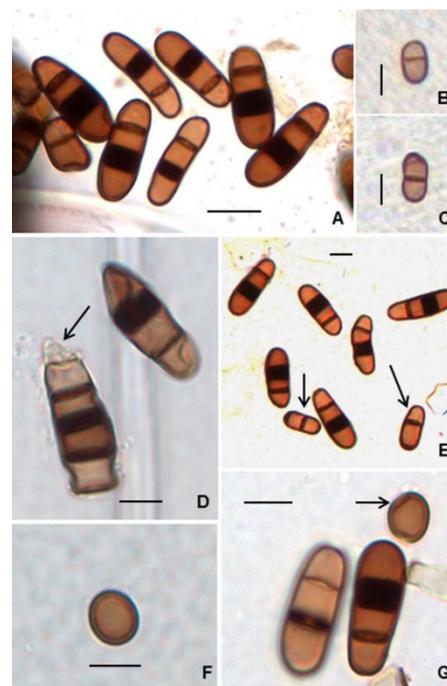


Fruiting body of *Ganoderma lingzhi* (formerly *G. lucidum*)

New fungal taxa

Science has only described about 7% of fungi. A majority of fungi remain unknown and mycologists are facing a huge challenge to describe these unknown taxa. Some are in danger of becoming extinct and global warming is adding additional threats to fungal survival, as our planet is becoming warmer and drier. Each new fungal species described is significant to science and biodiversity, and we need to continue our effort to discover, describe new fungal species, and conserve all fungal taxa as each new species of fungi adds essential information for future studies on ecosystems, fungal preservation, and biosystematics. The significance of new fungi as bio-resources and to our environments remains less-explored. Dr. Li collected both indoor and outdoor specimens through the year in the USA and overseas. One fungal species new to science (*Triadelphia acericola*) was found in Windsor (Valley Lab) and submitted for publication. One species, *T. centroseptata* is validated and one new name, *T. archontophoenicicola* is proposed to replace a homonym, *Triadelphia australiensis* Joanne E. Taylor et al.

Impact: The key and synoptic table for the genus *Triadelphia* will assist people to identify the members of *Triadelphia* with better information.



Triadelphia acericola.

Indoor mold study

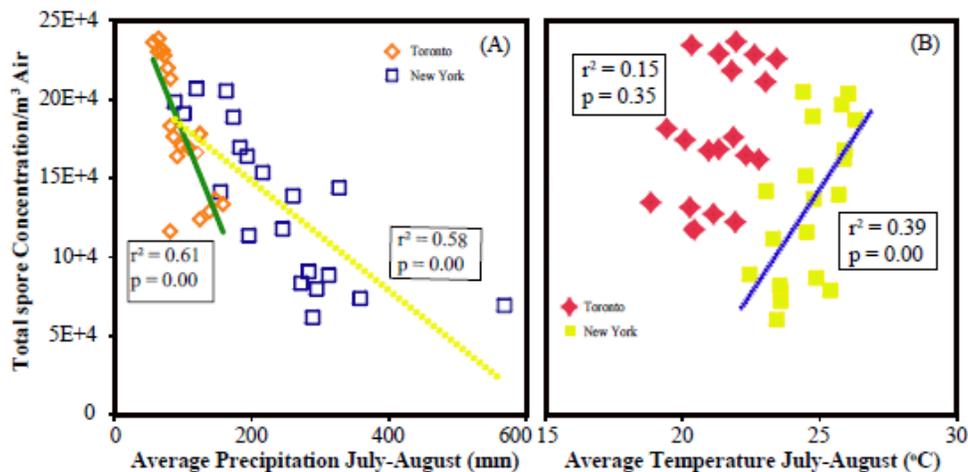
A new species (to be named) and two new records were collected from indoor environments. At present the culture and type specimen are in preparation for deposition. A number of additional species are understudy. A fact sheet was written to address public concerns over indoor mold issues.

Impact: The indoor environment is a man-made environment that can be a perfect place for fungal infestation, since moisture/water is the sole determinant factor. We had always considered fungal diversity indoors as simple with a small number of taxa. However, over the years a number of new species were described from indoor environments by several mycologists including DeWei Li. Fungal diversity in indoor environments has not been fully studied and a comprehensive list of indoor fungi remains to be developed. Fungal taxa from indoor environments provide new information to allergic patients, the public, public health professionals, medical practitioners, mycologists, indoor air quality professionals, certified industrial hygienists, and indoor mold investigators for better diagnosis, management and remediation. Because the health effects of some indoor fungi are species specific, results will assist in the study of the potential effects of indoor molds on human health.

Aeromycological Study

Dr. Li is conducting a project in collaboration with Dr. J. Klironomos of the University of British Columbia focusing on two aspects: 1) long-term changes in airborne fungi in North America using 20-years of data; 2) arbuscular mycorrhizal fungal (AM) spores (very large spores, commonly >100 μm) in the air. The results have shown that the total precipitation during the 2-month period prior to sampling (Jul-Aug.) was negatively related to airborne fungal spore concentrations. *Glomus* (AM fungus) spores were found in the air. The results showed that AM fungi may be more likely to be dispersed via the air (wind) in arid systems. These results were published in two papers in *Fungal Ecology*.

Impact: The results suggested that drought and elevated temperatures resulting from global warming will lead to incremental increases in airborne fungi in the future. AM fungi are truly pioneer species for their roles in establishing plant communities in deserts. These fungi may be useful for controlling desertification, a huge ecological problem that several countries are facing. However, these trends may also increase the risk of allergies, asthma, and other airborne fungi related health issues due to exposure to elevated levels of airborne fungi.



Variation of total spore concentration with (A) Jul-Aug. average precipitation, and (B) average temperature in Toronto and New York from 1992 to 2011.

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. Dr. James LaMondia and Dr. Katja Maurer have conducted research to determine fungicide efficacy *in vitro* and in plant systems. *Calonectria pseudonaviculata* causes leaf spot and stem lesions resulting in defoliation and dieback of boxwood. *In vitro* assays identified systemic and protectant fungicides with activity against conidial germination and mycelial growth. Five Strobilurins (pyraclostrobin, azoxystrobin, trifloxystrobin, kresoxim-methyl, fenamidone) and five demethylation inhibitor fungicides (DMI; propiconazole, tebuconazole, triflumizole, myclobutanil, tetraconazole) have been tested for their suitability as fungicides against *C. pseudonaviculata*. All DMIs showed activity against mycelial growth. Furthermore, pyraclostrobin, azoxystrobin and kresoxim-methyl inhibited mycelial growth. At CAES-Windsor, we have conducted two evaluations of differential susceptibility in boxwood cultivars using 39 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 which 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.

Similar to differential susceptibility among *Buxus* species and cultivars, *Pachysandra* species have different susceptibilities to *C.ps.* Infected *Pachysandra* plants are known to serve as a source of inocula for existing *Buxus* plantings. Knowing which *Pachysandra* cultivars are less likely to develop infections will aid in reducing further spread of this disease to established boxwood. Dr. LaMondia conducted evaluations of available *Pachysandra* cultivars using both inoculation of whole plants in the greenhouse and detached leaves in the laboratory. Plants were sprayed with infective conidia and held under disease-conducive conditions. Numbers of lesions and sporulation were scored to compare cultivar susceptibility. Common pachysandra (*P. terminalis*) was the most susceptible cultivar tested, Green Sheen was intermediate and Green Carpet, Crinkled and Variegated were significantly less susceptible than Common. We also determined that two additional species, *Pachysandra procumbens* and *P. axillaris* were hosts of the boxwood blight pathogen.

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. We conducted experiments using our most efficacious fungicide program for protectant fungicides alone or protectant plus systemic fungicides at 2- or 3-week spray intervals. At two-week intervals, disease control was 98-99% effective, whereas control was 78 to 87% effective at three-week intervals. Propiconazole, but not thiophanate methyl fungicide exhibited significant curative activity in detached leaves 48 hours after infection. Knowing more about curative activity and the timing of sprays will help growers and landscapers select chemistries

that have longer periods of residual activity against the disease. Additional knowledge about the environmental factors affecting infection and risk models for disease will need to be developed.

Solatenol™ fungicide is a new broad-spectrum active ingredient under development by Syngenta. Mural™ fungicide is a combination of solatenol, an SDHI (succinate dehydrogenase inhibitor) fungicide and azoxystrobin. Five- to six-year-old hybrid boxwood *B. sinica* var. *insularis* × *B. sempervirens* ‘Green Velvet’ were treated twice with Mural, Pageant, or Cleary’s 3336 fungicides or water alone at 14-day intervals. Plants were treated with a fungicide spray and then challenged by inoculation of wet foliage with conidia of *Calonectria pseudonaviculata* (*Cylindrocladium pseudonaviculatum*) after 48 hours. All fungicides evaluated were significantly different from the inoculated untreated controls, but the fungicides were not significantly different from each other. Disease control averaged over all fungicides was excellent, 93 to 94% control for the two evaluations, respectively. The pathogen was isolated from symptomatic lesions. No phytotoxicity was observed in Green Velvet boxwood for any of the fungicides evaluated.

Sanitizers were assessed for their effects on mycelial growth, conidial germination, and microsclerotia using *in vitro* assays with serial dilutions and contact times. Depending on fungal structure and experimental conditions, sanitizers including Lysol (O-benzyl-p-chlorophenol), alcohol (70% ethanol), and 10% bleach (sodium hypochlorite) acid were effective with contact times as short as five minutes. Conidial spores are the most common means of pathogen spread and were killed very quickly by all of the sanitizers tested. Fungal colonies growing on artificial agar-based media (consisting of hyphae, microsclerotia and conidia) were killed by exposure to 10% bleach for as little as 5 minutes, but not by exposure to 70% ethanol or Lysol for up to 30 minutes. However, the artificial media itself seems to have a dramatic effect as individual microsclerotia (tough survival structures that can last for years) that were removed from media can be killed by as little as 4 minutes exposure to 70% ethanol, while isolated microsclerotia can survive more than 30 minutes in 10% bleach or Lysol. These results will help growers and landscapers refine current best management practices, as conidia can be easily killed by a number of sanitizers on pruning implements and hard surfaces. Microsclerotia, however, alone or on leaf surfaces are much harder to kill and may best be eliminated by alcohol-based sanitizers. Management of boxwood blight will rely on integrated best management practices, sanitation, cultural controls, cultivar resistance and fungicide application.

Impact: The identification of fungicide application programs with 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 have developed a hybrid line with significant resistance to the pathogen. This line, B3, is being evaluated under field conditions in 2014 and 2015. 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 are being used to develop hybrid lines with resistance to multiple pathogens. A burley tobacco cultivar (TN-86) with resistance to Potato Virus Y (PVY) has been obtained and is being crossed to CT tobacco types.

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, should allow sustainable crop production with reduced losses to disease and much reduced pesticide inputs. B2 has been released as a new cultivar and seed production has been licensed to a local company. Proceeds will support further research on plant resistance. Adding resistance to black root rot and to PVY will further reduce plant losses to disease.

Black Shank Management

Black shank, caused by *Phytophthora nicotianae*, is a re-emerging disease in Connecticut. An experiment was conducted in 2014 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 3 July, symptomatic plants were observed and counted on 18 and 31 July and 11 August, 2014. Numbers of black-shank affected plants were higher in untreated control plots than in all fungicide treated plots, incidence in the untreated control average about 28% symptomatic plants. There were no significant differences between fungicide treatments, indicating that all fungicides tested had similar efficacy and that mefenoxam-resistance did not appear to be present. Disease control averaged over all fungicides was quite good, about 85% control. No phytotoxicity was observed in broadleaf cigar wrapper tobacco for any of the fungicides evaluated.

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 as low as possible. Dr. LaMondia conducted experiments to maximize disease control with reduced levels of fungicide in cured leaves for a third year in 2014. 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 more uniformly 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.

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. In initial experiments, we evaluated broadleaf cigar wrapper tobacco (*Nicotiana tabacum*), eastern black nightshade (*Solanum ptychanthum*), and sticky nightshade (*Solanum sisymbriifolium*) root diffusates on egg hatch and subsequent development of the tobacco cyst nematode, *Globodera tabacum*. *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 cm³ soil for tobacco and 4.5 *G. tabacum* J2 per 100 cm³ soil for *S. sisymbriifolium*.

Impacts: 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.

Root-Knot nematode control in vegetables

Northern root-knot nematodes, *Meloidogyne hapla*, are damaging pathogens of many crops, including vegetables and ornamentals. Pepper breeding lines under development by the USDA Vegetable Laboratory in Charleston, SC were provided by Dr. Judy Thies for evaluation against *Meloidogyne hapla* in Connecticut. Two S4 lines had been screened against *M. hapla* in SC. We evaluated 20 replicate pots of each of these lines and a susceptible control pepper variety ‘California Wonder’ in the greenhouse in pots and in the field. All transplants were inoculated with 6,000 eggs and juveniles of *Meloidogyne hapla*. One of the USDA lines had lower numbers of gall than the susceptible control, California Wonder. The other was not different than California Wonder. Our results indicate that CT isolates of *Meloidogyne hapla* may be different biotypes that respond differently to pepper resistance genes.

Impacts: Plant resistance to nematodes is the most effective and economical control of the plant pathogens, however, the efficacy of resistance genes against different biotypes of the nematode needs to be considered to be effective.

Hops

Hop (*Humulus lupulus*) cultivation in New England and New York dates back to the first settlers. Over time, the high pressure of diseases and pests due to humid climate conditions forced the relocation of hop production to the drier Northwest region of the United States, where the main commercial production of hops is currently located. However, increased demand for local or regional products, and the popularity of microbrews and local brewpubs have renewed interest in growing hops in New England.

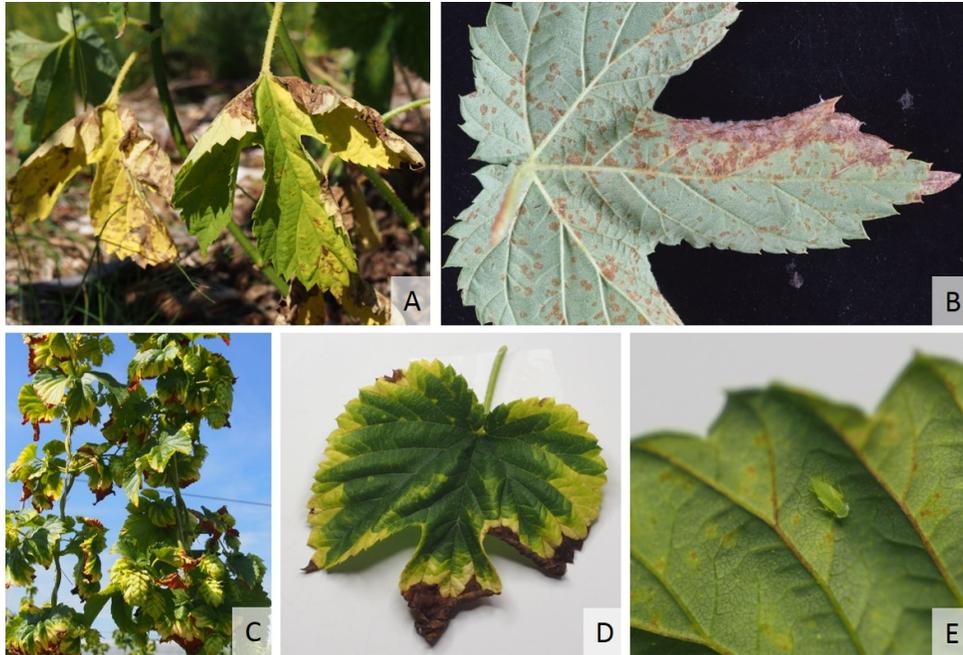
The CAES has established two small hop yards with several cultivars using high and low trellis systems to evaluate yield, growing characteristics, and susceptibility to diseases in two locations: at the Valley Laboratory in Windsor, and at the Lockwood Farm in Hamden, CT. The hop research is conducted by

Dr. James LaMondia and Dr. Katja Maurer. The team established high and low trellis production systems within the last three years. Although hops achieve their full yield production after three years, the growth, yield, and disease/pest development of five different cultivars, Cascade, Summit, Alpharoma, Newport, and Perle, are currently being evaluated to gain a preliminary prediction. The harvest data in 2014 showed that the variety Cascade has the most well-adapted growth process. Whereas, Perle, a German breeding line, had the smallest growth and lowest yield when compared to the other cultivars. The same trend can be expected for this year's harvest. Furthermore, in 2014, the high trellis production system was more fruitful for Cascade, Alpharoma, and Newport compared to the low trellis system.



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

The high pressure from diseases and pests in New England requires a strict control system. The most common diseases and pests are downy mildew, caused by *Pseudoperonospora humuli*, aphids, and mites. The symptoms of downy mildew are stunted short shoots, called spikes, as well as chlorotic and curled down leaves. The first rating in 2015 showed that Alpharoma, which is described as tolerant to downy mildew, had the most leaf symptoms, followed by Cascade. Spraying fungicides, removing weeds and redundant sprouts as well as stripping the upper leaves helps to reduce the spread of downy mildew. Spider mites were controlled by horticultural oil application before bloom and by the release of commercially available predatory mites. Aphids have been observed but have not been significant. However, this year a novel pest, the potato leafhopper, appeared in the hop yards in Windsor as well as Lockwood and caused damage on the leaves. Furthermore, Alternaria blight, caused by *Alternaria humuli*, has been found in a few rare cases. This disease has a minor importance for hops and its appearance might be related to secondary infection of already diseased leaves.



A-B: Symptoms of downy mildew; C-E: Symptoms of leafhoppers.

In conclusion, the preliminary data of evaluating growth, yield and disease/pest development show that Cascade, a very popular cultivar in the U.S., and Summit seem to be promising varieties for hop cultivation in Connecticut. Additional varieties will be evaluated over time.

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.

SERVICE ACTIVITIES

Requests for information

A total of 5,118 inquiries were answered at the Valley Laboratory during the past year. The majority of these queries were answered by Ms. Rose Hiskes (57%) in the inquiry office or by Dr. LaMondia (28% – 88% commercial). About 49% of the information requests to the inquiry office were from the public sector; the remainder was from commercial growers, government, and nonprofit, educational or other (54%). The majority of inquiries concerned insects (20%), diseases (38%) or general horticulture (8%).

Valley Lab scientists made more than 61 presentations to grower, professional and citizen groups, (over 3,500 people), were interviewed 11 times and made 261 visits to commercial and municipal fields, nurseries, greenhouses, Christmas tree farms, forests and private landscapes to diagnose complex problems or conduct research projects.

Dr. LaMondia initiated and maintained the Connecticut River Valley Blue Mold Web Site to keep tobacco growers current with the progress of this devastating disease in North America, and the potential exposure to the pathogen and management options in the Valley. His laboratory conducted 198 nematode diagnostic samples and conducted testing as an APHIS certified pinewood 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. Musante (Analytical Chemistry Department). 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 4,957 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, 77% were for landscapers; 7% for tobacco growers; 6% for vegetable growers, 3% for municipalities, 3% for golf course superintendents; 2% for nursery growers; 1% for small fruit, and 1% for Christmas tree growers. Diane Riddle also conducted inspections to maintain USDA APHIS Authorized Official Certification.

Valley Lab Information Office Insect, Disease and Plant Health Survey

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

Insects



Azalea lacebug nymph.

During the summer months, insects, such as black vine weevil, lacebugs, and bagworms were common problems on trees and shrubs in the landscape. Black vine weevil, in the adult stage, eats foliage at night and hides in the duff below plants during the day. Many broadleaved evergreens, such as rhododendron, euonymus, azalea and holly are attacked as well as conifers and perennials such as astilbe and sedum. Black vine weevil larvae live in the soil and eat the roots of the same plants that the adults feed on. The only manifestation of this ‘ghost’ pest is notching of foliage. Lace bugs feed as nymphs and adults on upper or lower leaves of foliage. Many are somewhat host specific such as azalea lace bug, hawthorn lace bug and andromeda lace bug. Those that feed on evergreen hosts overwinter as eggs laid in the foliage near the midrib or glued

to leaves. Those living on deciduous hosts overwinter in protected areas near their host. Their piercing sucking feeding damage removes chlorophyll from the leaves causing browning and eventual early leaf drop. Bagworm caterpillars eat foliage of many deciduous and evergreen hosts such as honeylocust and arborvitae. Bags are made of host plant material and silk tightly interwoven. As the larvae grow they add to the bag. Young larvae balloon on silk strands with air currents to move to new hosts. This insect overwinters as eggs within the bag of the female.

Lawns suffered several insect issues during the summer and fall. Grass was attacked by chinch bugs during hot dry periods and in hot dry areas near sidewalks and asphalt. Larvae and adults remove chlorophyll from grass blades with their piercing sucking mouthparts. By August ground nesting yellowjacket colonies were very large and became noticeable during summer picnics. In September many citizens reported large black beetles coming out of their lawns. The larvae of these blister beetles feed on the larvae of yellowjackets in ground nests. Adult blister beetles will feed on foliage of clematis. A vegetable grower had a problem with these beetles feeding on a crucifer crop this year as well.



Hairy chinch bug nymph



Rose rosette disease

Rose rosette disease was officially diagnosed in Connecticut in fall, 2014 as Oklahoma State now has a test for the virus involved in this disease. An eriophyid mite transmits the virus while feeding in plant meristems. Symptoms such as very red, enlarged new growth with many soft spines had been noticed in Connecticut since 2006. The mite had also been found. Homeowners and public gardens are reporting symptoms. Since multiflora rose, a widespread invasive plant in the state, is very susceptible there is little chance of controlling this disease.

In spring 2015, a small outbreak of gypsy moth occurred in many areas of the state. Consecutive dry springs hampered the ability of a beneficial fungus to spread and infect the caterpillars. Oaks, willows, and beech were affected as were understory plants, such as witchhazel, as the caterpillars ate through leaves and dropped from the trees.

Homeowners continued to report populations of brown marmorated stinkbugs in their houses during the winter months into the spring.

Diseases



Downy mildew on Rudbeckia

In summer 2014, diseases such as cedar-apple rust lesions on apple foliage and continued fire blight problems were brought to our attention in orchards and home fruit plantings. Downy mildew was a problem for some grape, herb and perennial growers. Homeowners experienced blossom-end rot on tomatoes. During the fall, Phomopsis canker on blueberry stems was noticed. Alfalfa mosaic virus was found in some pachysandra plantings. Rhizosphaera needlecast infections continued on spruces and even some Norway spruce, somewhat resistant, were also found to be infected.

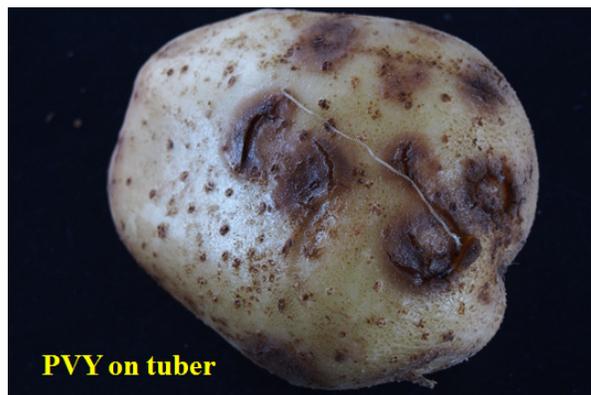
In spring 2015, homeowners brought in many boxwood samples as they became aware of the boxwood blight issue. No boxwood blight was found but winter injury, *Volutella* and *Macrophoma* leaf spot were found. Mountain laurels were brought in with *Cercospora* leaf blight. A large, newly planted hemlock was found to have died from *Armillaria* root rot. Nearby, an oak had previously died and *Armillaria* had subsequently spread to the surrounding area.

Perennials with southern blight and bacterial soft rot were brought in from home gardens. Plants such as astilbe and hosta were most affected.

Weather fleck, small white leaf spot symptoms caused by damage from air pollutants such as ozone, were common in wrapper tobacco and also diagnosed in other crops such as cucurbits.

Potato virus Y, tobacco veinbanding virus and tobacco etch virus are aphid-transmitted viruses in the POTY virus group. These viruses resulted in poor quality cigar wrapper tobacco in 2014 and in potato tuber losses due to reduced yields and also tuber symptoms consisting of circular decay and necrosis on the tuber surfaces.

Extended periods of warm, wet weather and high humidity in the fall resulted in significant losses of cured tobacco to postharvest storage rot fungi such as *Alternaria*, *Aspergillus* and *Penicillium*.



Plant Health

Winter 2014-2015 was cold with a lot of snowfall. Deep snow cover for an extended time over the winter allowed voles to girdle many of our landscape plants. Bridge grafting is a possible way to save these plants. Holly and Japanese maple were some of the plants affected. Trees such as Carolina silverbell and Eastern redbud suffered severe winter dieback. Watering these plants during the hot, dry May, pruning back to healthy wood and removing adventitious growth can get these plants back in good shape.



Vinca minor affected by Southern blight

A homeowner brought in some stems from her rosemary plant, worried they had a canker disease. The bumps on the stem were adventitious roots, not a disease symptom.

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, 11 different groups used the room on 39 occasions. Our most frequent users were the Connecticut Department of Agriculture, Connecticut Rhododendron Society, Connecticut Invasive Plants Working Group, Connecticut Farmland Trust, Connecticut Council for Soil & Water Conservation, Connecticut Christmas Tree Growers Association, Connecticut Nursery & Landscape Association, Connecticut Land Conservation Council, Connecticut Agricultural Information Council, USDA Farm Service Agency, Working Lands Alliance, and West Hartford Farmers Market. Ms. Jane Canepa-Morrison scheduled the meetings and James Preste arranged the furniture and ensured that the room was available after hours.

*BULLETINS OF THE CONNECTICUT AGRICULTURAL EXPERIMENT
STATION PUBLISHED DURING 2014-2015*

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*SCIENTIFIC JOURNAL ARTICLES PUBLISHED BY OUR STAFF
DURING 2014-2015*

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VALLEY LABORATORY

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