THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

Record of the Year

2016 - 2017

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, 2017 were:

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

The Board of Control met on August 3, 2016, October 19, 2016, January 18, 2017, and April 12, 2017.

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, 2017.

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

ANALYTICAL CHEMISTRY
Dr. Jason C. White, Vice Director, Department Head
Michael A. Ammirata
Terri Arsenault
Michael J. Cavadini
Dr. Roberto De La Torre-Roche
Dr. Brian D. Eitzer
Dr. Walter J. Krol
Dr. Chuanxin Ma
Dr. MaryJane Incorvia Mattina, Emeritus
Craig L. Musante
Kitty Prapayotin-Riveros
John F. Ranciato
Dr. Christina S. Robb
Dr. Nubia Zuverza-Mena

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

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

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

GRISWOLD RESEARCH CENTER
Robert J. Durgy, Research Farm Manager

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

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

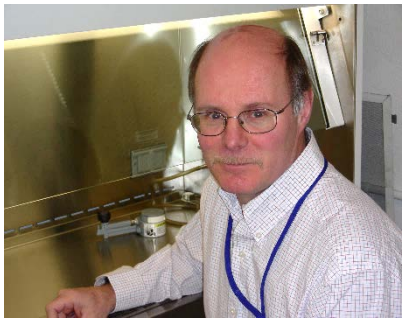
PLANT PATHOLOGY AND ECOLOGY
Dr. Wade H. Elmer, Department Head
Dr. Sandra L. Anagnostakis, Emeritus
Dr. Donald E. Aylor, Emeritus
Dr. Sharon M. Douglas, Emeritus

Dr. Francis J. Ferrandino
Regan B. Huntley
Dr. Yonghao Li
Dr. Robert E. Marra
Dr. Neil A. McHale, Emeritus
Lindsay A. Patrick
Dr. Richard B. Peterson, Emeritus
Dr. Neil P. Schultes
Dr. Teja S. Shidore
Peter W. Thiel
Dr. Lindsay R. Triplett
Dr. Israel Zelitch, Emeritus
Dr. Quan Zeng

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

RETIREMENTS

Dr. Douglas W. Dingman



Dr. Douglas W. Dingman joined the staff of The Connecticut Agricultural Experiment Station in April 1987 as an Assistant Scientist in the Department of Entomology and was promoted to Associate Scientist in 2001, serving in both the Department of Entomology and the Department of Biochemistry and Genetics. As a microbiologist and molecular biologist, Dr. Dingman contributed to a better understanding of gene expression, identification, and pathogenicity of various strains of milky spore disease for the control of the white grubs of Japanese beetles and related bacteria. He advanced molecular diagnostic techniques for studying and differentiating different bacterial isolates and conducted research on issues related to honey bee health and the pathogens that cause American foulbrood and nosemosis. He educated Connecticut beekeepers on how to diagnose honey bee diseases and studied the genetics of Connecticut honey bees. Dr. Dingman further studied the genomics, antibiotic resistance, and prevalence of American foulbrood in Connecticut apiaries advancing molecular knowledge of honey bee diseases, and over his career provided science-based support for the understanding of microbial biological control and honey bee health. For thirty years, Dr. Douglas Dingman ably served The Connecticut Agricultural Experiment Station and the citizens of Connecticut. His research truly exemplified the motto of the Experiment Station: “Putting Science to Work for Society.” We honor Dr. Dingman and his contributions on the occasion of his retirement.

Ms. Pamela Sletten

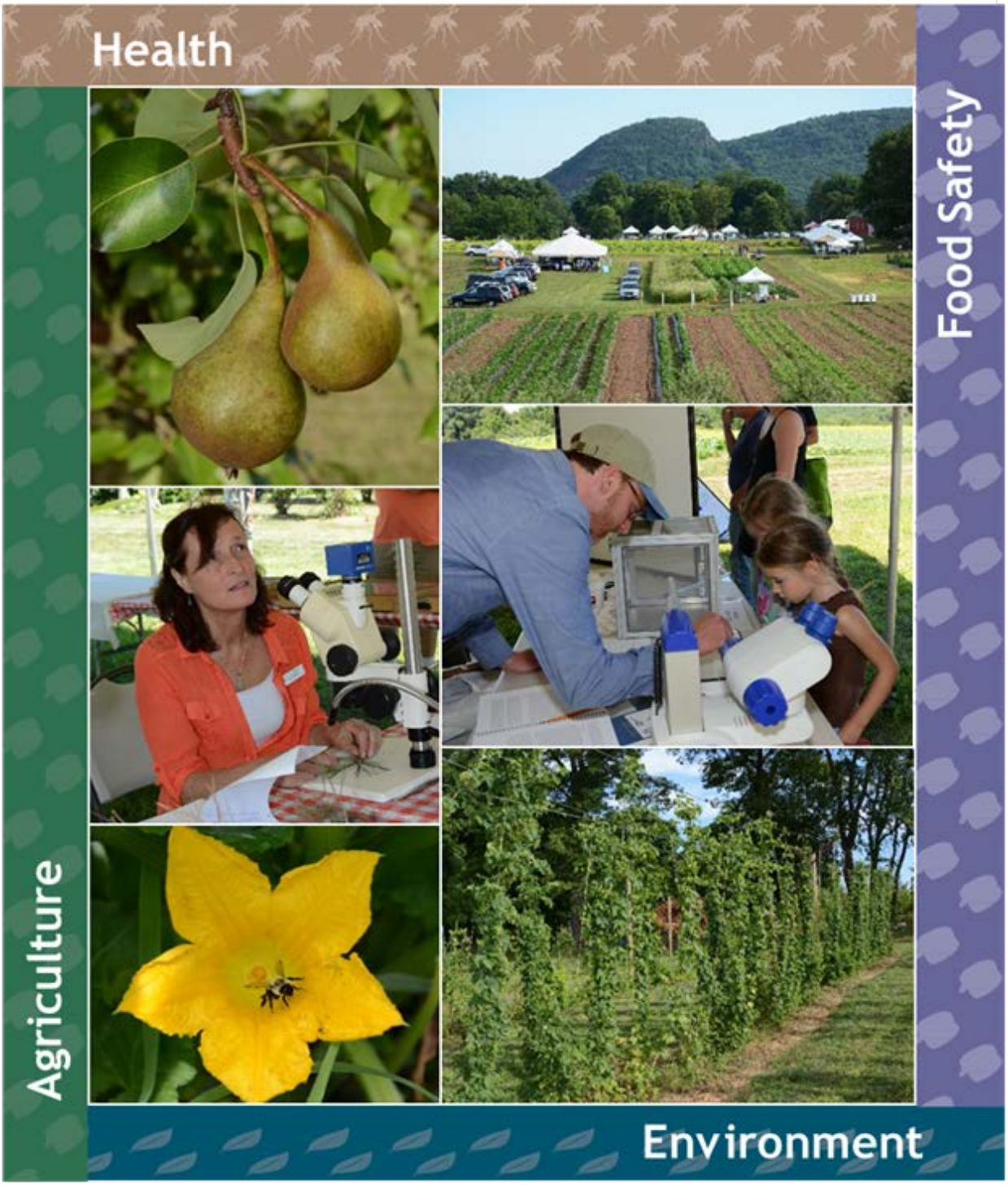
Ms. Pamela Sletten joined the staff of The Connecticut Agricultural Experiment Station in May 1985 as an Aide II and was assigned to work under the supervision of Dr. Sandra Anagnostakis where she was promptly promoted to Aide III in October 1987. In recognition of her work assisting with Chestnut blight research, she was promoted to the rank of Technician I in October 1995. In 2014, Ms. Sletten began assisting in the Plant Disease Information Office and was subsequently trained and certified to conduct the state-mandated seed analysis where she ensured the citizenry that vegetable, lawn, and crop seed companies met state-mandated regulations on seed quality and purity. Ms. Sletten was consistently rated as an excellent assistant who had passion and dedication to the research in which she was engaged. Her tireless efforts in the laboratory and in the field provided the consistency necessary to ensure a high level of research quality. Over her tenure at the Station, Ms. Sletten was always willing to learn new techniques, master new equipment, and help to navigate Station projects on chestnut and butternut trees. She always maintained a cheerful outlook leading Dr. Anagnostakis to say “A cheerful assistant is a value beyond pearls!” Ms. Sletten continued to project her positive outlook in the Plant Disease Information Office where she painstakingly assisted in the daily activities of the Station’s flagship office along with her seed testing duties. For thirty-two years, Pam Sletten ably served the Station and the citizens of Connecticut, ensuring quality research. Her service truly exemplified the motto of the Experiment Station: “Putting Science to Work for Society.” We honor Ms. Pamela Sletten for her contributions on the occasion of her retirement.

The Connecticut Agricultural Experiment Station

106th Plant Science Day

Lockwood Farm, Hamden, CT

August 3, 2016



PLANT SCIENCE DAY
2016

The weather on Plant Science Day 2016 was in the 80s with low humidity and a nice breeze. A total of 1,183 guests visited Lockwood Farm, making it one of the best attended Open Houses at the Farm that we have ever had.

Director Theodore G. Andreadis welcomed attendees in the newly constructed Pavilion and gave opening remarks. Ms. Vickie Bomba-Lewandoski moderated the Short Talks and introduced the speakers.

All the short talks were very well attended:

SHORT TALKS:

Dr. Philip M. Armstrong	**Mosquitoes and Zika Virus: Assessing the Threat**
Dr. Katja Maurer	**Hops: A Specialty Crop for Connecticut**
Dr. Adriana L. Arango-Velez	**Climate Change and Invasive Pests and Pathogens**

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

DEMONSTRATION TENT:

Dr. Jatinder S. Aulakh	**Know Your Weeds-Identification and Control**
Dr. Kimberly A. Stoner	**Planting for the Bees' Needs**

Attendees took advantage of several tours around the farm:

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

Stops on the tour:

Dr. Wade Elmer	**Use of Nanoparticles of Metal Oxides to Suppress Soil-Borne Diseases of Eggplants and Watermelons**
Dr. Wade Elmer	**The Effect of Chloride Nutrition on Fusarium Head Blight of Spring Barley**
Dr. Francis Ferrandino	**Environmentally-Friendly Control of Powdery Mildew on Vegetable Plants**

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

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

WALKING TOUR – Dr. Robert E. Marra, Guide

A one-hour guided tour of selected field plots. Participants discussed experiments and topics with scientists at each station on the tour:

	The Rock
Dr. Francis Ferrandino and Ms. Joan Bravo	**Hybrid and Vinifera Winegrape Cultivar Trials and Pinot Gris Cultural Trials**
Dr. Abigail Maynard	**Kabocha Squash, Okra, Brussels Sprouts, and Sweet Potato Trials**
Dr. James LaMondia and	**Hops – A New Crop for Connecticut**

Dr. Katja Maurer

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

Visitors wanting to cool off and 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.

- **Integrated Tick Management.** Investigators**:** Dr. Kirby C. Stafford III, Dr. Scott C. Williams, and Dr. Goudarz Molaei. Assisted by Ms. Heidi Stuber, Ms. Megan Linske, Mr. Michael Short, Ms. Sarah McQuade, Ms. Megan Carroll, Ms. Erica Rayack, and Ms. Magali Bazzano

- **Biological Control of Fire Blight.** Investigators: Dr. Quan Zeng and Dr. Neil Schultes

- **Ensuring the Safety of Connecticut's Food Supply.** Investigators: Dr. Brian D. Eitzer, Dr. Walter J. Krol, Dr. Christina S. Robb, Dr. Sanghamitra Majumdar, and Dr. Jason C. White. Assisted by Ms. Terri Arsenault, Mr. Craig Musante, Mr. John Ranciato, Ms. Kitty Prapayotin-Riveros, Mr. Joseph Hawthorne, and Mr. Michael Cavadini

- **Neonicotinoid Exposure of Honey Bees.** Investigators: Dr. Rich Cowles, Dr. Kimberly Stoner, and Dr. Brian D. Eitzer

- **Microbiology in Agriculture, the Environment, and Public Health.** Investigators: Dr. Blaire Steven, Dr. Doug Brackney, and Dr. Quan Zeng. Assisted by Agatha Carneiro and Ariana Trease

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

FIELD PLOTS:
The plots at Lockwood Farm are planted and maintained by The Connecticut Agricultural Experiment Station's scientists and technical staff, along with the help of Farm Manager Mr. Richard Cecarelli and his Research Technicians Mr. Rollin Hannan and Mr. Michael McHill as well as seasonal resource assistants Mr. Frank Cervo and Mr. Steve Gerard. Visitors were able to visit the following 85 Field Plots:

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

	Pamela Sletten
THE EFFECT OF CHLORIDE NUTRITION ON FUSARIUM HEAD BLIGHT OF SPRING BARLEY	Dr. Wade Elmer, assisted by Peter Thiel
GREENHOUSE PRODUCTION OF FIGS IN SELF-WATERING PLANTERS	Dr. Charles R. Vossbrinck, assisted by Richard Cecarelli and Mario DiNatale
USE OF COPPER OXIDE NANOPARTICLES ON FUSARIUM CROWN ROT OF ASPARAGUS	Dr. Wade Elmer, assisted by Peter Thiel
COMMERCIAL CHESTNUT CULTIVARS	Dr. Sandra L. Anagnostakis, assisted by Pamela Sletten
REMOTE ACCESS WEATHER STATION	Dr. Francis J. Ferrandino, assisted by Joan Bravo
TECHNICAL DEMONSTRATION TENT	
COMMERCIAL CHESTNUT SEEDLINGS	Dr. Sandra L. Anagnostakis, assisted by Pamela Sletten
CONTROL OF BLIGHT ON AMERICAN CHESTNUTS	Dr. Sandra L. Anagnostakis, assisted by Pamela Sletten
NEW HYBRID CHESTNUT ORCHARD	Dr. Sandra L. Anagnostakis, assisted by Pamela Sletten
USE OF NANOPARTICLES OF METAL OXIDES TO SUPPRESS SOIL-BORNE DISEASES OF EGGPLANTS AND WATERMELONS	Dr. Wade Elmer and Dr. Jason White, assisted by Peter Thiel
COMPARISON OF GRAFT UNION HEIGHT ON CHARDONNAY GRAPEVINES	Dr. Francis J. Ferrandino, assisted by Joan Bravo and Catherine Walters
POWDERY MILDEW ON CHARDONNAY WINE GRAPES	Dr. Francis J. Ferrandino, assisted by Joan Bravo and Catherine Walters
TABLE GRAPE DEMONSTRATION PLOT	Dr. Francis J. Ferrandino, assisted by Joan Bravo and Catherine Walters
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
QUESTIONS AND ANSWERS TENT	Robert Durgy, Rose Hiskes, Dr. Yonghao Li, Lindsay Patrick, Diane Riddle, and Dr. Gale E.

	Ridge
HAMDEN POLICE DEPARTMENT	
COMPOSTING LEAVES USING THE STATIC PILE METHOD	Dr. Abigail Maynard and Dr. David Hill, assisted by Collin McCarthy
VERIZON WIRELESS	
THE FARMER'S COW	Kathy Smith of Farmer's Cow
KID'S KORNER	Kathryn Soleski, Lisa Kaczenski Corsaro, and Tracy Zarrillo
SELF-GUIDED ACTIVITY FOR ALL CHILDREN, INCLUDING GIRL SCOUTS	Terri Arsenault
EXPERIMENT STATION ASSOCIATES	Anne Rowlands, President of Experiment Station Associates
FIDDLEHEAD TRIALS	Dr. Abigail Maynard and Dr. David Hill, assisted by Collin McCarthy
REMOVING AND DESTROYING METHYL BROMIDE IN FUMIGATION CHAMBER VENT STREAMS	Dr. Joseph J. Pignatello and Dr. Hsin-Se Hsieh
HANDS-ON CHEMISTRY	Dr. Christina Robb, Kitty Prapayotin-Riveros, Dr. Walter Krol, Terri Arsenault, Michael Cavadini, and Dr. Jason C. White
NANOMATERIALS IN AGRICULTURE: TROPHIC TRANSFER AND CO-CONTAMINANT INTERACTIONS	Dr. Roberto De La Torre-Roche, Dr. Sanghamitra Majumdar, Dr. Luca Pagano (University of Parma, Italy), Joseph Hawthorne, Craig Musante, and Dr. Jason C. White
INTEGRATING FOREST AND ROADSIDE MANAGEMENT OBJECTIVES TO CREATE STORM RESILIENT FOREST	Dr. Jeffrey S. Ward, assisted by Joseph P. Barsky and Amanda Massa
THE PUBLIC HEALTH AND ENTOMOLOGY TENT:	
THE "DEER" TICK *IXODES SCAPULARIS*	Dr. Kirby C. Stafford III, assisted by Heidi Stuber, Megan Carroll, and Erika Rayack
MOSQUITO SURVEILLANCE FOR WEST NILE AND EASTERN EQUINE ENCEPHALITIS	Dr. Philip Armstrong, Dr. Theodore Andreadis, and John Shepard, assisted by Angela Bransfield, Michael Misencik, Michael Thomas, Stephanie Canales, Daniel Cole, Alexander Diaz, Max Engel, Ryan

	Gregory, Michael Olson, Cora Ottaviana, James Maccone, and Sofia Moscovitz
TICK TESTING PROGRAM FOR LYME AND ALLIED DISEASES	Dr. Goudarz Molaei, assisted by Tommy Ferri, Magali Bazzano, Charles Sisson, and Jianxun Shen
BACTERIA BUSTERS-CAES RESEARCH FIGHTS BACTERIAL PLANT DISEASE	Dr. Lindsay R. Triplett and Dr. Teja S. Shidore, assisted by Derek LeJeune
SUDDEN VEGETATION DIEBACK OF CONNECTICUT SALT MARSHES	Dr. Wade Elmer, assisted by Peter Thiel
INVASIVE INSECTS IN THE NORTHEAST	Dr. Chris T. Maier, assisted by Tracy Zarrillo and Morgan Lowry
STACHYBOTRYS SPECIES FOUND IN INDOOR ENVIRONMENTS	Dr. De-Wei Li
NATIVE WOODY SHRUBS	Dr. Jeffrey S. Ward, assisted by Joseph P. Barsky
BIRD AND BUTTERFLY GARDEN	Jane Canepa-Morrison and Jeffrey Fengler
ENVIRONMENTALLY-FRIENDLY CONTROL OF POWDERY MILDEW ON VEGETABLE PLANTS	Dr. Francis J. Ferrandino, assisted by Joan Bravo
POLLINATOR HABITAT ON CONNECTICUT VEGETABLE FARMS	Dr. Kimberly Stoner, assisted by Tracy Zarrillo, Morgan Lowry, and Ben Gluck
INVASIVE AQUATIC PLANT PROGRAM	Mr. Gregory Bugbee and Dr. Mark June-Wells, assisted by Michael Cavadini, Jennifer Fanzutti, Jordan Gibbons, and Brian Hart
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 and Jeffrey Fengler
THE COOPERATIVE AGRICULTURAL PEST SURVEY (CAPS) PROGRAM AND FARM BILL SURVEYS	Ms. Katherine Dugas, assisted by Zachary Brown
KABOCHA SQUASH TRIALS	Dr. Abigail Maynard and Dr. David Hill, assisted by Collin McCarthy
OKRA TRIALS	Dr. Abigail Maynard and Dr. David Hill, assisted by Collin McCarthy

BRUSSELS SPROUTS TRIALS	Dr. Abigail Maynard and Dr. David Hill, assisted by Collin McCarthy
SWEET POTATO TRIALS	Dr. Abigail Maynard and Dr. David Hill, assisted by Collin McCarthy
HYBRID AND VINIFERA WINEGRAPE CULTIVAR TRIAL	Dr. Francis J. Ferrandino, assisted by Joan Bravo
PINOT GRIS CULTURAL TRIALS	Dr. Francis J. Ferrandino, assisted by Joan Bravo
THE ROCK	
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 Maynard and Dr. David Hill, assisted by Collin McCarthy
PAWPAW TRIALS	Dr. Abigail Maynard and Dr. David Hill, assisted by Collin McCarthy
JAPANESE PLUM VARIETY TRIALS	Dr. Abigail Maynard and Dr. David Hill, assisted by Collin McCarthy
HYBRID ELM TREES	Dr. Sandra L. Anagnostakis, assisted by Pamela Sletten
MANAGEMENT OF BOXWOOD BLIGHT, A NEW DISEASE OF BOXWOOD AND PACHYSANDRA	Dr. James A. LaMondia and Dr. Katja Maurer, assisted by Michelle Salvas and Nathaniel Child
KNOW YOUR WEEDS-IDENTIFICATION AND CONTROL	Dr. Jatinder S. Aulakh
HOPS – A NEW CROP FOR CONNECTICUT	Dr. Katja Maurer and Dr. James A. LaMondia, assisted by Nathaniel Child and Michelle Salvas
BIOLOGICAL CONTROL OF HEMLOCK WOOLLY ADELGID AND MILE-A-MINUTE WEED IN CONNECTICUT	Dr. Carole Cheah, assisted by Emmett Varricchio
EMERALD ASH BORER RESEARCH UPDATE	Dr. Claire E. Rutledge, assisted by Ionela M. Scott and Shelby Farnham

THE PAVILION AT LOCKWOOD FARM	
THE CONNECTICUT BOTANICAL SOCIETY	Truda Steinnagel of CT Botanical Society
THE CONNECTICUT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION DIVISION OF FORESTRY (CT DEEP DIVISION OF FORESTRY)	Chris Donnelly, Larry Rousseau, Dick Raymond, Jen Hockla, and Hannah Reichle
THE CONNECTICUT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION WILDLIFE DIVISION (CT DEEP DIVISION OF WILDLIFE)	Kelly Cannon and Brendan Zielinski (of DEEP, Wildlife Division)
CONNECTICUT PROFESSIONAL TIMBER PRODUCERS ASSOCIATION	Brennan Sheahan
THE SLEEPING GIANT PARK ASSOCIATION	Julie Hulten
UNITED STATES DEPARTMENT OF LABOR (US OSHA)	Leona May and Tandy Mazo
CONNECTICUT DEPARTMENT OF LABOR (CONN OSHA)	Catherine Zinsser of CONN-OSHA
UNITED STATES DEPARTMENT OF AGRICULTURE ANIMAL AND PLANT HEALTH INSPECTION SERVICE PLANT PROTECTION AND QUARANTINE (USDA APHIS/PPQ)	Eric Chamberlain
SOUTH CENTRAL CONNECTICUT REGIONAL WATER AUTHORITY	Lisa DeFrancesco
CONNECTICUT FOREST & PARK ASSOCIATION	Liz Fossett
THE FEDERATED GARDEN CLUBS OF CONNECTICUT, INC.	Arlene Field
UNIVERSITY OF CONNECTICUT EXTENSION MASTER GARDENER PROGRAM (UCONN EXTENSION MASTER GARDENER PROGRAM)	Jude Hsiang
CONNECTICUT ENVIRONMENTAL COUNCIL (CTEC)	Erica Fearn
HAMDEN LAND CONSERVATION TRUST	Gail Cameron
CONNECTICUT DEPARTMENT OF	Rebecca Eddy

AGRICULTURE

UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE (USDA NRCS)	Lisa Krall
TREE-SAVERS	Jayme Boniewicz and Fred Lishman
UNITED STATES DEPARTMENT OF AGRICULTURE, FARM SERVICE AGENCY (USDA FSA)	Debbie Castle and Teresa Peavey
CONNECTICUT INVASIVE PLANT WORKING GROUP (CIPWG)	Donna Ellis
LYMAN HALL HIGH SCHOOL AGRICULTURAL SCIENCE AND TECHNOLOGY PROGRAM	Emily Picard
CONNECTICUT FARM BUREAU ASSOCIATION (CFBA)	Joan Nichols

Lockwood Farm made a beautiful appearance due to the hard work of the farm crew, Richard M. Cecarelli, Farm Manager, Rollin J. Hannan, Jr., and Michael M. McHill, who worked on the plots, grass, trimming, and set up. The barns, buildings, and grounds were cleaned by the Maintenance crew – Bancroft Nicholson, Supervisor, Eric Flores, Brian Hart, Ronald A. LaFrazier, and Miguel Roman. They also delivered all items needed for the day to the farm. Tent setups were done by Eric Flores, Brian Hart, Ronald LaFrazier, and Miguel Roman. Students from the Sound School, under the supervision of teacher Chaz Mavrelion, helped set up the demonstration tent. The podium, tables, and chairs setup in the pavilion, washing tables and chairs, and the cleaning of the cement floor were all done by Richard Cecarelli, Eric Flores, Brian Hart, Ronald LaFrazier, Michael McHill, and Miguel Roman.

At 11:00 AM, Director Theodore G. Andreadis introduced Mr. David K. Leff, essayist, environmentalist, and former Deputy Commissioner of the Connecticut Department of Environmental Protection, as the Samuel W. Johnson Memorial Lecturer. He gave a talk on “The Positive Power of Plants: Frederick Law Olmsted in Connecticut.”

Following Mr. Leff’s talk, Dr. Andreadis presented the Century Farm Award to Norman Hill Farm of Thompson, Connecticut.

Proclamation from Governor Dannel P. Malloy:

> Norman Hill Farm, located in Thompson, was founded in 1910 by Carl A. Norman, who emigrated from Sweden in 1900. Vegetables, eggs, and butter were produced and sold. He gradually increased the dairy herd and poultry flock, and built three greenhouses to increase vegetable production. One of Carl’s sons, Oscar Norman, bought the farm from his mother in 1943 after the death of his father, continuing with the same farm enterprises. Poultry was dropped in 1958 and the last commercial vegetable crop was greenhouse tomatoes in 1980. Oscar and his wife Elizabeth were involved with many organizations including the Killingly Regional Vocational Agricultural Consulting Committee, The New England Vegetable Growers Association, The Connecticut Farm

Bureau, 4H, and the Woodstock Green Thumbs Garden Club. They also hosted young people from Costa Rica, India, Taiwan and Zambia as a part of the International Farm Youth Exchange Program.

Roy and Earl Norman, Oscar's sons, and the third generation on the farm, bought the farm in 1976. They each built homes on the farm and now operate strictly as a dairy farm. Currently, Roy and Earl have a 100 cow freestall barn for the milking herd and a 120 cow freestall barn for dry cows and 3 different age groups of heifers. They also produce grass and corn for hay and silage feed. Roy and Earl are members of The Connecticut Farm Bureau, and Roy is very involved with the Fellowship of Christian Farmers Association. Earl serves on the Thompson Agricultural Commission and the New England Dairy Promotion Board. The farm received the Albert R. Todd Conservation Award for improvements in conservation and pollution control practices. Members of the fourth generation of Normans continue to work on the farm and a member of the fifth generation recently joined the Happy Herdsmen 4H Dairy Club, the same club that their grandfather Earl belonged to over 50 years ago.

As Governor, I am pleased to join The Connecticut Agricultural Experiment Station and the Connecticut Agricultural Information Council in presenting this Century Farm Award to Norman Hill Farm, who is most deserving of this honor.

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

Plant Science Day 2016 was a very big success that was enjoyed by a record number of visitors – due to the hard work of the entire Station staff.











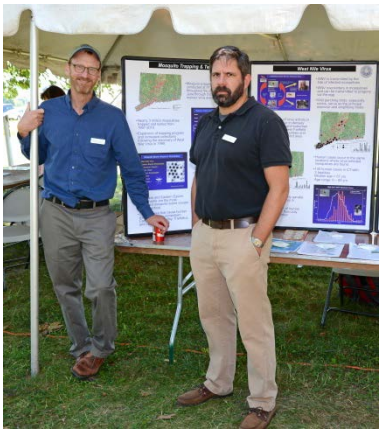










EVENTS HELD AT THE STATION

Forest Health Workshop

A Forest Health Workshop, organized annually by Dr. Victoria Smith, was held March 7, 2017 in Jones Auditorium at CAES. 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.

Pollinator Workshop

A pollinator workshop titled "Creating or Improving Pollinator Habitat on Your Farm" and supported by a Specialty Crop Block Grant from the Connecticut Department of Agriculture and the U.S. Department of Agriculture was held in Jones Auditorium on March 9, 2017 (30 people attended). The speakers were:

- Dr. Kimberly Stoner, CAES, "Your Crop Depends on Bees for Pollination!"
- Emily May, Xerces Society for Invertebrate Conservation, "What Do Bees Need? Assessing Quality of Existing Pollinator Habitat on Your Farm"
- Eric Venturini, University of Maine, "Pollination Reservoirs Support Wild Bees and Wild Bees Support Growers: Examples from Maine Wild Blueberry"
- Virginia Keith, Blueberry Hill Organic Farm, "Pollinator Habitat at Blueberry Hill Organic Farm"
- Mark Creighton, CT State Apiary Inspector, CAES, "Planting Pollinator Habitat in Straw Bales--A Quick and Easy Method"
- Dr. Kimberly Stoner, CAES, "Protecting Pollinator Habitat from Pesticides"
- Dr. Aaron Hoshide, economist, University of Maine, "Costs to Create and Maintain Your Pollinator Reservoir"

2017 Connecticut State AgriScience Fair

On Thursday, May 4, 2017, The Connecticut State AgriScience Fair was held at The Connecticut Agricultural Experiment Station. This annual event is sponsored by the 19 regional high schools that offer Agricultural Science and Technology Education (ASTE) Programs in Connecticut. A record number of students participated in the event this year, with 44 students preparing 34 exhibits. Students may work either as a team or design their own project. The projects can cover many topics, including: animal science, environmental services/natural resource systems, food products and processing systems, plant systems, social systems and power, structure, and technology systems. The winning projects in each category are eligible to participate in the Northeast Regional AgriScience Fair, held at The Eastern States Exposition in September and the National FFA AgriScience Fair held in Indianapolis, IN, October 25-27, 2017. Tours of various programs at the Experiment Station were given to the participants, advisors and chaperones attending the AgriScience Fair. Brian Eitzer, Gale Ridge, and John Shepard offered presentations of their research programs to students during the tour. Students were afforded the opportunity to see and speak with the researchers and learn about their ongoing research to assist Connecticut's agricultural industry. Several individuals volunteered to serve as judges for the event, including: Kevin Anstett, Mr. Gregory J. Bugbee, Mrs. Vickie Bomba-Lewandoski, Michele Dischino, Gordon Gibson, Bob Klancko, Katie Golembeski, Laura Mantz, George Page, Kirk Shadle, Dr. Blaire Steven, and Dr. Nubia Zuverza. The participating ASTE high schools included: Bridgeport, Glastonbury,

Middletown, Northwestern, Southington, Stamford, and Wamogo. The event was organized by Harold Mackin of the Connecticut State Department of Education, and Mr. Joseph P. Barsky of The Connecticut Agricultural Experiment Station. The agricultural science and technology education program serves secondary students in full and shared time programs. Each program, located at a comprehensive high school, includes instruction in agricultural science and technology education. The purpose is to prepare individuals for entry-level employment or higher education and to develop leadership skills in the field of agriculture. Programs include instruction in plant and animal science, agricultural mechanics, food science, biotechnology, aquaculture, agribusiness, natural resources and the environment. The agricultural science and technology education program includes interrelated components such as classroom instruction, laboratory experience, leadership training and supervised agricultural work experience.

EVENTS HELD AT LOCKWOOD FARM

2016 Connecticut-FFA Forestry Career Development Event

On November 18, 2016, the Department of Forestry & Horticulture marked its 5th year hosting the Connecticut-FFA Forestry Career Development Event at Lockwood Farm. This year's Forestry Career Development event evaluated students' knowledge of forest management practices, forest mensuration, map reading skills, knowledge of chainsaw parts and safety, and tree identification. Thirty-two students from eight State FFA chapters participated in the event. The 4-student team from E. O. Smith High School Agricultural Education Program took first place and will represent Connecticut at the 2017 Eastern States Exposition and the 2017 National FFA Convention in Indianapolis, IN. Dr. Scott Williams, Michael Short, and Joseph P. Barsky of the Department of Forestry and Horticulture and Megan Linske, Department of Entomology, organized and oversaw the event. Former Station seasonal employees Emily Picard, Geoffrey Picard, and Vikki Christian were on hand as teachers. Richard Cecarelli, Lockwood Farm Manager, was gracious in preparing the barns and cottage for the event.

EVENTS HELD AT THE VALLEY LABORATORY

Nursery & Landscape Research Tour in 2016

Eighteen people attended the Valley Laboratory Nursery & Landscape Research Tour held on September 15, 2016. Dr. Jim LaMondia welcomed growers prior to a walking tour of plots on the farm. On the tour, Dr. Carole Cheah gave an update on biological control of HWA in CT, Dr. Katja Maurer spoke about hops as a new crop for Connecticut, Mr. Thomas Rathier spoke about water issues in soils and the landscape, Dr. Jatinder Aulakh spoke about crop safety herbicide trials for container ornamentals and Dr. Jim LaMondia spoke about developments in management of boxwood blight. Talks presented in the Gordon S. Taylor Conference Room included "Neonicotinoid insecticides research results" by Dr. Richard Cowles, "Common cultural/disease problems 2015-16" by Dr. Yonghao Li, "White pines in the CT landscape" by Dr. Yonghao Li and Ms. Rose Hiskes, "Common insect/herbicide problems 2015-16" by Ms. Rose Hiskes and Dr. Jatinder Aulakh, and "Push for pollinator habitat: Needs for plants and seeds" by Dr. Kim Stoner. Isaac Buabeng, Daria Chamerda, and Jim Preste assisted with much of the behind the scenes work for the meeting. The meeting qualified for pesticide applicator recertification credits.

THE STATION IN THE COMMUNITY

New Haven Public Schools Science Fair at Yale University

From May 15-17, 2017, at the Yale University Commons, Dr. Robert Marra, Dr. Lindsay Triplett, and Ms. Lindsay Patrick served as special-award judges for the Greater New Haven Science Fair, on behalf of *The Connecticut Agricultural Experiment Station Special Award* for the "Best project related to food, plants, insects, or the environment." Two awards were given this year, one to the 1st grade class of Ms. Jane Hosen of the Wexler-Grant School for their presentation, "Up, Up, and Away: Which Plant Transpires the Least?" and the second to the 3rd grade class of Ms. Andria West of the Mauro-Sheridan Interdistrict Magnet School, for their presentation "Erosion Invaders."

DONATIONS MADE TO THE COMMUNITY

Lockwood Farm

A total of 22,027 pounds of fresh produce, including cabbage, cucumbers, eggplants, grapes, peppers, pumpkins, summer and winter squash, sweet corn, tomatoes, and assorted vegetables grown at Lockwood Farm were donated to the Connecticut Food Bank in Wallingford, Hamden/North Haven Y.M.C.A., Masonicare in Wallingford, North Haven Parks & Rec., Unitarian Society of New Haven in Hamden, Walter Brooks House in New Haven, Waverly House in New Haven, and Wesley School in Middletown. Farm Manager Richard Cecarelli arranged for the distribution of the produce.

Valley Laboratory

A total of 10,030 pounds of fresh produce including butternut squash, acorn squash, muskmelons, summer squash, tomatoes, peppers and pumpkins grown at the Valley Laboratory were donated to Foodshare of Hartford. Mr. Preste, Drs. Abigail Maynard, David Hill, and James LaMondia generated the fresh produce, and Jim Preste and Dr. LaMondia organized the distribution effort. The Valley Laboratory also donated two bins of pumpkins to Northwest Park in Windsor and loaned irrigation equipment to the Connecticut Epilepsy Foundation in support of their Mud Volleyball Tournament Fundraiser. Mr. Preste coordinated the distribution of the irrigation equipment.

AWARDS AND RECOGNITION RECEIVED BY STATION STAFF

On July 17, 2016, Dr. Teja S. Shidore was awarded the Ko Shimamoto Travel Award to attend the 2016 Congress of the International Society of Molecular Plant-Microbe Interactions, where she presented a poster titled "Characterization of the Functional Duality of a Bacterial Type III Secreted Protein AvrRxo1 and its Chaperone Arc1 as a Toxin-Antitoxin System."

On July 21, 2016, Mr. Gregory J. Bugbee received, along with co-authors Ms. Jordan Gibbons and Dr. Mark June-Wells, the 2015 "Outstanding Contribution of the Year Award" by the National Aquatic Plant Management Society for the journal article titled "Efficacy of single and consecutive early-season diquat treatments on curlyleaf pondweed and associated aquatic macrophytes: a case study."

From August 22-24, 2016, Dr. Joseph J. Pignatello attended and gave the lecture "Adsorption and reactions of organic compounds on pyrogenic carbonaceous surfaces: so, what else is new?" at the three-day symposium in his honor, *The Chemistry of Environmental Sorptive and Oxidative Processes: A symposium in honor of Joseph J. Pignatello*, at the American Chemical Society National Meeting held in Philadelphia, PA.

On September 20, 2016, Ms. Vickie M. Bomba-Lewandoski was elected to serve on the New Haven County Farm Bureau Association's Board as Secretary at the New Haven County Farm Bureau Association's Annual Meeting.

On September 29, 2016, Dr. Joseph Pignatello was appointed to the Editorial Board of the journal *Molecules*.

On October 26, 2016, Dr. Jeffrey S. Ward was co-awardee of the Connecticut Urban Forest Council's Outstanding Urban Forestry Project for the Stormwise roadside management studies.

On November 29, 2016, Dr. Richard S. Cowles was recognized by the Connecticut Pomological Society at their annual meeting and given the Award of Merit.

On December 28, 2016, Dr. Jason C. White was awarded ISO 17025/IEC Accreditation from the American Association for Laboratory Accreditation (A2LA) for the Department of Analytical Chemistry.

On May 26, 2017, Dr. Lindsay Triplett was awarded a community-based faculty appointment as Assistant Clinical Professor in the Department of Medical Sciences of the Frank H. Netter MD School of Medicine at Quinnipiac University, effective January 1, 2017.

THE PUBLIC SPEAKS

On September 22, 2016, Trish Manfredi, Chair of The Federated Garden Clubs of Connecticut, Inc. Judges Council wrote the following about Eric Flores. “Everything went very smoothly at Judges Council – Eric was very helpful, once again!”

On September 23, 2016, Ed Walsh, Executive Director of the Connecticut Grounds Keepers Association wrote the following to Philip Armstrong. “The feedback from attendees at Wednesday night’s workshop has been outstanding. Your presentation was spot on the kind of information we hope to share with CGKA members and the industry. On behalf of the CGKA Board let me say again, your time and expertise is greatly appreciated.”

On November 15, 2016, Kelly Lenz from Cheshire Public Schools wrote the following to Joseph Barsky. “Thank you for helping us celebrate American Education Week by participating today in Sophomore Career Day. What you are doing here this morning is meaningful for our students. You show them that there are caring adults who want to help kids acquire the tools needed for success in this world. You provide them the opportunity to explore different careers, help them make connections between school and work, and give them the chance to see that it is possible to channel their personal strengths, work ethic, passion, and drive into a rewarding career. I understand how busy you are and the effort it took for you to be here this morning, so thank you again for making time for our students!”

On December 6, 2016, Dr. Diba Khan-Bureau, Professor & Program Coordinator, Civil & Environmental Engineering Technologies, Three Rivers Community College, Norwich, wrote the following to Gregory Bugbee and Jennifer Fanzutti. “On behalf of Three Rivers Community College (TRCC) I want take this opportunity to thank you for your continual support and for the educational experience that you provide our TRCC students. As usual you were wonderful presenters last spring semester! My students enjoy your seminar and presentation so much that the students that have seen you in previous years come back to see you again. My students enjoyed identifying the invasive and native aquatic plants and continued to communicate with Jennifer via email with questions pertaining to the presentation and the plants that you brought. Jennifer responded to the student inquiries, which the students appreciated. The students love the hands-on learning. Several students were taking photographs of the invasive aquatic plants on display. The educational outreach that you provide is very important, and the Connecticut Agricultural Station research that you do in lakes and ponds is pertinent to our society. Invasive and/or nuisance aquatic plants, algae, and diatoms (micro-algae) are being observed more frequently in Connecticut and throughout the USA. We see it more now than ever before. We as a society have made this possible by using too much fertilizer on our lawns, buying non-indigenous plants, spreading these invasive species by boats, ballast, and boots of fishermen while non-point source pollution is degrading our surface waters. It is imperative to stay informed now more than ever. I thank you and your colleagues for the research that you do. Thank you again Greg and Jennifer for traveling to TRCC (with the many containers of water and aquatic plants) to educate our students. I will be writing a letter of support since I believe that your research in Connecticut and your educational outreach are very important. You continue to make a significant contribution with a positive impact in Connecticut. I hope that you will consider presenting again for the upcoming spring semester.”

On December 6, 2016, Michele L. Tremblay from the Northeast Aquatic Nuisance Species Panel wrote the following about Gregory Bugbee and Sandra Carney. “Thank you for your gracious hosting of the Northeast Aquatic Nuisance Species Panel fall meeting last week. The Panel could not have asked for a more beautifully situated venue for its meeting. Everyone was content and felt welcomed by your staff. The Panelists and guests enjoyed the background and facility information that Greg Bugbee presented. I am grateful for all of the support that Sandra Carney provided to make this meeting possible. The Connecticut Agricultural Experiment Station staff made everyone feel at home, which facilitated a very

productive two days together. On behalf of the entire Northeast Aquatic Nuisance Species Panel and its presenters and guests, please accept my sincere and heartfelt gratitude for making the November-December 2016 Panel meeting a great success."

On December 30, 2016, Christine Witkowski, Associate Professor and Coordinator of the Environmental Science Program at Middlesex Community College, wrote the following about Scott Williams. "The Environmental Science Program at Middlesex Community College would like to express its sincere appreciation for the time Dr. Scott Williams has contributed to our students' success. We offer an "Exploring Environmental Careers" course to expose students to their many education and career options, and we rely on weekly guest speakers to provide a window into the work of environmental professionals. The talks are each about an hour, with a PowerPoint presentation about each speaker's background, education and career highlights, and time for student questions. It is a valuable experience for students and we could not do this without people like Scott. Scott has visited the class twice since Spring 2015 to share his work. His talk is particularly interesting because he describes specific projects he has worked on in detail, and shares stories that fascinate the students. Students leave inspired and newly educated about the work of the Connecticut Agricultural Station, important work that most students are not familiar with. Scott has also agreed to serve on the Environmental Science Program advisory board that will help guide the program into the future. Scott's expertise and experience will be valuable assets on our board. The Middlesex Community College Environmental Science program is very grateful for the time Scott contributes to our students, and grateful that CAES supports this type of education and outreach. We look forward to continuing to work with Scott and CAES in the future.

On February 3, 2017, Nell Glass wrote the following about Gregory Bugbee. "I would like to tell you how grateful I am to Greg Bugbee and the Invasive Aquatic Plant Program at CAES. I sit on the board of a small association called Friends of West Side Pond, Inc. We have been working on plans to remediate our small lake in the NW corner of CT. The process is both expensive and complicated and time consuming. Some of our members have had concerns and questions about various remediation methods, the problem facing groups like ours is where and who to turn to. We have found Greg Bugbee of CAES an incredible resource and help to our questions and concerns. I realize that you have lost much of your State funding and I would like you to know that your programs and people are a treasured resource to small lakes and communities such as FOWSP. It would be a crime against the people, communities and environmental groups if we lose any of CAES programs or people. The work you all do and provide for our state is priceless and very much needed. Greg has helped me on several occasions, he unlike the Limnologist we hired has been always accessible and there to answer questions we may have. Case in point, my daughter was writing a research paper on aquatic invasive plants. She came to a point in her paper where she could not get any up to date information on remediation and mapping methods, and I told her to contact Greg. Because she was at school in New Haven, and right around the corner from CAES she took a chance and went to see Greg. Mr. Bugbee could have told her he was busy and sent her away; instead, he stopped what he was doing and spoke with her for a good hour. This to people like myself is what "Putting science to work for people" is all about. I hope someday that the State will realize the importance of your facility and reinstate the funding you so deserve. I for one will do my best to get the word out!"

On February 24, 2017, Adam H. Putnam, Commissioner of Agriculture, Florida Department of Agriculture and Consumer Services, wrote the following to Jason White. "Thank you for leading the AgScience Café presentation and discussion on February 23, 2017 regarding *Nanomaterials and the Food Supply: Assessing the Balance Between Applications and Implications*. You took a critical and impactful subject for all citizens and made it easy to understand. The discussion allowed FDACS team members to better understand the applied use and implications of nanomaterials with respect to our food. A subject that seems more complicated for the average citizen. I appreciate the sacrifice of your personal time,

travel and preparation of your presentation offering. Your knowledge of this topic is invaluable to the department. Thank you again for your time."
On March 6, 2017, Vince Musto wrote the following to Goudarz Molaei. "Thank you for the quick turnaround…I appreciate the professionalism of your office."

On March 16, 2017, Chris Frattarola wrote the following to Goudarz Molaei. "Thank you so much. You guys are a great service to the people of Connecticut and I applaud your work."

On March 31, 2017, Bill Bartley wrote the following to Goudarz Molaei. "Thank you so much. Thanks again for this wonderful service and your time!!"

On April 7, 2017, Susan Laursen, Co-Joint Chair, LDSS, wrote the following to Theodore Andreadis. "Thank you for once again providing a terrific space for our Landscape Design Study School. Your team did a fabulous job with the setup and coordination of equipment. In addition, everyone enjoyed the CAES slide presentation to kick off our school. Thank you to all!"

On June 3, 2017, David Katz wrote the following to Theodore Andreadis about Gregory Bugbee. "I'm writing to thank you for your help earlier this week. It's the exception these days for people to be so accommodating. As you suggested, I spoke to Greg Bugbee and he was very helpful and more than generous with his time. I've used your service several times over the years both in person and over the phone and have always been impressed by the passion and commitment with which you all do your jobs. You may perform your work in anonymity, but what you do positively affects everyone of us. Your stewardship of the environment is more important now than ever and I hope you get the funding that you need to continue doing what you do."

On June 7, 2017, Daniel Paier wrote the following to Goudarz Molaei. "Thank you for examining the tick I dropped off at the CAES…And thank you for all the information and for getting back to me so promptly."

On June 9, 2017, Eric Lukingbeal wrote the following to Kirby Stafford. "I can't tell you how delighted we were to listen to you talk about ticks last night. The number of favorable comments I got after the event, and already this morning, is pretty special. My guess is that there are already some orders placed for permethrin-treated clothing. According to our count, there were over 90 folks in attendance, a local record for an event of this sort. Thank you for doing this work."

On June 9, 2017, Robert Bystrowski wrote the following to Kirby Stafford. "On behalf of the Friends of Holcomb Farm, and the Granby Land Trust, I cannot thank you enough for coming to the farm and making this presentation. It is truly a public service, and the state of CT is lucky to have you! Thank you."

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

ADMINISTRATION

THEODORE G. ANDREADIS

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

DEPARTMENT OF ANALYTICAL CHEMISTRY

JASON C. WHITE

- Immediate Past President, International Phytotechnology Society
- Managing Editor, *International Journal of Phytoremediation*
- Editorial Board, *Environmental Pollution*
- Editorial Board, *NanoImpact*
- Editorial Advisory Board, *Environmental Science & Technology*
- Editorial Advisory Board, *Environmental Science & Technology Letters*
- Science Advisory Board, Annual International Conference on Soils, Sediments, Water, and Energy
- Advisor, Nanotechnology Advisory Group, Society of Environmental Toxicology and Chemistry
- Member, Sustainable Nanotechnology Organization
- Member (ad-hoc), FDA Food Emergency Response Network (FERN) Method Coordination Committee (MCC)

BRIAN D. EITZER

- Member, Conservation Commission for the Town of Bethany
- Member, Organizing Committee for the North American Chemical Residue Workshop
- Member, Quinnipiac Chapter of Sigma Xi

CHRISTINA S. ROBB

- Board Member, Eastern Analytical Symposium (Exposition Chair 2016, Program Vice-Chair 2017)

DEPARTMENT OF ENTOMOLOGY

KIRBY C. STAFFORD III
- Member, Board, Connecticut Coalition Against Bed Bugs
- Member, Tick IPM Working Group
- Capstone Mentor and Assistant Clinical Professor Department of Medical Sciences at the Frank H. Netter MD School of Medicine, Quinnipiac University

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

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

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

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

GALE E. RIDGE
- Chair, Connecticut Coalition Against Bed Bugs
- Member, EPA FIFRA Scientific Advisory Board
- Member, State Health Improvement Plan (SHIP)
- Honorary member of the Connecticut Pest Management Association (CPCA)

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

VICTORIA L. SMITH
- Member and Past President, Eastern Plant Board
- Member, Horticultural Inspection Society
- Member, National Plant Board Systems Approach to Nursery Certification Committee
- Member, National Plant Board *Phytophthora ramorum* Working Group
- Member, New England Wildflower Society, Connecticut Task Force
- Member, Yale Biosafety and Recombinant DNA Committee
- Member, Farm Bill Review Team 6: Enhanced Mitigation Capabilities
- New Pest Advisory Group, Eastern Plant Board Liaison
- Member, Northeast Area Association of State Foresters Firewood Working Group
- Member, USDA-APHIS-PPQ Early Detection-Rapid Response Committee
- Member, National Clean Plant Network Fruit Tree Committee

KIMBERLY A. STONER
- Member, Multi-State Research Project NC1173 – Sustainable Solutions to Problems Affecting Bee Health
- Organizer and Member, Connecticut Native Plant, Pollinator, and Wildlife Working Group
- Steering Committee, New England Vegetable and Fruit Conference
- Member, City Farm and Garden Working Group, New Haven Food Policy Council

DEPARTMENT OF ENVIRONMENTAL SCIENCES

JOSEPH J. PIGNATELLO
- Professor Adjunct of Chemical Engineering and Environmental Engineering, Yale University
- Editorial Board, *Molecules*
- Editorial Board, *Environmental Engineering Science*
- Council Member for Environment Briefs, Connecticut Academy of Science and Engineering

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

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

GREGORY J. BUGBEE
- Panelist, Northeast Aquatic Nuisance Species Panel
- Director, Clear Lake Improvement Association
- Contributor for CT updates, *Northeast Aquatic Plant Management Society Newsletter*

GOUDARZ MOLAEI
- Director, The CAES Tick Testing Program
- Associate Clinical Professor, Department of Epidemiology of Microbial Diseases, Yale School of Public Health

JOHN J. SHEPARD
- Treasurer, Northeastern Mosquito Control Association

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

CHARLES R. VOSSBRINCK

- Member, Editorial Board, Springer Plus

DEPARTMENT OF FORESTRY AND HORTICULTURE

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

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

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

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

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

SCOTT C. WILLIAMS
- Adjunct Professor, Department of Natural Resources and the Environment, University of Connecticut, Storrs
- Executive Treasurer, Connecticut Urban Forest Council
- Executive Treasurer, The Wildlife Society, Northeast Section
- Certified Wildlife Biologist, The Wildlife Society
- Scientific Advisor, Middlesex Community College Environmental Science Advisory Board
- Scientific Advisor, Fairfield County Municipal Deer Management Alliance
- Chair, Town of Guilford Inland Wetlands Commission
- Commissioner, Town of Guilford Land Acquisition Commission
- Graduate Advisor, Ph.D. candidate Megan Linske, 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

WADE H. ELMER
- Associate Editor, *Crop Protection*
- Member, Widely Prevalent Fungi List Committee, American Phytopathological Society

- Member, Northeast Research, Extension and Academic Programs Committee for IPM
- Member, Program Committee, Connecticut Greenhouse Growers Association
- Member Thesis, Advisory Committee, University of Connecticut
- Member Thesis, Advisory Committee, University of Texas at El Paso

FRANCIS J. FERRANDINO
- President, Past President, Northeastern Division of the American Phytopathological Society Member Thesis, Advisory Committee, University of Texas at El Paso
- Member, Connecticut Wine Council
- Member, Science/Education Committee, Connecticut Wine Council

YONGHAO LI
- Member, Connecticut Christmas Tree Association

ROBERT E. MARRA
- Member, Phytopathology Committee, Mycological Society of America
- Member, Connecticut Conference on Natural Resources Steering Committee. Founding Member
- Vice-President, Executive Committee, Northeast Division of the American Phytopathological Society

NEIL P. SCHULTES
- Fellow of the Linnaean Society of London
- Vice President & Executive Board Member, Quinnipiac Chapter of Sigma Xi
- Junior Radiation Safety Officer, CAES
- Chair, Institutional Biosafety Committee, CAES
- Member, Institutional Animal Care and Use Committee, CAES
- Member, Thesis Advisory Committees, University of Indiana – Purdue at Ft. Wayne, IN

LINDSAY R. TRIPLETT
- Associate Editor, *Phytopathology*
- Associate Editor, *Phytobiomes*
- Faculty Affiliate, Colorado State University
- Adjunct Faculty, Quinnipiac Netter School of Medicine
- Member, Widely Prevalent Bacteria Committee
- Member, National Academy of Science Advisory Committee on Citrus Greening Disease

QUAN ZENG
- Chair, Bacteriology Committee, American Phytopathological Society
- Member, Biosafety Committee for CAES

VALLEY LABORATORY

JAMES A. LAMONDIA
- Northeast Regional Project NE-1040, “Plant-parasitic Nematode Management as a Component of Sustainable Soil Health Programs in Horticultural and Field Crop Production Systems”
- Senior Editor, Journal of Nematology
- Society of Nematologists Extension Committee
- Connecticut Agricultural Information Council
- Member, Century Farm Award Selection Committee

- Ex-Officio Member, Connecticut Tree Protection Examining Board
- Worker Protection Standards Trainer for the Valley Laboratory
- CT Vegetable & Small Fruit Growers' Conference Steering Committee

CAROLE CHEAH
- Fellow of the Cambridge Philosophical Society, UK

RICHARD S. COWLES
- Connecticut Entomological Society (co-President, 2016 to 2017)

DEWEI LI
- President of the Pan-American Aerobiology Association
- Editor of "Biology of Microfungi" (book) for Springer
- Associate Editor of Aerobiologia (journal)
- Editorial board member of Fungal Biology and Biotechnology (journal)
- Advisor and team member for "Recovery from Catastrophic Weather-Hurricane Sandy: Mold Exposure and Health-Related Training project," which was led by the UCONN Health Center, Center for Indoor Environments and Health

THOMAS M. RATHIER
- Past President, Member of the Program, Tree Improvement and Merit Award Committees, The Connecticut Christmas Tree Growers Association
- Member, Water Use and Conservation Committee, Connecticut Nursery and Landscape Association

LECTURES, SEMINARS, AND INTERVIEWS

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

ANAGNOSTAKIS, SANDRA L.

- Attended the annual meeting of the federal chestnut project, NE 1333, and reported on CAES chestnut holdings and valuable collections in Syracuse, NY (42 adults attended) *September 29-October 2, 2016*

ANDREADIS, THEODORE G.

- Participated in a meeting of the Connecticut Invasive Plant Council held at the Department of Agriculture in Hartford *July 12, 2016*
- Was interviewed about federal and state funding for research and surveillance for Zika virus in Connecticut by Fran Schneidau, WCBS Radio New York *July 21*
- Participated in a press conference held at the Station with Governor Dannel P. Malloy and Department of Public Health Commissioner Raul Pino to formally announce the testing of Connecticut residents for Zika virus and provide an update on mosquito testing. The press conference was followed by a tour of the Biosafety Level 3 and Mosquito laboratories *July 21*
- Was interviewed about the Station's Mosquito Surveillance program for Zika virus in Connecticut by Kathleen McWilliams, Hartford Courant *July 21*
- Was interviewed about Plant Science Day 2016 by Ray Andrewsen, WQUN AM 1220 in Hamden *July 26*
- Participated in a press conference in the atrium of the Johnson-Horsfall Laboratory with Governor Dannel P. Malloy to discuss Zika virus *July 31*
- Was interviewed about Connecticut's response to the Zika virus by WFSB TV 3 Hartford *August 2*
- Presided over a quarterly meeting of the Station's Board of Control held at Lockwood Farm *August 3*
- Was interviewed about the West Nile virus activity in Connecticut this summer by Amanda Cuda, Connecticut Post *August 9*
- Was interviewed about Zika virus and the CAES mosquito and arbovirus surveillance program by WNPR Connecticut Public Radio, Hartford *August 11*
- Participated in a press conference with Congresswoman Rosa DeLauro and Connecticut Public Health Commissioner Raul Pino to express support for federal funding for Zika virus research and mosquito control held at Lockwood Farm *August 12*
- Was interviewed about the recent emergence of salt marsh mosquitoes along the Connecticut coastline by Marc Sims, WNPR Connecticut Public Radio, Hartford and Fran Schneidau, WCBS Radio New York *August 16*
- Was interviewed about the detection of West Nile virus in several towns in Fairfield County by Amanda Cuda, Connecticut Post *August 22*
- Presented an overview of scientific staff and research activities at the Center for Vector Biology & Zoonotic Diseases at CAES at an orientation session for incoming MPH students within the Department of Epidemiology of Microbial Diseases at the Yale School of Public Health *August 23*
- Participated in a Zika Vector Control Response Tabletop Exercise attended by Governor Malloy and sponsored by the Connecticut Department of Public Health *August 24*
- Participated in a press conference held at the Station with Senator Richard Blumenthal to express support for federal funding for Zika virus research and mosquito control and provide an update on mosquito testing. The press conference was followed by a tour of the Biosafety Level 3 and Mosquito laboratories *August 30*

- Participated in the formal signing by Governor Malloy of Public Act No. 16-17: An Act Concerning Pollinator Health held at the State Capitol in Hartford *August 30*
- Presented opening remarks and an overview of CAES current research programs and diagnostic services available to citizens to the Federated Garden Clubs of Connecticut Garden Studies School held in Jones Auditorium *September 13*
- Participated in a meeting of Connecticut's Invasive Plant Council held in Hartford *September 13*
- Hosted a group of MPH students from the School of Public Health at Yale University who came to the Station to learn about possible research opportunities for their rotations and theses *September 20*
- Presented a talk entitled "Morphological and Molecular Characterization of a Novel Microsporidian Parasite from the Invasive Asian Rock Pool Mosquito, *Aedes japonicus*" at the 25th International Congress of Entomology held in Orlando, FL *September 25-30*
- Participated as a debater in a conference on the "Socioeconomic Contexts of Sustainable Agriculture" held at Western Connecticut State University in Danbury *October 14*
- Presided over a quarterly meeting of the Station's Board of Control held at the Valley Laboratory in Windsor *October 19*
- Hosted State Senators Beth Bye and Clark Chapin; Melissa Spear, Executive Director Common Ground; Jen Cushman, Hartford County 4-H Extension Educator; and CAES Board Member Terry Jones, who visited the Station for a tour of the facilities *October 25*
- Participated in a meeting of Connecticut's Invasive Plant Council held in Hartford *October 26*
- Participated in a meeting of Connecticut's Invasive Plant Council held in Hartford *November 15*
- Attended the annual meeting of Connecticut's Working Lands Alliance held in Hartford *November 16*
- Attended a board meeting of the Experiment Station Associates held at the Station *November 16*
- Attended the annual meeting of the Connecticut Farm Bureau held in Wallingford *November 18*
- Participated as Administrative Advisor to Multistate Research Project, NEERA1306, "Management of the Brown Marmorated Stink Bug" held at the Virginia Agricultural Experiment Station in Winchester, VA *November 30*
- Presented a talk entitled "Life Cycle and Pathology of a Novel Microsporidian Parasite Isolated from the Invasive Exotic Mosquito, *Aedes japonicus*, from Japan" at the 62nd Annual Meeting of the Northeastern Mosquito Control Association held in Falmouth, MA (180 attendees) *December 6*
- Presented an overview of the Experiment Station and its various research, regulatory, and public service programs to a group of students from Norwich Technical High School *December 20*
- Presented information on the Station's mosquito and arbovirus surveillance program and results on West Nile virus in 2016 at a "Human Case Presentation" of the Yale Medical Group *January 4, 2017*
- Attended the annual Connecticut Vegetable & Small Fruit Growers' Conference held in South Windsor *January 9*
- Presided over a quarterly meeting of the Station's Board of Control held in Hartford *January 18*
- Presented an overview of the Experiment Station and its various research, regulatory, and public service programs at the Annual Meeting of the Connecticut Tree Protective Association held in Plantsville (900 attendees) *January 19*
- Presented an update on Experiment Station activities at a meeting of the Experiment Station Associates Board of Directors *January 20*
- Attended the annual meeting of the Connecticut Nursery and Landscape Association *January 25*
- Attended a Board Meeting of the Experiment Station Associates held at the Station *February 1*
- Attended the 83rd Annual Meeting of the American Mosquito Control Association held in San Diego, CA to recruit and interview Postdoctoral scientists for the Northeast Regional Center of Excellence in Vector-Borne Diseases (900 attendees) *February 13-17*
- Participated in the spring meeting of the Northeastern Regional Association of State Agricultural Experiment Station Directors held in Baltimore, MD *March 14-15*
- Presented welcoming remarks and an overview of the Experiment Station and its various research,

regulatory, and public service programs to the Landscape Design School held at the Station *March 20*

- Presented an update on the Northeast Regional Center for Excellence in Vector Borne Diseases at the 14th Arbovirus Surveillance and Mosquito Control Workshop and participated as Administrative Advisor in the annual meeting of Multi-State Project, NE-1443, Biology, Ecology & Management of Emerging Disease held in St. Augustine, FL *March 28-30*
- Presided over a quarterly meeting of the Station's Board of Control held at the Station *April 12*
- Presented welcoming remarks and an overview of the Experiment Station and its various research, regulatory, and public service programs at the Annual Meeting of the Experiment Station Associates held at the Station *April 12*
- Presented a seminar entitled "Global Climate Change and Mosquito Borne Diseases" as part of the Yale Climate Change and Health Initiative Program at the Yale School of Public Health *April 19*
- Held a news conference at the Station on ticks and tick-borne diseases and to announce the establishment of the Northeast Center for Excellence in Vector-Borne Diseases in Connecticut with US Senator Richard Blumenthal *April 20*
- Was interviewed about Powassan virus and the first confirmed human case in Connecticut by Greg Hladky, Hartford Courant *April 20*
- With Dr. Jason White, hosted legislative aides Emily Boushee and Ben Florsheim from US Senator Chris Murphy's office and gave an overview and tour of the Experiment Station *April 25*
- Presented an overview of the Experiment Station and its research, regulatory, and public service programs at a quarterly meeting of the Council of the Connecticut Academy of Science and Engineering (21 attendees) *April 26*
- Was interviewed about ticks and tick-borne disease threats in Connecticut by Mike Puffer, Republican-American *April 27*
- With Dr. Jason White, hosted State Representative Steven Stafstrom from Bridgeport and gave an overview and tour of the Experiment Station *April 27*
- Was interviewed about the current status of ticks and tick-borne diseases in the state and the Station's Tick Testing Program by Jill Konopka, NBC 30 Connecticut *May 1*
- Was interviewed about ticks and tick-borne diseases by Lucy Nalpathanchil, on WNPR's, "Where We Live" show in Hartford *May 2*
- Was interviewed about the current status of ticks and tick-borne diseases in the state and the Station's Tick Testing Program by Edmund Mahoney, Hartford Courant *May 2*
- Was interviewed about the rising tick population in the state by Hayley Miller, Huffington Post *May 4*
- With Dr. Jason White, hosted Dr. Rick Rhodes, Executive Director of the Northeast Regional Association of Experiment Station Directors, and gave an overview of the Station's research, regulatory, and public service programs and a tour of Station facilities *May 10*
- Participated in a meeting of principal investigators of the four Regional Vector-Borne Centers of Excellence Visit held at the Centers for Disease Control and Prevention Division of Vector-Borne Diseases in Fort Collins, CO *May 18-19*
- Presented welcoming remarks and an overview of the Experiment Station and its various research, regulatory, and public service programs for a "Behind the Scenes Tour" for the Experiment Station Associates held at the Station (12 attendees) *May 24*
- Was interviewed about the establishment of the Asian tiger mosquito, *Aedes albopictus*, in CT by NBC Connecticut *May 24*
- Was interviewed about the outlook for mosquitoes and West Nile virus and the start of the Mosquito Trapping and Virus Testing Program for the 2017 season by Amanda Cuda, Connecticut Post *May 30*
- Was interviewed about the current status of ticks and tick-borne diseases in the state and the Station's Tick Testing Program by Aaron Kupec, WTIC Radio *June 7*
- Participated in the joint summer meeting of the Northeastern Regional Association of State Agricultural Experiment Station and Extension Directors held in White Sulphur Springs, WV *June*

12-14

ARANGO-VELEZ, ADRIANA L.

- Spoke on "From West to East, South to North, the Unwelcome Guests Mountain Pine Beetle (MPB- *Dendroctonus ponderosae* Hopkins) and Southern Pine Beetle (SPB- *D. frontalis* Zimmermann): Are Naïve Conifers Ready to Defend?" at the IUFRO Conference in Sept-Îles in Quebec, Canada (40 attendees) *July 11-15, 2016*
- Served as Program Chair for the 28th CUFC and 12th Annual Forest Forum Conference "How is the Forest and the Trees along your Street Challenged by Environmental Change?" in Plantsville (170 attendees) *October 26*
- Gave a talk titled "Effect of Insects and Pathogens in Plant Performance" to Norwich Technical High School students (24 students, 2 teachers) *December 20*
- Participated in the New England SAF, Northeastern Forest Pest Council and Maine Chapter of the Wildlife Society joined meeting "Adapt. Adopt. Advance: Resiliency in Natural Resource Management" in Bangor, ME *March 8-10, 2017*
- Gave a talk "Drought: Its After-effects, and Management Strategies for Woody Ornamentals" at the 2017 Spring Horticultural Forum in Stamford (40 attendees) *March 22*
- With Drs. Jeffrey Ward, Dr. Roberto De La Torre-Roche, Mr. Joseph P. Barsky, and Ms. Amanda Massa, spoke on research at CAES and provided tours of Station labs to Fair Haven 5th graders (23 students, 2 teachers) and 6th graders (16 students, 1 teacher) in bilingual/English as a 2nd Language classes *March 30*
- Gave a lecture titled "Physiological, Anatomical and Molecular Adaptations of Plants to Drought and Insect/Pathogens" at Quinnipiac University (30 students) *April 4*
- Gave a talk for the NENHC 2017 "Southern Pine Beetle Expansion into Pitch Pine Areas" (30 attendees) *April 22*
- Co-presented a poster "Development of a Robust Gas Chromatography-Mass Spectrometry Method for Determination of Monoterpenes in Pitch Pine Against Southern Pine Beetle" at the annual meeting of Connecticut Valley Section of the American Chemical Society (CVSACS) in Storrs *April 22*
- Gave a lecture titled "Why Science Matters? A Plant Physiologist's Tale" at Central Connecticut State University (40 students) *April 27*
- Gave a short talk "Sugar Maple Health" for the Behind the Scenes Tour to the Experiment Station Associates (7 attendees) *May 24*

ARMSTRONG, PHILIP M.

- Was interviewed about monitoring mosquitoes for Zika virus by the New Haven Register *July 11, 2016*
- Was interviewed about the first detection of West Nile virus in mosquitoes by Fox 61 *July 15*
- Was interviewed about the detection of West Nile virus in Stamford by the Stamford Advocate *July 18*
- Gave the presentation "What's the Latest Buzz about Zika Virus" to the Business Council of Fairfield County (25 attendees) *July 28*
- Was interviewed by News 12 Connecticut about the salt marsh mosquitoes *August 17*
- Was interviewed by News Channel 8 about West Nile virus *August 17*
- Was interviewed by Fox Channel 61 and Fox News about West Nile virus *August 19*
- Was interviewed by the Wall Street Journal about monitoring mosquitoes for Zika virus *August 22*
- With Dr. Theodore G. Andreadis, participated in a Zika virus emergency response exercise with the Governor, Lieutenant Governor, and Commissioner of Public Health, as well as representatives from the Departments of Public Health, Emergency Services, Energy and Environment *August 24*
- Was interviewed by the Wall Street Journal about West Nile virus risk in Connecticut *August 26*

- Was interviewed by the New Haven Register about detection of West Nile virus in East Haven *August 30*
- Was interviewed by News Channel 8 about the first human case of West Nile virus *August 30*
- Gave the talk "Zika Virus and Mosquitoes: Assessing the Threat" to the Department of Pathobiology at UConn (30 attendees) *September 8*
- Spoke and gave a tour to incoming students from the Yale School of Public Health, Epidemiology of Microbial Diseases Program (20 attendees) *September 20*
- Spoke to the Connecticut Grounds Keepers Association about mosquitoes and monitoring for Zika virus (30 attendees) *September 21*
- Was interviewed by CT Radio Network about the detection of EEE virus in mosquitoes *September 22*
- Gave the talk "Emergence of Deer-Associated Arboviruses: Jamestown Canyon and Cache Valley Virus" for the Epidemiology of Microbial Diseases Seminar Series at the Yale School of Public Health (approx. 100 attendees) *October 6*
- Gave the talk "Zika Virus and Mosquitoes: Assessing the Risks" to the Yale Occupational Health Program (15 attendees) *October 18*
- Was interviewed by the CT Radio Network and WTIC about the mosquito trapping and testing program and its major findings during 2016 *October 31*
- Gave the talk "Mosquitoes and Zika Virus: Assessing the Threat" at the Connecticut Entomological Society meeting in Jones Auditorium (25 attendees) *November 18*
- Gave the talk "Isolation of La Crosse Virus from Mosquitoes Collected in Connecticut" at the Annual Northeastern Mosquito Control Association Meeting in Falmouth, MA (180 attendees) *December 5*
- Gave the lecture "An Overview and Survey of Arboviral Diseases" for the Biology of Disease Vectors course held at the Yale School of Public Health (8 student attendees) *January 25, 2017*
- Gave the lecture "Dengue, Zika, and Other Arboviral Diseases" for the Principles of Infectious Diseases course held at the Yale School of Public Health (20 student attendees) *February 7*
- With Dr. Theodore Andreadis, Dr. Douglas Brackney, and Dr. Goudarz Molaei, hosted Dr. Scott Halstead, Emeritus Professor of Preventive Medicine, Uniformed Services University of the Health Sciences, to discuss research on arboviruses at CAES *February 10*
- Attended the Vector-Borne Disease Prevention Task Force Meeting at the Stamford Government Center (20 attendees) *March 15*
- Presented a talk on La Crosse virus in Connecticut at the Arbovirus Surveillance and Mosquito Control workshop in St. Augustine, FL (50 attendees) *March 29*
- Served as chair at the NE1443: Biology, Ecology, & Management of Emerging Disease Vectors Regional Project Meeting in St. Augustine, FL (30 attendees) *March 31*
- Gave the talk "West Nile Virus: Ecology and Epidemiology of an Invasive Virus" to the Department of Ecology and Evolutionary Biology, Yale University (40 student attendees) *April 19*
- Gave the presentation "Mosquitoes and Zika Virus: Assessing the Threat" at the Northeastern Natural History Conference in Cromwell (30 attendees) *April 23*
- Was interviewed by the New Haven Register about the northward expansion of the Asian tiger mosquito *May 23*
- Was interviewed by the Connecticut Post about the northward expansion of the Asian tiger mosquito *May 23*
- Was interviewed by Wired Magazine about monitoring ticks for Powassan virus *May 24*
- Was interviewed by News 8 about the invasive Asian tiger mosquito in Connecticut *May 30*
- Was interviewed by News Channel 3 about the statewide mosquito trapping and testing program *June 5*
- Was interviewed by the CT Radio Network about mosquitoes and mosquito-borne viruses in CT *June 8*

- Attended the Executive Council Meeting for the American Society of Tropical Medicine and Hygiene in Alexandria, VA *June 10-11*
- Was interviewed by the CT Radio Network about mosquitoes and mosquito-borne viruses in CT *June 15*
- Was interviewed by the CT Post about precautions to prevent mosquito-borne diseases *June 20*

ARSENAULT, TERRI
- Was an invited guest lecturer for the LB508 FDA/Food Emergency Response Network Chemistry Training for Gas Chromatography – Mass Spectrometry (GCMS) held at the Arizona Department of Health Services in Phoenix, AZ *December 13-15, 2016*

AULAKH, JATINDER S.
- Presented a talk on "Know Your Weeds - Identification of Invasive Trees and Vines in Connecticut" at Plant Science Day at Lockwood Farm in Hamden *August 3, 2016*
- Attended the Connecticut Christmas Tree Growers twilight meeting and discussed herbicide options for the post-emergence control of broadleaf and grass weeds, and perennial woody vines in Christmas trees *August 17*
- Demonstrated pre-emergence weed control efficacy trial and talked about weed management plans for fall 2016 at the Connecticut Christmas Tree Growers annual meeting in Hamden *September 10*
- Gave a demonstration on new herbicide safety trials in ornamental plants and talked about common weed problems in landscapes during the Valley Laboratory Nursery and Landscape Research Tour (20 attendees) *September 15*
- Attended the CIPWG annual symposium at UCONN in Storrs and served as moderator *October 11*
- Presented a poster on "Tolerance of Container-grown Dogwood and Virginia Sweetspire to SP-1770 Herbicide" at the Northeastern Plant, Pest, and Soils Conference in Philadelphia, PA *January 3-6, 2017*
- Was interviewed by Growing Magazine regarding herbicide resistant weeds and their management *January 17*
- Talked about weed management in Christmas trees at the annual meeting of the CT Christmas Tree Growers Association in Middletown (50 attendees) *March 4*
- Gave the talk "Identification and Control of Weeds in Container and Landscape Roses" at the annual meeting of the CT Rose Society in Glastonbury (50 attendees) *April 1*
- Gave a talk on "Identification and Control of Weeds in Cool Season Turf" in East Windsor (15 attendees) *April 18*
- Gave a talk on "Identification and Control of Non-native Invasive Plants" to the Prospect Land Trust in Prospect (14 attendees) *April 26*
- Gave a talk on management of perennial weeds at the Connecticut Christmas Tree Growers Twilight Meeting held at Allen Hill Farm in Brooklyn (approx. 60 growers from Connecticut, Massachusetts, and Rhode Island attended) *June 9*

AYLOR, DONALD E.
- Gave an invited talk on "Physical Aspects of Aerial Spore Dispersal" at the Annual Meeting of the American Phytopathological Society (APS) in Tampa, FL (120 attendees) *July 31, 2016*
- Met with the Long Range Transport Research Group at Cornell University and gave an invited seminar entitled "Aerial Spore Dispersal: Near and Far" in the Department of Plant Pathology and Plant-Microbe Biology at Cornell University (40 adult attendees) *March 14-17, 2017*

BARSKY, JOSEPH P.

- With Mr. Michael R. Short and Ms. Megan Linske, staffed the CAES booth at the 28th Annual Connecticut Urban Forest Council Conference and 12th Annual Forest Forum in Plantsville *October 26, 2016*
- Participated in the quarterly meeting of the Connecticut State Consulting Committee for Agricultural Science and Technology Education at the Valley Laboratory *November 3*
- Gave a presentation on "Career Opportunities in Science and Agriculture" at Cheshire High School (64 students) *November 15*
- Participated in a New England Society of American Foresters Executive Committee conference call *December 14*
- Gave a presentation on "Sugar Maple Research" in the CAES greenhouse to visiting Norwich Technical High School students (24 students, 2 teachers) *December 20*
- Participated in the quarterly meeting of the New England Society of American Foresters Executive Committee in Concord, NH *January 11, 2017*
- Participated in the triennial review of the Westhill High School Agriscience Program in Stamford (40 students, 9 teachers, 12 parents) *February 7 and 28*
- Participated in the CT Society of American Foresters winter meeting in Rockfall *February 27*
- Participated in New England Society of American Foresters Executive Council meeting *March 7*
- Participated in the New England SAF, Northeastern Forest Pest Council and Maine Chapter of the Wildlife Society joined meeting "Adapt. Adopt. Advance: Resiliency in Natural Resource Management" in Bangor, ME *March 8-10*
- With Dr. Jeffrey Ward, presented a research poster on "Oak Success Following Regeneration Harvesting" at the NESAF annual meeting in Bangor, ME (25 attendees) *March 9*
- Participated in the quarterly meeting of the Connecticut State Consulting Committee for Agricultural Science and Technology Education, and provided an update on CAES research (2 teachers, 5 administrators) *March 15*
- Co-organized the 2017 Connecticut AgriScience Fair and led student tours (44 students, 10 teachers) *May 4*
- Participated in the quarterly meeting of the Connecticut State Consulting Committee for Agricultural Science and Technology Education, and provided an update on CAES research (8 attendees) *May 9*
- Participated in the Yankee Division SAF Meeting in Vernon *May 26*
- Participated in the Executive Committee meeting of the New England Society of American Foresters in Concord, NH *June 21*

BLEVINS, TIA M.

- Attended the 2016 HIS Interstate Inspection held in Concord, NH. Participants visited a brand new, state of the art, hydroponic facility for edible baby greens and toured NH's largest wholesale nursery. The group also conducted a mock systems audit of the newest SANC Phase II pilot nursery (and current USCGCP participant). Presentations from associated organizations included a demonstration of NHBugs.org: How and why it works for NH; a visual presentation of NH upland invasive species; and a short talk about management of Japanese stiltgrass: the industry perspective (16 participants) *October 18-20, 2016*
- Participated in the 43rd Annual Horticultural Inspection Society - Eastern Chapter's meeting in Martinsburg, WV. As Archivist, she presented the archival report to the members (19 participants) and toured the USDA Agricultural Research Service Laboratory at the Appalachian Fruit Research Station (76 participants) *April 3-6, 2017*

BOMBA-LEWANDOSKI, VICKIE M.

- Attended and hosted a CAES booth at the 97th Annual Connecticut Farm Bureau Annual Meeting, Fantasia, North Haven *November 18, 2016*

- Participated in FE3 (Facilitating Environmental Excellence) Facilitator Training, Electronic Seminar and Training for FE3 *December 13*
- Hosted a tour from Norwich Technical High School (20 students and 3 teachers) *December 20*
- Attended and presented the CAES booth at the Connecticut Vegetable & Small Fruit Growers' Conference held at Maneeley's Conference Center in South Windsor *January 9, 2017*

BRACKNEY, DOUGLAS E.

- Gave the talk "The Influence of Genetic Bottlenecks, RNAi-mediated Diversification, and Selective Constraints on Powassan Virus Evolution" at the 65th Annual American Society of Tropical Medicine and Hygiene in Atlanta, GA (approx. 100 attendees) *November 13, 2016*
- Presented the poster "The Role of Autophagy During Dengue Virus, Zika virus and Chikungunya Virus Infection of *Aedes aegypti* Mosquitoes" at the Cellular Stress Responses and Infectious Agents Keystone Symposium in Santa Fe, NM *December 4-8*

BRAVO, JOAN L.

- Spoke on "How to Improve Yields through Pruning to Obtain Balanced Vines" at the Connecticut Farm Wine Development Council's Research and Education Twilight Meeting for Connecticut Wineries and Vineyards at Paradise Hills Vineyard & Winery in Wallingford (63 attendees) *August 9, 2016*
- Spoke with the new owners of Franklin Vineyard on best training methods, drainage procedures, and trellising systems for the 10,000 newly planted vines *April 11, 2017*

BUGBEE, GREGORY J.

- Spoke on "Invasive Aquatic Plants in Coventry Lake" at a town meeting held at the Coventry Lake Lodge (approx. 75 attendees) *July 13, 2016*
- Spoke on "CAES IAPP Surveys of Bashan Lake and Control of Phragmites" at a meeting of The Bashan Lake Association in East Haddam Grange Hall (approx. 90 attendees) *July 27*
- Was interviewed by Katrina Koerting of the Danbury News Times on invasive aquatic plants in Candlewood Lake http://www.newstimes.com/local/article/Scientist-One-of-the-worst-milfoil-seasons-at-9132399.php *August 9*
- Spoke on "Invasive Aquatic Plants in Candlewood Lake" at a multi-town meeting held at the Danbury Town Hall (approx. 40 attendees) *September 7*
- Gave a demonstration on invasive aquatic plants of Connecticut at the Southeast Connecticut Federation of Lakes Conference at Connecticut College in New London (approx. 40 attendees) *September 17*
- With Jennifer Fanzutti, gave a demonstration on invasive aquatic plants at the Connecticut Invasive Plant Working Group conference at the University of Connecticut in Storrs (approx. 500 attendees) *October 11*
- Gave a talk in the CAES Seminar Series entitled "Invasive Aquatic Plants – The State of the State" (approx. 50 attendees) *October 19*
- Gave an update on "Connecticut's Invasive Aquatic Plant Problems" to the Connecticut Invasive Plant Council at the CT Department of Agriculture in Hartford (approx. 20 attendees) *November 15*
- Gave a talk entitled "Pond Problems - A Growers Guide to Taming the Beast" at the Connecticut Pomological Society Annual Meeting in Glastonbury (approx. 120 attendees) *November 29*
- With Ms. Jennifer Fanzutti, hosted a meeting of the Northeast Aquatic Nuisance Species Panel in Jones Auditorium and greeted the panel with a talk on the history of CAES (approx. 20 attendees) *November 30*
- Gave a talk entitled "CAES Surveys of West Lake, Guilford" at the Guilford police station (approx. 40 attendees) *November 30*

- Gave the talk “Invasive Aquatic Plants: The State of the State” at a meeting of the Northeast Nuisance Aquatic Species Panel in Jones Auditorium (approx. 20 attendees) *December 1*
- Hosted and gave welcoming remarks to a meeting of the Connecticut and Massachusetts Water Chestnut Working Group at the Valley Laboratory (approx. 40 attendees) *December 7*
- With Ms. Jennifer Fanzutti, gave an Aquatic Plant Workshop to CT DEEP staff at the CT DEEP water monitoring facility in Windsor (approx. 12 attendees) *December 13*
- Gave the talk “The Battle for Connecticut’s Largest Lake – Controlling Eurasian Watermilfoil with Winter Drawdown, Weevils and Grass Carp” at the 2017 Northeast Aquatic Plant Management Society Conference in New Castle, NH (approx. 150 attendees) *January 1, 2017*
- With Jennifer Fanzutti, gave a workshop on Invasive Aquatic Plants at the 2017 Envirothon in East Hartford (approx. 55 attendees) *January 14*
- Spoke to the Ajello’s Pond Association in Seymour on “Controlling Aquatic Vegetation” (11 attendees) *January 18*
- Gave a seminar on “Soil Health” as part of the “Accelerated Arboriculture Program” at the Bartlett Arboretum in Stamford (approx. 12 attendees) *February 8*
- Presented the results of the “CAES IAPP 2016 Monitoring of Mamanasco Lake” at the annual Mamanasco Lake Association meeting in Ridgefield (approx. 50 attendees) *March 9*
- Gave a talk entitled “Connecticut's Invasive Aquatic Plant Problem - The State of the State” at the annual meeting of the Northeast Association of Environmental Biologists in Hartford (approx. 75 attendees) *March 16*
- With Mr. Michael Cavadini, proctored the invasive species event at the 2017 Science Olympiad in Farmington (approx. 50 attendees) *March 18*
- Presented the results of the “CAES IAPP 2016 Survey of Bushy Pond” at the Bushy Pond Board of Directors meeting in Clinton (12 attendees) *March 21*
- With Amanda Massa, gave an Invasive Aquatic Plant Workshop at Three Rivers Community College in Norwich (approx. 50 attendees) *March 22*
- Presented the results of CAES IAPP surveillance and monitoring of Lakes Candlewood, Lillinonah, Zoar and Squantz Pond to the FirstLight Power Resources Technical Committee in New Milford (approx. 18 attendees) *March 24*
- Gave a talk on “Soils and Fertilizers” as part of the Institute for Learning in Retirement’s Care and Maintenance of Landscape Plants seminar series at CAES (approx. 12 attendees) *April 19*
- Hosted the 2017 Connecticut Federation of Lakes Conference at CAES and gave a brief history of CAES and the talk “Connecticut’s Invasive Plant Problem–the State of the State” (approx. 110 attendees) *April 29*
- Participated as a judge at the Future Farmers of America Science Fair held in Jones Auditorium *May 4*
- Gave a talk on composting to the Bethany Garden Club at the Bethany Town Hall (approx. 25 attendees) *May 8*
- Spoke on “Soil Testing” and “Invasive Aquatic Plants” as part of the Experiment Station Associates CAES Tour (approx. 10 attendees) *May 24*
- With Amanda Massa, gave a presentation on Invasive Aquatic Plants to a group of high school teachers at Bashan Lake in East Haddam (approx. 12 attendees) *June 19*
- Gave the talk “The Aquarium Trade as Source of Invasive Aquatic Plant Invasions” at the Long Island Invasive Species Managements Area Conference in Brentwood, Long Island (approx. 50 attendees) *June 22*

CAVADINI, MICHAEL J.

- With Mr. Gregory J. Bugbee, proctored three invasive species exams for the CT Science Olympiad in Farmington (30 middle school participants) *March 18, 2017*

- Presented information about the field of analytical chemistry and CAES's work in PCB analysis to students at the North Branford High School Environmental Science Fair (~30 student and 5 adult attendees) *May 19*

CHEAH, CAROLE A.

- Gave a talk on HWA biological control at the Nursery and Landscape Research Tour at the Valley Laboratory (15 attendees) *September 15, 2016*
- Gave a talk on HWA biological control to the Men's Breakfast Club, McAuley's Assisted Living Community (30 attendees) *September 21*
- With Ms. Donna Ellis of the University of Connecticut, assisted by Mr. Emmett Varricchio, summer research assistant at the Valley Laboratory, presented a poster on Connecticut's program for biological control of mile-a-minute weed at the Connecticut Invasive Plant Working Group Symposium held at UConn in Storrs *October 11*
- Presented a talk on climate change influence on hemlock woolly adelgid at the 2017 Winter Symposium and Expo of the Connecticut Nursery and Landscape Association in Southington (15 attendees) *January 25, 2017*
- Presented a talk on climate change influence on mile-a-minute and hemlock woolly adelgid biological control at the Forest Health Monitoring Workshop held in Jones Auditorium (50 attendees) *March 7*
- Presented a talk on climate change impacts on hemlock woolly adelgid biological control at the North East Natural History Conference in Cromwell (65 attendees) *April 23*
- Spoke about climate change influence on biological control of hemlock woolly adelgid at the Connecticut Association of Biology Teachers Conference at Northwest Community College in Winsted (20 attendees) *April 29*
- Staffed a CAES booth on invasive insect threats to Connecticut forests and presented a talk on hemlocks and the biological control program for HWA at the 47th Barkhamsted Earth Day Nature Festival (55 attendees) *April 30*
- Gave an overview of the importance of hemlock habitat to breeding bird species to members of the Friends of America Legion and People's State Forests (FALPS) and others, and to plan for volunteer birder surveys of hemlock stands in state forests at DEEP Forestry Headquarters at Pleasant Valley, Barkhamsted (10 attendees) *May 5*
- Was interviewed about the *S. tsugae* biological control release at the Pachaug State Forest in Voluntown by Judy Benson of the New London Day *June 12*
- Presented an overview on the effects of winters on HWA and the biological control program in CT to Great Mountain Forest forestry interns and GMF Forest Manager, Jody Bronson at the GMF Headquarters in Norfolk (4 attendees) *June 15*
- Was interviewed by Marven Moss of the Monroe Courier on the *S. tsugae* biological control release at Webb Mountain Park, Monroe *June 16*
- Was interviewed for a report in the Litchfield County Times on the June 16, 2017 release of *S. tsugae* for biological control of hemlock woolly adelgid at the Mine Hill Preserve, Roxbury Land Trust *June 22*
- Hosted an evening summary meeting with Ralph Scarpino, President of FALPS, with volunteers who had conducted breeding bird surveys in June in hemlock stands at the People's and American Legion State Forests at the DEEP Pleasant Valley offices, Barkhamsted (8 attendees) *June 26*

COWLES, RICHARD S.

- Met with the Hartford Tree Commission to discuss the economics of ash and emerald ash borer management in Hartford (8 attendees) *July 6, 2016*
- Presented "Neonicotinoids and Pollinator Health" to the Connecticut Tree Protective Association at their summer meeting in Farmington (180 attendees) *July 21*

- Provided a webinar presentation to the Second Annual Hemlock Woolly Adelgid Program Managers' Meeting (physically held in Ithaca, NY) on "Insecticide Efficacy and Pollinator Impacts" (50 participants) *July 26*
- Presented the Barn Exhibit "Neonicotinoid Exposure of Honey Bees" at Plant Science Day at Lockwood Farm in Hamden *August 3*
- Discussed "Insect pests of Christmas trees" at the CT Christmas Tree Growers' meeting in Oxford (40 attendees) *August 17*
- Participated with the ceremonial signing of the bill "An Act Concerning Pollinator Health" at the Governor's office (25 attendees) *August 30*
- Presented "Neonicotinoid insecticides research results" at the Valley Laboratory Nursery and Landscape Research Tour in Windsor (20 attendees) *September 15*
- Spoke on "Emerald ash borer management" to the Public Works committee for the City of Hartford (12 attendees) *September 15*
- Spoke on "Chemical control of emerald ash borer" at an EAB workshop hosted by the Connecticut Tree Protective Association in Monroe (60 attendees) *September 22*
- Presented "Pollinators and Alternatives to Neonics" at the Northeast Pesticide Applicator Certification and Training Conference (a conference for state pesticide extension specialists) in Amherst, MA (25 attendees) *October 25*
- Presented "Push-pull and pest management," at Dr. James Miller's retirement celebration, East Lansing, MI (120 attendees) *November 7*
- Spoke on "Neonics and Bees" at the CTEC meeting, Plantsville (200 attendees) *November 22*
- Presented "Weevils Wobble but Don't Fall Down: Annual Bluegrass Weevil Management," and "Neonics, Bees, and Trees," at the Ohio Turfgrass Foundation educational seminars in Columbus, OH (120 attendees) *December 7*
- Presented "Neonics, Bees, and Trees," at the Valley Green educational seminars, Ledyard (100 attendees) *December 14*
- Discussed "A Case Study for Tipping Point Dynamics: Neonics, Bees, Marketing, and Legislation," at the Connecticut Vegetable & Small Fruit Growers' Conference in South Windsor (275 attendees) *January 9, 2017*
- Presented "Cyclical, Emerging and Disappearing Pests" to the New York Nursery and Turf Association educational conference in Yonkers, NY *January 11*
- Talked about "Cyclical, Emerging and Disappearing Pests," at the SiteOne educational seminars in Darien and Cromwell (total of 200 attendees) *January 17 and 18*
- Presented "Neonics and Bees," and "Neonicotinoid Alternatives" at the CT Greenhouse Growers Association educational conference in New Haven (60 attendees) *January 19*
- Spoke on "Neonic Update, and Neonic Alternatives" at Prides Corner Nurseries (40 attendees) *January 23*
- Presented "Cyclical, Emerging and Disappearing Pests" (150 attendees) and "Making the right choices" (100 attendees) at the CT Nursery and Landscape Association winter educational meeting in Southington *January 25*
- Presented "Neonics and Bees, Is It Time to Change?" at the New Jersey Vegetable Growers Association meeting in Atlantic City, NJ (80 attendees) *February 7*
- Discussed "Neonics and Bees" for the CAES Seminar Series (60 attendees) *February 15*
- Presented "Neonicotinoid Update, and What the Rockettes Have to do with Your Business" at the CT Grounds Keepers Association winter meeting in Cromwell (300 attendees) *February 23*
- Presented "Insect and Specialty Crop Block Grant update" at the CT Christmas Tree Growers Association Annual Meeting, Middletown (50 attendees) *March 4*
- Presented "Honey Bee Health, and the SCBG Project" to the CT Beekeepers Association meeting, New Haven (40 attendees) *April 8*

- Discussed “Conserving Eastern Hemlock” at the CT Chapter of the Appalachian Mountain Club annual meeting in Wallingford (50 attendees) *April 8*
- Presented “Soil Acidification to Manage Phytophthora and Insect Management” to the CT Christmas Tree Growers Association, Brooklyn (55 attendees) *June 7*
- Was interviewed by Patrick Skahill from NEPR on the subject of genetic improvement of honey bees, Hamden *June 14*
- Discussed “Insecticide Trial for Managing Gypsy Moths” at the RI Nursery and Landscape Association meeting, Kingston, RI (30 attendees) *June 21*
- Discussed “Soil Acidification to Manage Phytophthora and Insect Management” at Cornell University’s Westchester County twilight meeting for Christmas tree growers, Yorktown Heights, NY (15 attendees) *June 27*

CREIGHTON, MARK H.

- Set up a honey bee educational booth in the Connecticut Building at the Big E in West Springfield, MA (several hundred attendees visited the booth) *September 22, 2016*
- Manned the CAES booth and set up a honey bee education table (538 attendees visited the booth) *September 24*
- Attended the Connecticut Beekeepers Association fall meeting held in Jones Auditorium. Registration forms were collected and he spoke to several beekeepers on bee health related issues *October 22*
- Spoke with students at John Winthrop Middle School in Deep River on pollinator health *November 9*
- Attended the Southern Beekeepers Assembly in Groton and discussed bee health related topics (spoke with 200 attendees) *November 19*
- Attended a workshop at the Wallingford Zoning Board and provided information and comments as they develop a Beekeeping Ordinance *November 21*
- Met with students from the Common Ground High School at West Rock Nature Center to continue site preparation for a new apiary *December 1*
- Met with an honors student on a honey bee research project at the Woodbridge Library *December 8*
- Presented a talk with beekeepers on the strategies for overwintering honey bee colonies in CT (38 attendees) *December 18*
- Presented a talk on “Honey Bee Health” at the 2017 Connecticut Beekeepers Association Bee School held in Jones Auditorium (108 attendees) *January 21, 2017*
- Spoke on the role of honey bees in pollination at the Milford Women’s Club in Milford (30 attendees) *February 6*
- Spoke about honey bees at the Connecticut Beekeepers Association meeting held at CAES (98 attendees) *February 11*
- Spoke before the Wallingford Zoning Commission on a proposed change in a local ordinance to allow beekeeping within the town, which passed 7 to 0, allowing beekeepers to have two hives on properties under 5 acres *February 15*
- Was interviewed by The Events Magazine for the Town of Old Lyme on bees and beekeeping *February 17*
- Spoke with The New Haven Land Trust and received permission on having students from the Youth Minority Beekeeping initiative to develop and maintain apiaries at Community Gardens in New Haven *February 20*
- Was interviewed by Matthew Zabierk of the Record Journal on bee health related topics *February 21*
- Staffed a booth at the Hartford Garden and Flower Show and provided information about CAES programs and honey bee information (several hundred attendees visited the booth) *February 23-25*
- Spoke at Shagbark Lumber and Supply in East Haddam on preparing honey bees for the spring and on bee health topics (40 attendees) *February 25*

- Spoke with 2nd grade students at EASTCONN School in Hampton on the role of bees and pollination (80 student attendees) *March 1*
- Was invited by Dr. Susan Cusato of Southern Connecticut State University in New Haven to speak with her honors class on the role that bees play in our environment and the use of bees in pollination of agricultural crops (20 students) *March 2*
- Spoke on honey bee health related topics to new beekeepers at the Connecticut Beekeepers Association's Third Bee School at Housatonic Valley High School in Falls Village (120 attendees) *March 11*
- Attended the Backyard Beekeepers Association meeting in Weston for a talk presented by Dr. Carl Jurka on Rearing Queens in the Northeast and spoke to beekeepers about honey bee registration (spoke with 180 attendees) *March 28*
- Spoke to 3rd grade students at EASTCONN School in Hampton on the role of bees and pollination (65 students) *March 30*
- At the request of Mr. Terry Grant, made a presentation at Green Hill School in Bristol to 8th grade students and faculty on the merits of establishing an Apiary and a beekeeping program at the school (15 students) *March 31*
- Spoke about honey bee health issues and a queen rearing grant at the Connecticut Beekeepers Association meeting held in Jones Auditorium (60 attendees) *April 8*
- Participated in a panel and spoke at the Sustainability Symposium on bees at Central Connecticut State University in New Britain (80 participants) *April 13*
- Set up a bee information table for an Arbor Day event at the UCONN Storrs campus and discussed honey bee related topics (spoke with 80 students) *April 18*
- Spoke at the Hamden County Beekeepers Association Bee School in Chicopee, MA on our honey bee registration program and Queen Rearing Project (approx. 80 attendees, many from Connecticut) and also met with the Chief Apiary Inspector for Massachusetts and discussed how our programs may collaborate in the future *April 20*
- Attended an Earth Day event titled "Science Matters" at the Old Town Hall in East Haddam and staffed an information booth on CAES programs and honey bee topics (spoke with approx. 49 visitors) *April 22*
- Spoke at Lake Street School in Vernon about honey bees and their role in pollination (22 student attendees) *May 1*
- Was interviewed by the Hartford Courant on bee health issues; the story appeared on the cover page of the Sunday edition *May 2*
- Spoke at the East Hartford Garden Club on bee health and pollination (70 attendees) *May 15*
- Attended the Backyard Beekeepers Annual meeting and spoke to 90 members on bee health and the state honey bee registration program *May 23*
- Spoke to the Backyard Beekeepers Association about bee health issues (110 attendees) *May 30*
- Attended the Connecticut Beekeepers Summer meeting at Lockwood Farm in Hamden and demonstrated several methods on mite detection in honey bee hives to approx. 65 members *June 10*
- Was interviewed by Vanessa De La Torre from the Hartford Courant for an article on Schools and Beekeeping *June 11*
- Spoke about beekeeping in general and about the beekeeping program at Common Ground High School and at West Rock Nature Center *June 11*
- Attended a Common Council meeting in West Hartford and spoke to city leaders on a pending Beekeeping Ordinance change that would allow beekeeping in West Hartford; the ordinance passed by a majority vote *June 13*
- With Dr. Richard Cowles, was interviewed at Lockwood Farm by Patrick Skahill from National Public Radio on our Honey Bee Queen rearing project to develop a Connecticut specific queen with mite tolerance genetics *June 14*

- Spoke about honey bees and their role in pollination to residents at Elmwood Hall Senior Center in Danbury (25 attendees) *June 15*

CUI, ZHOUQI

- Presented "Dynamic Expression of T3SS Genes in Single Cells of *Dickeya dadantii* During the Interaction with Potato" at the inaugural New Haven Plant Symposium held in Jones Auditorium (40 attendees) *May 26, 2017*

DE LA TORRE-ROCHE, ROBERTO

- Gave a presentation entitled "Trophic Transfer of Engineered Nanoparticles in Terrestrial Food Chains" for CAES staff and scientists in Jones Auditorium *July 28, 2016*
- Attended and gave a lecture entitled "Trophic Transfer of Engineered Nanoparticles in Terrestrial Food Chains" at the American Phytopathological Society (APS) Annual Meeting held in Tampa, FL *July 30-August 1*
- Attended the 13th International Phytotechnology Conference in Hangzhou, China and gave a lecture entitled "Engineered Nanomaterials and Agricultural crops: Co-contaminant Interactions" *September 26-28*
- Spoke to 5th and 6th graders from Fair Haven public schools about nanoparticles at the Station (30 youths and 6 adults) *March 30, 2017*
- Met with Professor Philip Demokritou and staff from Harvard University's T.H. Chan School of Public Health to discuss nanoparticle related research and also attended a lecture given by Dr. Jason White entitled "Engineered Nanomaterials in Agriculture: Implications and Application" *May 3*

DUGAS, KATHERINE

- Attended the Connecticut Nursery and Landscape Association summer meeting at Monrovia Nursery in Granby and staffed a Cooperative Agricultural Pest Survey table *July 20, 2016*
- Attended the Connecticut Tree Protective Association summer meeting at the Farmington Club in Farmington and staffed a CAES table *July 21*
- Staffed a Forest Pest table at the East Haddam Farmers' Market *July 27*
- Set up and staffed a Forest Pest display booth at the Woodstock Fair *September 2-5*
- Gave a talk to the Woodbridge Garden Club about pests and beneficial insects in the garden *September 13*
- Gave a talk at Flanders Nature Center in Woodbury about insect pollinators and biological control *September 15*
- With Mr. Mark Creighton and Ms. Rose Hiskes, staffed a joint Forest Pest/Honey Bee booth in the Connecticut Building at the Big E in West Springfield, MA *September 22*
- With Mr. Mark Creighton and Mr. Joseph P. Barsky, staffed a CAES booth at the Durham Fair *September 23-25*
- Gave a talk about forest pests to the CT Chapter of the Hardy Plant Society in Wethersfield *September 28*
- Attended and staffed a CAES/CCABB booth at the University of Bridgeport Health and Wellness Fair *October 27*
- Assisted Dr. Gale Ridge with Bed Bug Forum X, "Bed Bugs Meet the Law," held at Quinnipiac University *November 8*
- With Dr. Kirby Stafford III and Dr. Victoria Smith, attended and ran the State CAPS Committee meeting in Jones Auditorium (12 participants) *November 10*

- Attended the CT Tree Protective Association Winter Meeting in Watertown, and staffed a CAPS and Forest Pest booth *January 19, 2017*
- Attended the CT Nursery and Landscape Association Winter Meeting in Watertown, and staffed a CAPS and Forest Pest booth *January 25-26*
- Staffed the CAES booth at the CT Flower Show in Hartford. The display included Station information, a display on honey bees, and invasive insects *February 24-25*
- Attended the Forest Health Monitoring Workshop held in Jones Auditorium and gave a short talk entitled "CAPS Survey Targets for 2017" *March 7*
- Attended the Master Gardener Association Annual Symposium held at Connecticut College in New London and staffed a table covering CAES, including Forest Pest and CAPS program information (150 attendees) *March 18*
- Staffed a display table at the Hunting and Fishing Expo at the CT Convention Center in Hartford. The table covered invasive insect topics, including Forest Pests and Don't Move Firewood *March 31-April 2*
- Staffed a Forest Pest Outreach booth at North Haven Earth Day (100 people stopped by the booth) *April 8*
- Staffed a Forest Pest Outreach booth at Hamden Earth Day (200 people stopped by the booth) *April 22*
- Attended the CT Tree Wardens Association 25th Anniversary Meeting held at the Omni Hotel in New Haven. Topics discussed with tree wardens included the spread of EAB, invasive insects, and the prospects of gypsy moth activity in the state for 2017 *April 28*
- Organized and ran the Statewide CAPS committee meeting held in Slate Board Room (12 attendees) *May 17*

DURGY, ROBERT J.

- Attended as a member of the steering committee and ran the audiovisuals at the Connecticut Vegetable & Small Fruit Growers' Conference in South Windsor (273 attendees) *January 9, 2017*
- Taught Vegetable Production for Small Scale Farming in Windham (40 attendees) *February 4*
- Taught a University of Connecticut Master Gardener Program class on vegetables in Bloomfield (46 attendees) *February 8*
- Taught a University of Connecticut Master Gardener Program class on vegetables in Haddam (51 attendees) *February 14*
- Taught a University of Connecticut Master Gardener Program class on vegetables in Bethel (44 attendees) *February 23*
- Taught a University of Connecticut Master Gardener Program class on vegetables in Stamford (31 attendees) *February 27*
- Taught Math Calculations and Calibration for Pesticide Applicator's Training in West Hartford (46 attendees) *February 21*
- Attended a meeting of the steering committee for the Connecticut Vegetable & Small Fruit Growers' Conference in preparation for next year's meeting in Vernon *March 22*
- Taught Vegetable Production for Small Scale Farming in Bridgeport (13 attendees) *March 25*
- Participated in Griswold High School Career Day and discussed opportunities in environmental science with students (55 attendees) *April 6*
- Taught a University of Connecticut Master Gardener Program class on vegetables in Brooklyn (26 attendees) *April 14*

EITZER, BRIAN D.

- Was the program co-chair and presided over a session on Advanced Analytical Techniques at the 53rd Annual North American Chemical Residue Workshop in St. Petersburg Beach, FL (350 attendees) *July 23-28, 2016*
- Presented a talk entitled "Analysis of Pesticide Residues in Pollens and Nectars from Plants at Ornamental Nurseries and Bee Collected Pollen at Those Nurseries" at the American Chemical Society's 252nd National Meeting held in Philadelphia, PA (30 attendees) *August 21*
- Presented a talk on "Evaluating the Risk Pesticide Use Poses to Honey Bees" at the American Bee Research Conference (100 attendees) and attended the PI meeting for the Multi-State Hatch "Sustainable Solutions to Problems Affecting Bee Health" in Galveston, TX *January 12-13, 2017*
- Was a participant in the FDA Agricultural Foods Regulatory Program Standards face to face meeting in Mobile, AL *January 18-19*
- Was an instructor for the course "LB511 FDA/FERN Training for LC-MS" held in Cincinnati, OH (12 attendees) *April 17-21*

ELMER, WADE H.

- Gave an invited presentation titled "Metal Oxide Nanoparticles for Management of Verticillium Wilt of Eggplant and Fusarium Wilt of Watermelon" (88 attendees), attended the Widely Prevalent Fungal Working Group, and participated in the APS Academic Unit Leaders Forum at the Annual Meeting of the American Phytopathological Society (APS) in Tampa, FL *July 31-August 2, 2016*
- Was interviewed by Dr. Richard Massey of The Royal Society of Chemistry's (RSC) members' magazine *Chemistry World* about his recent *RSC Environ Nano* article on nanoparticles on vegetable diseases *August 11*
- Was interviewed by Jan Spiegel of the CT Mirror about nanoparticles in agriculture *August 17*
- Co-hosted the CT Greenhouse Grower's Association meeting in Jones Auditorium (25 adult attendees) *August 30*
- Attended the Extension/Industry Meeting at the annual meeting of the Northeastern Division of the American Phytopathological Society in Ithaca, NY, chaired the Graduate Student Award session, and presented the talk "Nanoparticles of Micronutrients Suppress Fusarium Wilt of Watermelon" (23 attendees) *October 19-21*
- Was interviewed by Jan Spiegel of the CT Mirror on his research program using nanoparticles to suppress plant diseases *October 25*
- Presented a talk entitled "Biocontrol options for management of soilborne pathogens in ornamentals" to the 2016 Advanced Biocontrol School sponsored by Penn State Extension in Lancaster, PA (45 attendees) *November 3*
- With Dr. Jason White, was interviewed by Ms. Anna Bisaro of the New Haven Register on the use of nanoparticles to suppress plant diseases *December 9*
- Attended the Pesticides and Roast Beef Meeting of the Connecticut Greenhouse Grower's Association and participated in the annual meeting (52 attendees) *January 19, 2017*
- Participated in Ms. Cora McGehee's Masters committee meeting in the Department of Plant Science at University of Connecticut in Storrs *January 31*
- Visited the University of Texas in El Paso to present a seminar entitled "Use of Nanoparticles to suppress soilborne diseases of vegetables" (21 students and 4 adults) and conferred with Mr. Ishaq Adisa, a graduate student, on a joint project *February 16*
- Attended the BIT World Conference on Smart Materials in Bangkok, Thailand, chaired the session "Nanotechnology in the Environment," and presented the talk "Nanoparticles of Plant Micronutrients Suppress Root Disease and Enhance Yield of Vegetables" (12 attendees) *March 17*
- Visited staff and faculty at Chiang Mai University in Chiang Mai, Thailand, and presented the seminar "Nanoparticles of CuO suppress soilborne diseases of vegetables" (29 students and 4 adults) *March 21*

- Participated in a "Meet and Greet" session with undergraduate students of Southern Connecticut State University (15 students and 8 adults) *March 29*
- Served as a judge for the Sigma Xi Science fair at Quinnipiac University (30 students participated) *April 19*
- With Dr. Jason White, was interviewed by Jan Spiegel of the CT Mirror on the NIFA Nanoparticle grant *April 26*
- Hosted Dr. Ben Niu from Harvard Medical School *May 17*
- Presented a webinar to the Center for Sustainable Nanotechnology on "How nanoparticles of micronutrients can affect plant disease resistance" (22 attendees) *May 24*
- Was interviewed by Jan Spiegel of the CT Mirror on how nanoparticles suppress plant diseases *June 12*

FANZUTTI, JENNIFER M.

- With Mr. Gregory Bugbee, spoke about invasive aquatic plant identification to CT DEEP staff at the CT DEEP water monitoring facility in Windsor (approx. 12 attendees) *December 13, 2016*

FERRANDINO, FRANCIS J.

- Presented the results of his winegrape research at CAES over the past eight years at The Connecticut Farm Wine Development Council's Research and Education Twilight meeting for Connecticut Wineries and Vineyards at Paradise Hills Vineyard & Winery in Wallingford (63 attendees) *August 9, 2016*
- Attended the Extension/Industry Meeting at the annual meeting of the Northeastern Division of the American Phytopathological Society in Ithaca, NY and presented the talk "Winegrape cultivar trials in Connecticut: 2012-2015" (25 attendees) *October 19-21*
- Participated in a special meeting of the Connecticut Wine Council at Department of Agriculture Building in Hartford to discuss an off-season (winter) educational program that would feature an enologist *November 3*
- With Ms. Joan Bravo, visited a 10,000-vine new vineyard at Franklin Farms in North Franklin to discuss pruning, training, drainage issues, and proper trellising for 2nd-year winegrape transplants *April 11, 2017*

HISKES, ROSE T.

- Organized and spoke at the Nursery and Landscape Research Tour at the Valley Laboratory in Windsor (18 attendees) *September 15, 2016*
- With Ms. Katherine Dugas and volunteer Daria Chamerda, led a team of Vernon Greenways volunteers along the Rail Trails in Vernon to look for Emerald Ash Borer and Asian Longhorned Beetle on maple, ash, willow, horse chestnut, birch, and elm trees (5 volunteers) *September 17*
- With Ms. Katherine Dugas and Mark Creighton, staffed a Station booth at the Big E in West Springfield, MA *September 22*
- Served on the planning committee and moderated the Aquatic Invasive Plant session at the Connecticut Invasive Plant Working Group's Invasive Plant Symposium at the University of Connecticut Student Union (477 attendees) *October 11*
- With Forestry personnel, staffed a Station Booth at the Urban Forest Conference at the Aqua Turf Club in Southington *October 26*
- With Hilary Kenyon, Northeast Aquatic Research, staffed a display table of invasive aquatic plants at the Friends of Bolton Lakes meeting and Community Forum at Bolton Town Hall (53 attendees) *October 27*
- With Dr. Gale Ridge, Ms. Katherine Dugas, and Ms. Heidi Stuber, assisted with and participated in the Bed Bugs Meet the Law, Bed Bug Forum X at Quinnipiac University in North Haven *November 8*

- Participated in the Cooperative Agricultural Pest Survey (CAPS) meeting held in Jones Auditorium *November 10*
- Gave a talk on "Invasive Plants" at the Connecticut Association of Conservation and Inland Wetlands Commissions (CACIWC) Annual Meeting and Environmental Conference at the Sheraton Hartford South Hotel in Rocky Hill (73 attendees) *November 12*
- Participated in a Connecticut Invasive Plant Working Group (CIPWG) meeting in Burlington *November 29*
- Gave a talk on "Insects: The Good, the Bad, the Beautiful and the Just Plain Ugly" to the New Haven Garden Club in Jones Auditorium (68 attendees) *January 9, 2017*
- With Ms. Lindsay Patrick, staffed an Experiment Station booth at the Connecticut Grounds Keepers Association winter meeting in Cromwell *February 23*
- With Mr. Mark Creighton and Ms. Katherine Dugas, staffed an Experiment Station booth at the Hartford Flower Show *February 25*
- Participated in the Connecticut Invasive Plant Working Group steering committee meeting at the Valley Laboratory in Windsor *March 7*
- Gave a tour of the Information Office to four Suffield High School Vocational Agriculture students *April 12*
- Gave a tour of the Information Office to 5th graders visiting the Valley Laboratory for Arbor Day and a tree planting (15 students and 15 adults) *April 28*
- Gave a talk on "The Silent Invaders" at the Simsbury Library (9 attendees) *May 4*
- Gave a short talk and walk on "Gypsy Moth in our Forests" to the Northern Connecticut Land Trust group at the Glover property in Somers (10 attendees) *May 13*
- Participated in the Cooperative Agricultural Pest Survey (CAPS) meeting in New Haven *May 17*

HSIEH, HSIN-SE

- Gave a talk "Activated carbon-mediated alkaline hydrolysis of alkyl halides (methyl bromide)" at the American Chemical Society National Meeting in Philadelphia PA (approx. 150 attendees) *August 22-24, 2016*

LAMONDIA, JAMES A.

- Participated in the Journal of Nematology Editorial Board meeting and presented a poster entitled "Evidence for Suppression of *Meloidogyne hapla* by *Pasteuria* sp. in Connecticut" at the joint meeting of the Society of Nematologists and the Organization of Nematologists of Tropical America held in Montreal, Quebec *July 17-22, 2016*
- Was interviewed about the effects of drought on crops in Hartford County by Greg Hladky of the Hartford Courant *July 26*
- With Dr. Jatinder Aulakh, Dr. DeWei Li, Ms. Rose Hiskes, and Ms. Diane Riddle, conducted a tour of the Valley Laboratory and spoke about research programs and services to an Environmental Monitoring Science class from Goodwin College (10 attendees) *July 26*
- Presented a poster about research titled "Susceptibility of *Buxus* Accessions to the Boxwood Blight Pathogen *Calonectria pseudonaviculata*" and participated in the APS Division Forum Representatives meeting and the Nematology Committee meeting at the annual meeting of the American Phytopathological Society in Tampa, FL *July 30-August 2*
- Was interviewed about hops research by Alison Kuznitz and Johnathon Henninger for the Connecticut Post *August 3*
- Was interviewed with Katja Maurer about hops research by Nicholas Leahey for the Journal Inquirer *August 16*
- Was interviewed about hops research and resurgence in CT by Sarah Page Kyrcz for the Shoreline Times *August 29*

- Examined candidates for the Connecticut arborist license and participated in the quarterly meeting of the Connecticut Tree Protection Examining Board in New Haven *September 7*
- Met with State Representative Melissa Ziobron to discuss industrial hemp research *September 13*
- Spoke about developments in management of boxwood blight at the Valley Lab Nursery and Landscape Research Tour (18 attendees) *September 15*
- Spoke about "Hop Research and Production in Connecticut" to the Eastern Region International Plant Propagators Society in Hartford (65 attendees) *September 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 (42 attendees) *September 28*
- Spoke about nematode management research results at the annual meeting of the Northeast Regional Multistate Nematology Technical Committee (NE-1040) held in Burlington, VT *October 5-7*
- Presented research results during the potato cyst nematode multi-agency research call (20 attendees) *October 11*
- Attended the annual meeting of the Northeastern Division of the American Phytopathological Society held in Ithaca, NY to moderate a contributed paper session and present "Susceptibility of *Buxus* Accessions to the Boxwood Blight Pathogen *Calonectria pseudonaviculata*" (60 attendees) *October 18-21*
- Was interviewed about CAES Specialty Crop projects by Steve Jensen of the Connecticut Department of Agriculture *November 14*
- Was interviewed about the value of the broadleaf tobacco crop in Connecticut by Rebecca Murphy of the CT Department of Agriculture *November 15*
- Was interviewed about hops research and the Specialty Crop Block Grant hop project by Greg Hladky of the Hartford Courant *November 22*
- Was interviewed about malting barley research by Greg Hladky of the Hartford Courant *November 23*
- Was interviewed about hops research and the Specialty Crop Block Grant hop project by Anna Bisaro of the New Haven Register *December 6*
- Examined candidates for the Connecticut arborist license and participated in the quarterly meeting of the Connecticut Tree Protection Examining Board in New Haven *December 7*
- Spoke about Valley Lab research and services and conducted a tour of the lab and farm for Water Chestnut Practitioners *December 7*
- Was interviewed about the potential value of a new biological fungicide for tobacco by Julia Ellis for Tobacco Farm Quarterly *December 22*
- With Ms. Rose Hiskes and Ms. Diane Riddle, spoke about the Experiment Station, the Valley Laboratory, and plant pathology research to Calvin Brodersen and students from the Rockville Agriculture Education Center (10 attendees) *January 4, 2017*
- Presented a poster about "Identification and Management of the Garlic Bloat Nematode *Ditylenchus dipsaci*" at the Connecticut Vegetable & Small Fruit Growers' Conference held in South Windsor (273 attendees) *January 9*
- Participated and spoke about research results and future projects during the CT Hop Growers Association meeting held at DeFrancesco Farm in Northford (55 attendees) *January 12*
- Spoke about management of tobacco pathogens including Fusarium wilt, viruses, black shank, target spot, cyst nematodes, and blue mold and spoke about strategies to reduce pesticide residues in broadleaf and shade tobacco wrapper leaves while managing fungicide resistance (120 attendees) *February 21*
- 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 attendees) *February 22*

- Spoke about research and services at the Station and Valley Laboratory summer employment opportunities at the Central Connecticut State University Biology Department Career Fair (40 attendees) *February 27*
- Spoke to Windsor Shade Tobacco growers about management of tobacco pathogens, breeding for resistance, and strategies to reduce pesticide residues in shade tobacco wrapper leaves (7 attendees) *March 3*
- Conducted the tree identification exam and oral exams for candidates for the Connecticut arborist license and participated in the quarterly meeting of the Connecticut Tree Protection Examining Board in New Haven *March 8*
- Was interviewed about Connecticut cigar wrapper tobacco and research conducted at the Station by Nicole Wetsman, freelance science writer from New York *March 16*
- Participated in Ag Day at the Capitol, speaking about the 2016 Century Farm Award, presenting the 2017 Outstanding Young Farmer Award to Arthur Spielman, and the Agricultural Journalism Awards to Jim Altman and Josh Hartmann of Fox 61 (100 attendees) *March 17*
- Participated in a tour of Smokedown Hop Farm in Sharon (15 attendees) *March 18*
- Participated in a steering committee meeting to develop an agenda for the Connecticut Vegetable and Small Fruit Growers' Conference in Vernon *March 22*
- Welcomed participants, spoke about Station research and services, and with Mr. James Preste and CTPA Board Member Sean Redding, assisted 5th grade winners of the Arbor Day poster contest plant a hop hornbeam as a part of the CTPA Arbor Day Celebration and tree planting held at the Valley Laboratory in Windsor (15 students and 15 adults) *April 26*
- Spoke about hop production, diseases, and IPM as a part of a Hops Workshop "Growing and Using Hops" held in Portland (14 attendees) *June 5*
- Conducted oral exams for candidates for the Connecticut arborist license and participated in the quarterly meeting of the Connecticut Tree Protection Examining Board in New Haven *June 7*
- Spoke about hops research and participated in the CT Hop Growers Association Farm Tour of Pioneer Hops in Morris (15 attendees) *June 10*
- Was interviewed about the cigar wrapper tobacco crop in CT by Greg Hladky of the Hartford Courant *June 12*
- Participated in farm tours and interviews by the Connecticut Agricultural Information Council to select the Connecticut Century Farm Award *June 13*
- With Dr. Katja Maurer, was interviewed about hops and hops research in Connecticut by Mary Donoghue and Patrick O'Sullivan for Grating the Nutmeg, podcast for Connecticut Explored magazine *June 16*
- Spoke about integrated pest management of Connecticut hops at the Connecticut Hop Growers Association seminar and, with Dr. Katja Maurer, staffed a Station display at the Tradeshow/hop show, and attended the CHGA fundraiser dinner event at DeFrancesco Farms in Northford (30 attendees) *June 17*

LI, DEWEI

- Took a one-month sabbatical leave at Nanjing Forestry University (NJFU) and made two presentations, "Principles of Research Paper Writing and Publication in English" and "Major Forest Diseases and Insects in the USA" at the College of Forestry, NJFU (45 and 52 attendees, respectively). He also made two field trips to Liyang in Jiangsu province to collect fungal specimens, conducted laboratory work on the hyphomycetes, and collaborative studies on fungi associated with pine wood nematode *September 15-October 14, 2016*
- Hosted a two-day visit by Jordan McDonnell, VA Sciences, Nunawading, Victoria, Australia working on aeromycology *October 24-25*
- Was interviewed by Kimberly Janeway, a reporter from Consumer Reports, about mold problems with front-loading washing machines *November 29*

LI, YONGHAO

- Visited the Northeast Institute of Geography and Agroecology at the Chinese Academy of Sciences in Harbin, China, and discussed soilborne diseases with Dr. Yanli Xu and her researchers in the lab *July 5, 2016*
- Attended the Connecticut Tree Protective Association Summer Meeting and staffed the CAES Booth in Farmington *July 21*
- Was interviewed about boxwood blight by James Mosher, Crain's Connecticut Newsletter *July 25*
- Presented the talk "Understanding Common Plant Disease and Design Strategies" for the continuing education program for landscape architects and landscape designers in Hamden (40 adults) *August 16*
- Gave a talk entitled "Disease Management of Christmas Trees" at the CCTGA twilight meeting in Oxford (35 adults) *August 17*
- Gave a talk about foliar diseases of spruce and their control at the Connecticut Christmas Tree Growers Association annual fall meeting in Hamden (40 adults) *September 10*
- Gave two presentations entitled "Common Cultural/Disease Problems" and "White Pines in the CT Landscape" at the Nursery & Landscape Research Tour in Windsor (20 adult attendees) *September 15*
- Was interviewed about weather and fall color change in CT by Robert Miller from the News-Times *September 12*
- Assisted with the CAES booth at the 2016 Natural Resource Conservation Fair organized by the Southwest Conservation District, held at Lockwood Farm in Hamden *October 4*
- Gave a talk titled "Common Plant Health Problems" for the Milford Garden Club in Milford (20 adult attendees) *October 11*
- Gave a talk titled "Plant Health Problems in 2016" in the Industry/Extension Session at the annual meeting of the Northeastern Division of the American Phytopathological Society in Ithaca, NY (35 adult attendees) *October 19*
- Staffed the "hands-on" table with tree diseases for the Arboriculture 101 class held in Wallingford (35 attendees) *October 26*
- Visited Dr. Tingbo Jiang at the Northeast Forest University, Harbin, China, and discussed woody ornamental diseases with staff and graduate students in his laboratory (5 adult attendees) *November 1-4*
- Presented a talk titled "Houseplants – General Care and Diagnosis of Common Problems" for the Spring Glen Garden Club in Hamden (10 adult attendees) *December 12*
- With Ms. Lindsay Patrick, talked about the Plant Disease Information Office to visiting students from Norwich Technical High School during a tour of the Station (20 youth attendees) *December 20*
- With Ms. Lindsay Patrick, staffed the CAES booth at the Connecticut Tree Protective Association Annual Meeting in Plantsville *January 19, 2017*
- Presented a talk titled "Disease Management in Organic Vegetable Gardens" for the Caudatowa Garden Club in Ridgefield (25 adults) *February 14*
- With Ms. Lindsay Patrick, spoke to the Experiment Station Associates about the Plant Disease Information Office during a tour of the Station (12 adult attendees) *February 15*
- Presented a lecture titled "Tree Diseases and Their Management" for the Stamford Arboretum Arboriculture 101 Class in Stamford (7 attendees) *February 27*
- Staffed the "hands-on" table with tree diseases for the Connecticut Tree Protective Association Arboriculture 101 course in Wallingford (36 adult attendees) *March 1*
- Gave a talk titled "Disease Management" at the Connecticut Christmas Tree Growers Association 57th Annual Meeting in Middletown (60 adults) *March 4*
- Gave a talk titled "What's Happening to Eastern White Pine in the Northeast" at the Forest Health Monitoring Workshop in Jones Auditorium (50 adult attendees) *March 7*

- Gave a talk about "Vegetable Diseases and Their Management" at the CT NOFA's 35th Annual Winter Conference in Danbury (60 adult attendees) *March 11*
- Gave a talk titled "Common Diseases of Woody Ornamentals" to the Daytime Gardeners Garden Club in North Haven (10 adults) *March 28*
- Participated in the CT Nurserymen's Foundation (CNF) Scholarship Committee meeting and reviewed applications in Jones Auditorium *March 29*
- Organized a four-week 2017 spring course for the Institute for Learning in Retirement at Albertus Magnus College in New Haven and presented the first lecture in the series titled "Care and Maintenance of Landscape Plants" (8 adult attendees) *April 5*
- Talked about the Plant Disease Information Office to a group of Cub Scouts from Bridgeport (5 children and 5 adult attendees) *April 10*
- Participated in a meeting of the CT Nurserymen's Foundation Scholarship Committee and interviewed candidates for the scholarship in New Haven *April 11*
- Presented a talk titled "Pruning 101" to the Caudatowa Garden Club in Ridgefield (19 attendees) *May 2*
- Gave a talk titled "Backyard Small Fruits" to the Branford Garden Club in Branford (13 attendees) *May 2*
- Gave a talk titled "Spring and Summer Gardening Tips" to the Tower One/Tower East Garden Club in New Haven (15 attendees) *May 10*
- Discussed tree health issues with Board Members of the Edgerton Park Conservancy in Hamden *May 15*
- Gave a talk titled "Gardening Tips" at the Danbury Senior Center in Danbury *May 18*
- Presented a talk titled "Spruce Needle Casts and Their Control" at the CCTGA twilight meeting in Brooklyn (50 attendees) *June 7*
- Presented a talk titled "Disease Management in Organic Gardens" to the Heritage Village River Garden Club in Southbury (32 adult attendees) *June 21*

LINSKE, MEGAN A.

- Presented an invited lecture titled "Diversity and Dilution: The Impacts of Medium-Sized Mammal Diversity on *Borrelia burgdorferi* Prevalence in Fragmented and Unfragmented Habitats in Connecticut, USA" in the Zoonotic Disease Symposium at the International Urban Wildlife Conference at San Diego State University, San Diego, CA *June 5, 2017*

MAIER, CHRIS T.

- Presented a poster on "Longhorned Beetles (Coleoptera: Cerambycidae) of Connecticut, U.S.A." while attending the XXV International Congress of Entomology in Orlando, FL *September 25-30, 2016*
- Spoke on "Range Expansion of the Japanese Cedar Longhorned Beetle and the Viburnum Leaf Beetle" at a meeting of the Advisory Committee of the Cooperative Agricultural Pest Survey in Jones Auditorium *November 10*
- Led staff and students of the University of Connecticut on a tour of the *Magicicada* (periodical cicada) Preserve in Hamden *November 11*
- Displayed 3-year old nymphs of the periodical cicada at a meeting of the Connecticut Entomological Society in Jones Auditorium *November 18*
- Displayed the invasive spotted lanternfly and distributed fact sheets on it at the Annual Meeting of the Connecticut Pomological Society in Glastonbury *November 29*
- Displayed specimens of the spotted lanternfly and distributed fact sheets about it at the Annual Meeting of the Connecticut Tree Protective Association in Plantsville *January 19, 2017*

- Presented an invited symposium paper titled “Invasive Insects in Connecticut: Two Beetles Expand Their Range and One Bee Possibly Stages a Takeover” at the Eastern Branch Meeting of the Entomological Society of America held in Newport, RI *March 21*
- Exhibited live adults of the Japanese cedar longhorn beetle, a classic 1928 book on leafminers, and a collection of adults of tentiform leafminers at the Annual Meeting of the Connecticut Entomological Society in Jones Auditorium *April 21*
- Participated in a meeting of the Advisory Committee of the Cooperative Agricultural Pest Survey (CAPS) at the Station *May 17*

MARRA, ROBERT E.

- Attended the annual meeting of the Northeastern Division of the American Phytopathological Society in Ithaca, NY where he presided as secretary/treasurer, attended the forest tour and a tour of a private research farm, and presented “Accurately account for decay and carbon loss in trees: a novel approach using sonic and electrical-resistance tomography (SoT-ERT)” *October 18-20, 2016*
- Presented a two-hour seminar on “The Impact of Drought and Other Stressors on Important Tree Diseases of the Northeast,” to the UConn Extension Master Gardener Program (24 attendees) *November 14*
- Participated with fellow members of the Steering Committee for the Connecticut Conference on Natural Resources in a planning meeting at the University of Connecticut, Storrs to structure the 2017 Conference, to be held on March 13, 2017 on the UConn Storrs campus *December 13*
- Presented a talk on “Nondestructive Assessment of Internal Decay” at the Forest Health Monitoring Workshop in Jones Auditorium (48 adults attended) *March 7, 2017*
- Attended the Connecticut Conference on Natural Resources at the University of Connecticut and served on the Steering Committee *March 13*
- Presented the talk “Three Important Tree Diseases of the Northeast” to the Wethersfield Men’s Garden Club at the Wethersfield Community Center in Wethersfield (20 adults attended) *March 27*
- Participated in a meet-and-greet with Southern Connecticut State University undergraduate students at the Station (15 students and 8 adults attended) *March 29*
- Presented the CAES award at the New Haven Science Fair Volunteer Appreciation Dinner at Amarante’s Sea Cliff Restaurant in New Haven (75 attendees) *April 25*
- Was an invited speaker and panelist for the CT Tree Wardens Association 25th Annual Meeting at the Omni Hotel, New Haven and presented a talk titled “Drought: Impact on Trees and Implications for Management,” followed by a panel discussion (120 attendees) *April 28*
- Presented a talk titled “Fungi of the Forest” to the Branford Garden Club (60 attendees) *May 4*
- Presented an impromptu presentation to the public while analyzing elm trees for internal decay, using sonic and electrical-resistance tomography, on the National Mall in Washington, DC (17 children, 3 adults) *May 8-10*
- With Dr. Lindsay Triplett and Ms. Lindsay Patrick, served as special-award judge for the Greater New Haven Science Fair, on behalf of the CAES Special Award “for the best project related to food, plants, insects, or the environment.” Two awards were given this year, one to the 1st-grade class of Ms. Jane Hosen of the Wexler-Grant School for their presentation, “Up, Up, and Away: Which Plant Transpires the Least?” and the second to the 3rd-grade class of Ms. Andria West of the Mauro-Sheridan Interdistrict Magnet School, for their presentation “Erosion Invaders” *May 15-17*

MAURER, KATJA

- Presented a short talk titled “Hops – a new specialty crop in Connecticut” at Plant Science Day at Lockwood Farm in Hamden (200 attendees) *August 3, 2016*

- Was interviewed about growing hops in CT by Alison Kuznitz and Johnathon Henninger of the CT Post *August 3*
- Was interviewed about hops by Nicholas Leahey of the Journal Inquirer *August 16*
- Conducted a tour of the hop research plot at the Valley Laboratory and spoke about hops to the New Haven Brew Club (7 attendees) *August 26*
- Presented a talk titled "Growing Hops in Connecticut" at the Nursery and Landscape Research Tour at the Valley Laboratory (18 attendees) *September 15*
- Attended the annual meeting of the Northeastern Division of the American Phytopathological Society held in Ithaca, NY and presented two talks titled "Evaluation of hop cultivation feasibility in Connecticut based on yield, growing characteristics, and susceptibility to diseases and pests" (25 attendees) and "Fungicide sensitivity of *Calonectria pseudonaviculata*, causal agent of boxwood blight, in Connecticut" (30 attendees) *October 19-21*
- With Dr. James LaMondia, was interviewed by Mary Donohue about hops for Grating the Nutmeg – The podcast of Connecticut History (Connecticut Explored) *June 16, 2017*
- Participated in Connecticut Hop Growers Association (CHGA) Seminars and Demonstrations at DeFrancesco Farms in Northford (30 attendees) *June 17*

MAYNARD, ABIGAIL A.

- Reported on Station activities at a quarterly meeting of the Council on Soil and Water Conservation in Windsor (16 participants) *August 4, 2016*
- Reported on Station activities at a meeting of the State Technical Committee in Tolland *August 31*
- Gave two talks on composting to Sustainability classes at Hamden Hall Country Day School in Hamden (2 teachers and 25 students) *September 7*
- Judged fruits and vegetables at the North Haven Fair *September 8*
- Gave a tour of Lockwood Farm and spoke about the New Crops Program to Thomas Morgart, NRCS State Conservationist *October 5*
- Gave a tour of Lockwood Farm to the kindergarten from Hamden Hall Country Day School (16 students and 2 teachers) *October 17*
- Gave a talk on composting to Daytime Gardeners in North Haven (18 attendees) *October 25*
- Visited Rose's Berry Farm in South Glastonbury and discussed the New Crops Program *December 21*
- Reported on Station activities at a meeting of the State Technical Committee in Tolland (27 attendees) *January 18, 2017*
- Reported on Station activities at a quarterly meeting of the Council on Soil and Water Conservation (15 attendees) *January 19*
- Gave a talk on composting and utilization of compost to a Sustainability class at Hamden Hall Country Day School (16 students and 1 teacher) *February 13*
- Gave a talk on unusual garden vegetables to the Suburban Garden Club in Cheshire (53 adult attendees) *February 15*
- Gave a talk titled "Unusual Garden Vegetables" to the Caudatowa Garden Club in Ridgefield (55 adults) *April 11*
- Participated in a meeting in Wethersfield organizing and forming a new Connecticut Vegetable & Berry Growers Association (16 adults) *April 18*
- Reported on Station activities at a quarterly meeting of the Council on Soil and Water Conservation at Lockwood Farm (19 adult attendees) *May 4*
- Participated in a meeting discussing the formation of the Connecticut Vegetable and Berry Growers Alliance in Wallingford *May 16*

MOLAEI, GOUDARZ

- Hosted Dr. Kaveh Khoshnood, of the Yale School of Public Health, and Tshering Dukpa, a research scientist from Bhutan, toured the facilities, and discussed research collaboration and training of Bhutan scientists in vector surveillance *September 26, 2016*
- Was interviewed by WTNH/WCTX News8 on ticks and tick-associated diseases in Connecticut *November 16*
- Gave an invited talk, "A Feathery Tale of Close Encounters: Avian Hosts as Super-spreaders of Eastern Equine Encephalitis Virus", and co-authored an invited talk by Mr. John Shepard, "Vector-Host Interactions of Other Evil Mosquito Species at Eastern Equine Encephalitis Virus Foci" at the Annual Meeting of the Northeastern Mosquito Control Association in Falmouth, MA (180 attendees) *December 5*
- Conducted a tour of the Tick Testing Laboratory for students from Norwich Technical High School in Norwich (20 student attendees) *December 20*
- Hosted Dr. Scott Halstead, Emeritus Professor of Preventive Medicine, Uniformed Services University of the Health Sciences, to discuss research on arboviruses at CAES *February 10, 2017*
- Hosted members of the Experiment Station Associates in the Tick Testing Laboratory and discussed research initiatives on mosquitoes and ticks and services offered by the Laboratory (12 attendees) *February 15*
- Discussed potential research topics with a student from the Quinnipiac Frank H. Netter School of Medicine that could be performed under his direction in the Capstone mentorship program *February 24*
- Presented a short talk on his research and services offered at the CAES Tick Testing Laboratory and discussed collaborations with faculty and internship opportunities for students the Central Connecticut State University Biology Internship/Career Fair (approx. 55 attendees) *February 27*
- Presented an invited talk, "New Threats and Old Enemies: Dynamics of Vector-Host Interactions and the Emergence and Expansion of Arboviruses in the USA" at the Department of Epidemiology of Microbial Diseases, Yale School of Public Health (approx. 60 attendees) *March 2*
- Was interviewed by Jennifer Kaylin, for a Yale Medicine newsletter, on the role of mosquitoes and birds in transmission and maintenance of arboviruses in the US *March 2*
- Was interviewed by NBC Connecticut for an article on Lyme disease in Connecticut *March 7*
- Was interviewed by News 8, WTNH on worsening tick disease problems *March 8*
- Presented an invited talk, "Vector-Host-Pathogen Interactions and the Emergence and Expansion of Arboviruses" at the Biology Department, Fairfield University (approx. 25 attendees) *March 8*
- Was interviewed by the Connecticut Post on worsening tick disease problems *March 25*
- Was interviewed by NBC News 4, New York on the increase in ticks carrying Lyme *March 27*
- Was interviewed by the Journal Inquirer on ticks and tick-associated diseases *March 28*
- Was interviewed by CBS Connecticut on ticks and tick-associated diseases *March 28*
- Was interviewed by News 8, "Rough tick season expected after mild winter" http://fox61.com/2017/04/26/with-increase-in-ticks-comes-possibility-of-more-dangerous-diseases/ *April 20*
- Was interviewed by the Connecticut Radio Network on high tick abundance and prevalence of infection *April 21*
- Organized and moderated the symposium, "Challenges and Advances in Disease Vector Biology in the 21st Century," and presented a talk, "A Feathery Tale of Close Encounters: Mosquitoes, Birds, and Human Health," to the Northeast Natural History Conference 2017 (approx. 30 attendees) *April 23*
- Was interviewed on "Lunch Break's Tanya Rivero" of Wall Street Journal TV about the rapid resurgence of tick populations and tick-associated diseases https://www.wsj.com/articles/prepare-for-a-bad-summer-for-ticks-1493050961 *April 24*

- Was interviewed by Fox 61 Connecticut, "With increase in ticks comes possibility of more dangerous diseases" http://fox61.com/2017/04/26/with-increase-in-ticks-comes-possibility-of-more-dangerous-diseases/ *April 26*
- Was interviewed by the Republican-American, "We're thick with ticks; State scientists expect another boom year for the bugs, with more carrying diseases" http://www.rep-am.com/news/newslocal/2017/04/28/were-thick-with-ticks/ *April 28*
- Was interviewed by CNN, "Experts warn of increases in tickborne Powassan virus" http://www.cnn.com/2017/05/03/health/powassan-tick-virus/index.html *May 2*
- Was interviewed by NBC Channel 3, "Connecticut Scientist Predicts 'Difficult' Season for Lyme Disease" http://www.nbcconnecticut.com/news/local/Connecticut-Scientist-Predicts-Difficult-Season-for-Lyme-Disease--415618923.html *May 4*
- Was interviewed by NPR on the impact of climate change and other ecological factors on recent increases in tick abundance and prevalence of infection in northeastern USA *May 4*
- Joined WTNH-Facebook, "Facebook Live Q&A: Dr. Molaei on Ticks + Powassan Virus" https://www.facebook.com/events/1446889178943717/ to answer questions regarding ticks and tick-borne diseases *May 9*
- Joined WTNH Live, "Doctor teaches how to identify ticks" http://wtnh.com/2017/05/12/local-doctor-talks-about-identifying-tick-dangers/ *May 12*
- Was interviewed by WTNH, "Tick season ramping up in Connecticut" http://wtnh.com/2017/05/12/local-doctor-talks-about-identifying-tick-dangers/ *May 12*
- Attended the "11th Annual Lyme Connection Patient Conference" in Western Connecticut State University, Danbury and discussed research and services at the CAES on ticks and tick-associated diseases *May 18*
- Was interviewed by CNN, "What you need to know about ticks" http://www.cnn.com/2017/05/23/health/tick-explainer/ *May 22*
- Was interviewed by WIRED, "Lyme Isn't the Only Disease Ticks Are Spreading This Summer" https://www.wired.com/2017/05/lyme-isnt-disease-ticks-spreading-summer/ *May 24*
- Was interviewed by the Weather Channel on the contributing factors to the rising tick populations and infections with tick-borne pathogens *June 20*
- Was interviewed by WCSU Radio, "This year worst on record for ticks - WTNH" http://wtnh.com/2017/06/21/westconn-this-year-worst-onrecord-for-ticks/ *June 21*
- Hosted a group from Central Connecticut State University at the Tick Testing Laboratory (23 students and staff) *June 22*
- Was interviewed by WQUN Radio, on the problems associated with tick activity, tick-associated diseases, and prevention, which was broadcasted on July 1st *June 22*
- Was interviewed by the New Haven Register, "Connecticut Agricultural Experiment Station in New Haven testing record number of ticks" http://www.nhregister.com/general-news/20170623/connecticut-agricultural-experiment-station-in-new-haven-testing-record-number-of-ticks *June 23*

PATRICK, LINDSAY A.

- Staffed a plant disease information booth at the Connecticut Tree Protective Association Annual Meeting in Plantsville *January 19, 2017*
- Staffed a CAES booth at the Connecticut Grounds Keepers Association Turf and Landscape Conference in Cromwell *February 23*
- Staffed a CAES booth at the Connecticut Flower and Garden Show in Hartford *February 26*
- Presented "Pruning 101" as part of The Institute for Learning in Retirement course on Care and Maintenance of Landscape Plants in New Haven (8 attendees) *April 5*
- Gave a tour of the PDIO to a visiting group of Boy Scouts (10 attendees) *April 10*

- Staffed a plant disease/CAES information booth at the Guilford Earth Fest in Guilford *April 22*
- Gave a tour of the PDIO to the Classroom in the Community group visiting CAES (10 attendees) *April 26*

PIGNATELLO, JOSEPH J.

- Gave the lecture "Adsorption and reactions of organic compounds on pyrogenic carbonaceous surfaces: so, what else is new?" at the three-day symposium in his honor, *The Chemistry of Environmental Sorptive and Oxidative Processes: A symposium in honor of Joseph J. Pignatello*, at the American Chemical Society National Meeting, Philadelphia, PA (approx. 150 attendees) *August 22-24, 2016*
- Gave the talk "Activated Carbon-Mediated Alkaline Hydrolysis of Methyl Bromide," co-authored by Dr. Hsin-Se Hsieh at the Methyl Bromide Alternatives and Outreach Annual Meeting, Orlando, FL (approx. 100 attendees) *November 10*
- Displayed an invited poster, "Bioaccessibility of Native Polycyclic Aromatic Hydrocarbons and Derivatives in a Fuel Soot Using an *in vitro* Gastrointestinal Model," at the 37th SETAC Congress/SETAC North American Annual Meeting, Orlando, Florida *November 6-10*
- Gave the talk, "Forces holding organic matter molecules together: Involvement of exceptionally strong hydrogen bonds," in the Environmental Chemistry Division at the 253rd American Chemical Society National Meeting, San Francisco (approx. 200 attendees, about half students) *April 2, 2017*
- Gave the talk, "Thermal air oxidation during biomass char formation and its effects on adsorption of organic compounds," in the Environmental Chemistry Division at the 253rd American Chemical Society National Meeting, San Francisco (approx. 200 attendees, about half students) *April 3*
- Was co-author on a talk by Dr. Yi Yang, "Activation of peroxides by phosphate ion for water purification," in the Environmental Chemistry Division at the 253rd American Chemical Society National Meeting, San Francisco (approx. 200 attendees, about half students) *April 2*
- Judged posters for the Sigma Xi Quinnipiac Local Chapter Science Fair *April 19*
- Gave the talk, "Bioaccessibility of native PAH and PAH derivatives in a fuel soot using an in vitro GI model," at the Society of Environmental Toxicology and Chemistry (SETAC) Europe in Brussels, Belgium (approx. 75 students and 75 other attendees) *May 7-11*

PRAPAYOTIN-RIVEROS, KITTY

- With Dr. Jason White, hosted the FDA eLEXNET team for a one-day onsite training *July 21, 2016*
- With Dr. Jason White, hosted Dr. Susan Audino of the American Association for Laboratory Accreditation (A2LA) for an on-site assessment of our FDA funded Manufactured Food Regulatory Program (MFRPS) *October 24-25*

RIDGE, GALE E.

- Was interviewed about how citizens might manage the gypsy moth populations next year and what they might do now in preparation by Denise Coffey from the Hartford Courant *July 11, 2016*
- Was interviewed about an increase of blow flies in homes and a connection with current high rodent populations in the state by Carl Castro from the Valley Independent *July 18*
- Was interviewed by WCBS about flying cockroaches, bed bugs, and wasps and the effect of high summer temperatures on insect activity *August 11*
- Ran a mattress recyclers training program at Recyc-Mattresses Corp, East Hartford on protection against bed bugs (10 attendees) *August 16*
- Spoke to residents of Ella B. Scantlebury Senior Residence, New Haven, about community management of bed bugs (38 attendees) *August 18*
- Presented a talk on "The maligned human bed bug, a masterpiece in adaptation and survival" and was a co-author on a presentation by colleague Dr. Johnathan Sheele titled "Systemic effects of ivermectin

and moxidectin on the common bed bug, *Cimex lectularis* L." while attending the International Congress of Entomology in Orlando, FL *September 25-30*

- Presented a talk about bed bugs to the New England Affordable Housing Management Association in Wallingford *October 6*
- With Attorney Judith R. Dicine, State Representative Larry B. Butler, and Dr. Ridge's daughter and son Heather and Timothy O'Connor, attended the official signing of the recently enacted law, "An Act Concerning the Rights and Responsibilities of Landlords and Tenants Regarding the Treatment of Bed Bug Infestations" in the Governor's Rooms, Capitol Building, Hartford *October 11*
- Assisted the Connecticut Child Guidance Center draft a bed bug protocol document for staff *October 18*
- Was interviewed by Eric Boodman, a journalist for STAT, a new national publication affiliated with the Boston Globe, on Delusions of Parasitosis *October 20*
- Was interviewed by Channel 8 News about northern black widow spiders *October 24*
- Was interviewed about the new landlord tenant bed bug law by Lorraine Weschler of the Waterbury Republican-American *November 3*
- Held Bed Bug Forum X, organized by the Connecticut Coalition Against Bed Bugs, titled "Bed Bugs Meet the Law." A panel of jurists and members of the board presented a program explaining the new law, "An Act Concerning the Rights and Responsibilities of Landlords and Tenants Regarding the Treatment of Bed Bug Infestations," which came into effect on October 1, 2016. The forum was held at Quinnipiac University in North Haven (182 attendees) *November 8*
- Spoke at a bed bug mattress training for the mattress recycling industry in Mansfield (10 attendees) *November 22*
- Was interviewed by Michael Holmes of the Yale Daily News about bed bugs at Yale University *November 30*
- Presented a bed bug talk to Carr Property Management in Springfield, MA (65 attendees) *December 6*
- Presented a talk to the Stratford and Bridgeport nurses associations and sanitarians about bed bugs in the schools (64 attendees) *January 13, 2017*
- Was interviewed by Eric Boodman of the Boston Globe at length about Delusory Parasitosis *January 27*
- Was interviewed about the gypsy moth outbreak in Ledyard by Heather Burian from NBC *March 20*
- Was interviewed by Tony Terzi Fox 61 News about the gypsy moth *March 22*
- Lectured on bed bugs at Southern Connecticut State University to students from the Environmental Health Training Program *March 29*
- Spoke to the Residence Service Coordinators of Connecticut in North Haven about the management of bed bugs (35 attendees) *April 4*
- Spoke about insects to a visiting Boy Scout troop from Bridgeport *April 10*
- Was interviewed by Tina Detelj from Channel 8 about how not to behave when bed bugs are discovered *April 11*
- Presented a CAES seminar about bed bugs, which included a display by Charlie and Christi Mastroberti, and George the dog on bed bug canine scent detection *April 12*
- Presented a talk about bed bugs at Luther Ridge in Middletown (45 attendees) *April 12*
- Spoke to delegates from the Northeast Natural History Conference who visited the Insect Inquiry Office (16 attendees) *April 21*
- Had an interview published in the Boston Globe Magazine, Pest Control Technology, and interviewed by Guiliano Aluffi from "La Repubblica," Italy about her work with Delusory Parasitosis sufferers *April 25*
- Presented a 3-hour program about bed bugs, hoarding, and delusional parasitosis to police, EMTs, and other emergency personnel in Vernon (50 attendees) *April 25*

- Presented talks on bed bugs at two webinars: the first was for the regional Municipal Waste Disposal Program for Connecticut, Massachusetts, and Rhode Island and the second was as a panelist on bed bugs in schools for the EPA during a nationwide webinar *May 9*
- Spoke at the YHouse (YMCA) in Torrington (37 attendees) *May 10*
- Talked about bed bug protection to mattress recyclers in Bridgeport (21 attendees) *May 12*
- Presented a talk at an Infectious Nurses Association of Connecticut New Haven meeting (27 attendees) *May 19*
- Gave a keynote speech to the graduating science class of 2017 at Amity Senior High School in Woodbridge (200 attendees) *May 19*
- Spoke about bed bugs as part of the Tilde Café series of lectures held at the James Blackstone Memorial Library in Branford (25 attendees) *May 20*
- Welcomed and talked about insects to visiting 1st graders (20 students and teachers) and 5th graders (15 students and teachers) from St. Thomas's Day School *May 23*

ROBB, CHRISTINA S.

- Participated in the board meetings of the Eastern Analytical Symposium (EAS) *September 16 and November 13, 2016, & June 9, 2017*
- Chaired the Young Investigator Award and the accompanying Food Analysis technical sessions, chaired the exposition committee for EAS 2016, and coordinated the presence of the New York and New Jersey Weapons of Mass Destruction Civil Support Teams (WMD CSTs) at the Eastern Analytical Symposium held in Somerset, NJ *November 14-16*
- With Ms. Terri Arsenault, demonstrated a children's science experiment involving kinetic sand to the 1st and 5th graders from St. Thomas's Day School (45 students) *May 23*

RUTLEDGE, CLAIRE E.

- Conducted training sessions for the Wasp Watcher Citizen-Scientist program in Glastonbury, Clinton, North Stonington, Bozrah, and Scotland (10 participants) *July 1, 5, 6 & 8, 2016*
- Helped run the Connecticut Tree Protective Association Summer Meeting in Farmington (738 adults and 40 youths attended) *July 21*
- Helped administer the oral portion of the Connecticut State Arborist License Exam at the Station *September 7*
- Presented an invited talk "Bronze Birch Borer, *Agilus anxius* (Coleoptera: Buprestidea)" in the session "Profiles of Forest Pests Ready to Cross Boarders and Invade New Areas" at the XXV International Congress of Entomology in Orlando, FL *September 25*
- Taught the lecture and laboratory sections of "Insects and Mites that Attack Trees" for Arboriculture 101, put on by the Connecticut Tree Protective Association in Wallingford (35 attendees) *October 12 & 26*
- Presented a lecture titled "Emerald Ash Borer in Connecticut" to the Advanced Master Gardeners in North Haven (8 attendees) *October 17*
- Presented a lecture titled "Unwelcome Guests - The Management of Invasive Insects" at the annual conference of the Connecticut Urban Forest Council in Southbury (60 attendees) *October 26*
- Hosted the exhibit "Dr. Rutledge's Insectorium and Petting Zoo" at Ghouls & Gourds, Brooklyn Botanic Garden, Brooklyn, NY (festival attendance 12,000) *October 29*
- Presented "Biosurveillance: Using a native wasp to detect an invasive beetle" as part of the CAES Seminar Series in Jones Auditorium (30 attendees) *November 2*
- Assisted in administering the oral portion of the State Arborist Licensing Exams in New Haven *December 7*
- Spoke with students from Nonnewaug High School in Woodbury about invasive insects at the USDA Forest Service Quarantine Facility in Ansonia (26 youths and 3 adults) *December 9*

- Presented a talk “Biosurveillance: Using a Native Wasp to Find an Invasive Beetle” to a Master Gardener class in Haddam (25 attendees) *January 31, 2017*
- Taught “Insects and Trees” at the CT Tree Protective Association’s Arboriculture 101 course in Wallingford (45 attendees) *February 8*
- Presented a talk titled “Biosurveillance: Using a Native Wasp to Catch a Native Beetle” to Master Gardeners in Bethel (60 attendees) *February 16*
- Taught “Tree conditions laboratory” for the Connecticut Tree Protective Association’s Arboriculture 101 class in Wallingford (45 attendees) *March 1*
- Presented the talk “New kid in town, *Agrilus smaragdifrons*” at the Forest Health Monitoring Workshop held in Jones Auditorium (60 attendees) *March 7*
- Ran the workshop “Winter Tree Identification” in conjunction with the Connecticut Tree Protective Association and Connecticut College Arboretum in New London (48 attendees) *March 16*
- Taught “Insects and mites that attack trees” for Bartlett Arboretum’s Arboriculture 101 class in Stamford (7 attendees) *March 20*
- Spoke to 5th and 6th graders from Fair Haven public schools about insects in New Haven (30 youths and 6 adults) *March 30*
- Presented “Using a Native Wasp to Catch an Invasive Beetle” at Housatonic Valley Regional High School’s Science day in Salisbury (150 youth attendees) *April 7*
- Presented “Southern Pine Beetle in Connecticut: Discovery and Distribution” at the New England Natural History Conference in Cromwell (25 adult attendees) *April 22*
- Presented the talk “The emerald ash borer in Connecticut” to the Goshen Land Trust in Goshen (20 adults) *June 30*

SCHULTES, NEIL P.

- As vice president of the Sigma Xi Quinnipiac Chapter, met in an executive meeting at Quinnipiac University *September 8, 2016*
- Presented a lecture on “Factors that influence plant growth” to the Federated Garden Clubs Master Gardeners School in Jones Auditorium (35 attendees) *September 14*
- Participated in an executive meeting for Sigma Xi at Quinnipiac University *October 13*
- Served as an expert debater in a two-day conference at Western Connecticut State University entitled “Socioeconomic Contexts of Sustainable Agriculture” sponsored by the Institute on Science for Global Policy *October 14-15*
- Attended the annual meeting of the Northeastern Division of the American Phytopathological Society in Ithaca, NY and delivered a short talk entitled “Functional analysis of the uracil transporter (UraA) of *Erwinia amylovora*” *October 19-21*
- Delivered a lecture on “Genetically Modified Plants in Agriculture” to a Science Class (Sci 031) at Yale University (6 students) *November 18*
- Gave his last presentations for the class series “Genetically Modified Plants in Agriculture” to Science Course Sci 031 at Yale University (6 students attended) *December 2 & 9*
- Participated as vice president of the Sigma Xi Quinnipiac Chapter in an executive meeting at Quinnipiac University *December 16*
- Participated in the Yale Office of Career Strategy Spring 2017 Workshop to highlight opportunities at CAES (15 students attended) *February 7, 2017*
- Participated in a “Meet and Greet” session with undergraduate students of Southern Connecticut State University (15 students and 8 adults) *March 29*
- Served as a Master’s thesis examiner for Amanda Stoffer in the Department of Biology at the University of Indiana, Ft. Wayne *April 12*
- Hosted Ms. Rebecca Goger, an undergraduate student in the Department of Biology at The University of New Haven, for a semester-long laboratory internship *January 2-April 28*

- Met with Dr. Rosemary Whelan, the Coordinator for Biology, Genetics and Biotechnology Programs, at the University of New Haven, to discuss student Internship opportunities and gave her a short tour of the Station *May 17*

SHEPARD, JOHN J.
- Gave two invited talks, "Arbovirus Activity in Connecticut, 2016," and "Vector-Host Interactions of Other Evil Mosquito Species at Eastern Equine Encephalitis Virus Foci" at the Annual Meeting of the Northeastern Mosquito Control Association in Falmouth, MA (180 attendees) *December 5-7, 2016*

SHIDORE, TEJA S.
- Presented a poster titled "Characterization of the Functional Duality of a Bacterial Type III Secreted Protein AvrRxo1 and its Chaperone Arc1 as a Toxin-Antitoxin System" at the 2016 Congress of the International Society of Molecular Plant-Microbe Interactions, for which she was awarded the Ko Shimamoto travel award to attend, in Portland, OR *July 17, 2016*
- Presented "Modification of a host central metabolite via a bifunctional type III secreted effector" to the inaugural New Haven Plant Symposium in Jones Auditorium (40 attendees) *May 26, 2017*

SHORT, MICHAEL R.
- Presented a poster "Diversity and Dilution: The impact of medium-sized mammal diversity on *Borrelia burgdorferi* prevalence in fragmented and unfragmented habitats in Connecticut, USA" at the 73rd Annual Northeast Fish & Wildlife Conference in Norfolk, VA (300 attendees) *April 11, 2017*

SLETTEN, PAMELA
- With Ms. Lindsay Patrick, staffed a CAES booth at the Connecticut Flower and Garden Show in Hartford *February 26, 2017*

SMITH, VICTORIA L.
- Participated in the annual summer meeting of the CT Nursery and Landscape Association, held at Monrovia Nursery in Granby, with a display on the newly-enacted Pennsylvania Boxwood Blight Quarantine (approx. 200 participants) *July 20, 2016*
- Participated in a meeting of the Yale Biosafety Committee in New Haven (20 participants) *July 21*
- Participated in a meeting of the US Forest Service Durham Field Office Forest Cooperators, held at the White Mountain National Forest Headquarters in Campton, NH (30 participants) *October 19-20*
- Participated in the Autumn Meeting of the CT Cooperative Agricultural Pest Survey (CAPS) held in the Jones Auditorium (12 participants) *November 10*
- Participated in a meeting of the Yale Biosafety/Recombinant DNA Committee in New Haven (25 participants) *November 17*
- With Eric Chamberlain of USDA-APHIS-Plant Protection and Quarantine, conducted a seminar for holders of federal plant permits at Yale University, in conjunction with the Yale Environmental Health and Safety staff (25 participants) *November 18*
- Participated in a meeting of the Yale Biosafety Committee in New Haven (20 participants) *December 15*
- Participated in a meeting of the Yale Biosafety Committee in New Haven (20 participants) *January 19, 2017*
- Participated in the CT Nursery and Landscape Association Winter Symposium held at the Aqua Turf in Southington with a talk titled "Inspection, Registration, and Early Detection: Activities of the Office of the State Entomologist" *January 25*
- Hosted the annual Forest Health Monitoring Workshop, held in Jones Auditorium. Participants included Experiment Station personnel and guests from UConn, DEEP, regional water authorities,

and USDA-APHIS Plant Protection and Quarantine. Presentations have been archived at http://www.ct.gov/caes/cwp/view.asp?a=2826&Q=591230&PM=1 (48 participants) *March 7*
- Attended and participated in the 92nd annual meeting of the Eastern Plant Board in Martinsburg, West Virginia (120 participants) *April 3-6*
- Participated in a meeting of the Yale University Biological Safety Committee, held at 135 College Street, New Haven (20 participants) *April 20*
- Participated in the spring Cooperative Agricultural Pest Survey meeting in the Slate Board Room (10 attendees) *May 17*
- Participated in a meeting of the Yale University Biosafety Committee in New Haven (20 attendees) *May 18*
- Participated in a meeting of the Yale Biosafety Committee in New Haven (20 participants) *June 15*

SOGHIGIAN, JOHN S.
- Gave a talk titled "Molecular phylogenetics of Aedini mosquitoes" at the XXV International Congress of Entomology in Orlando, FL (30 attendees) *September 30, 2016*
- Gave a talk "Evolution and Population Genetics of Mosquito Vectors" at the Yale School of Public Health's Epidemiology of Microbial Diseases Research Forum (15 attendees) *October 28*
- Gave the talk "Molecular Phylogenetics and Evolution of Habitat Specialization in Aedini Mosquitoes" at the Northeastern Mosquito Control Association, Falmouth, MA (180 attendees) *December 5*
- Gave the talk "Bite-sized stories on container-dwelling mosquito ecology and evolution" in the Department of Ecology and Evolutionary Biology, Yale University (15 attendees) *January 23, 2017*

STAFFORD, KIRBY C., III
- Was interviewed for an editorial on the gypsy moth outbreak and emerald ash borer by Henry McNulty, Hartford Courant *July 5, 2016*
- Was interviewed about the adult gypsy moths by John Charlton, Fox61 *July 6*
- Was interviewed about the gypsy moth by Andrew Revkin, The Times (Opinion) *July 6*
- Was interviewed about the gypsy moth by Joy VanderLek, The Cheshire Citizen *July 11*
- Was interviewed about the gypsy moth by Denise Coffey, Hartford Courant Community News *July 11*
- Was interviewed about flies and increased insect activity by Carl Castro, Valley Independent Sentinel *July 18*
- Was interviewed about a tick review by Carolyn Beans, NPR *July 19*
- Was interviewed about expectations for the gypsy moth in 2017 by John Penney, The Norwich Bulletin *July 21*
- Was interviewed about the emerald ash borer in Wooster Square by Aliyya Swaby, New Haven Independent *July 21*
- Was interviewed about the gypsy moth by Chris Woodside, CT Woodlands Magazine *July 27*
- Was interviewed by Nate Lynch, the Day, about aerial spraying for gypsy moth *August 1*
- Was interviewed by Leslie Mayes, NBC Connecticut, about spraying for gypsy moths in Ledyard *August 2*
- Was interviewed again by Nate Lynch, The Day, about aerial spraying for gypsy moth in Ledyard and potential for defoliation in 2017 *August 11*
- Presented a talk on tick-borne diseases in a webinar for Premise Health *August 12*
- Was interviewed by Annette Heist, an independent science writer, about gypsy moth *August 31*
- Participated in a meeting of the Connecticut Coalition Against Bed Bugs *September 12*
- Participated in a dissertation committee meeting at UConn *September 21*

- Presented a talk titled “Integrated tick management of the blacklegged tick to reduce the risk of Lyme disease” and co-moderated this tick session while at the XXV International Congress of Entomology (ICE) in Orlando, FL held in conjunction with the Entomological Society of America. There were 6,682 registrants from 102 countries at this prestigious conference with 298 symposia, 5,396 oral and poster presentations, 8 keynote addresses, and 2 Nobel Laureate presentations *September 25-30*
- Was interviewed on film by Jennifer Reid, Ridgefield Blast Lyme Program, and Tanya Kory, Premise Health Wellness Program Manager, about tick biology and management for the development of training materials for Premise wellness directors *October 12*
- Participated in a meeting at DEEP on control of gypsy moth *October 18*
- Coordinated a visit by Dr. Husain Poonawaha, Microbiology Fellow at Yale, to learn about our mosquito and tick research programs *October 19*
- Presented a talk on tick-borne diseases at the Annual Conference on Urban and Community Forestry in Plantsville *October 26*
- Presented a talk on tick-borne diseases and tick management at the Northeastern IPM Center Advisory Council Meeting in Baltimore, MD (28 attendees) *October 27*
- Gave the welcome and participated in the bed bug forum held at Quinnipiac University *November 8*
- Provided a brief research update on the Northeast IPM online web conference *November 9*
- Participated in a meeting of the Cooperative Agricultural Pest Survey (CAPS) committee in Jones Auditorium (12 participants) *November 10*
- Spoke on the gypsy moth outbreak and predictions for 2017 at the annual meeting of the Connecticut Association of Conservation and Inland Wetland Commissions (CACIWC) in Rocky Hill (30 attendees) *November 12*
- Participated in the Ph.D. oral examination of MS. MEGAN LINSKE at UConn *December 5*
- Participated in a meeting at DEEP on aerial spraying for gypsy moth *December 21*
- Was interviewed about gypsy moth in 2017 by Shawn Bourgeois, WINY-AM radio, Putnam *February 2, 2017*
- Presented a talk on ticks and tick management at the NOFA Land Care course at Three Rivers Community College in Norwich (30 attendees) *February 10*
- Was interviewed by Evan White, WFSB-TV, about winter tick activity *February 27*
- Presented a talk on the gypsy moth at the Forest Health Monitoring Workshop in Jones Auditorium (48 attendees) *March 7*
- Was interviewed about gypsy moth in 2017 by Judy Benson for the New London Day *March 7*
- Presented a talk on ticks and tick management at the Essex Library in Essex (42 attendees) *March 8*
- Participated in a media press conference with DEEP on the gypsy moth held at the CT Forest & Park Association Headquarters in Rockfall *March 23*
- Was interviewed about gypsy moth by Tony Terzi of Fox61 News *March 23*
- Was interviewed about gypsy moth by Tina Detelj from Channel News 8, WTNH *March 23*
- Was interviewed about gypsy moth by Kristen Johnson from NBC CT Channel 3 *March 23*
- Was interviewed about gypsy moth by Mark Sims, CT Radio *March 23*
- Was interviewed by Greg Hladky of the Hartford Courant about gypsy moth *March 27*
- Was interviewed by Fox 5 NBC News, New York, about ticks and Lyme disease *March 27*
- Assisted and was interviewed by Lauren Schneiderman, visual journalist for the Hartford Courant, with locating and photographing gypsy moth egg masses *April 7*
- Was interviewed by John Silva, WTIC News/Talk 1080, about current and upcoming tick activity *April 11*
- Was interviewed by Marlese Lessing, UConn Daily Campus, about Powassan virus and other tick-borne diseases *April 18*
- Consulted by Brian Sauvageau, Conn-OSHA, about occupational exposures to ticks and tick-borne diseases and tick-bite prevention *April 19*

- Participated in a news conference on Lyme disease by Senator Richard Blumenthal at CAES *April 19*
- Presented a talk on gypsy moths in Sterling sponsored by the Sterling Ag Commission (120 attendees) *April 20*
- Attended the meeting of the Connecticut Entomological Society in Jones Auditorium *April 21*
- Presented a talk on tick-borne diseases and tick management at a vector biology forum at the New England Natural History Conference in Cromwell (18 attendees) *April 22*
- With Drs. Theodore Andreadis and Jason White, met with representatives from Senator Chris Murphy's office during a tour of entomology research at the Station *April 25*
- Was interviewed by Cynthia Drummond about tick-borne diseases and tick management *April 25*
- Was interviewed by Ray Dunaway, WTIC radio, about gypsy moth *April 27*
- With Dr. Theodore Andreadis, met with State Representative Steven Stafstrom of Bridgeport during a tour of the Station *April 27*
- Was interviewed by Heather Burian, NBC Connecticut, about the gypsy moth *May 3*
- Was interviewed by Mark Sims, Connecticut Radio Network, about the potential for gypsy moth control by the fungus with current rains *May 5*
- Was interviewed by Mary Biekert, Norwich Bulletin, about the gypsy moth fungus *May 9*
- Was interviewed by Judy Benson, The New London Day, about the gypsy moth *May 9*
- Was interviewed by Ms. Sloan Brewster, The Valley Press, about ticks and tick-borne diseases *May 10*
- Spoke on the prevention of tick-associated diseases at the Global Lyme Alliance program in Stamford (100 attendees) *May 11*
- Spoke at the Edith Wheeler Memorial Library in Monroe on ticks and tick-borne diseases (50 adult attendees) *May 16*
- Participated in a Cooperative Agricultural Pest Survey (CAPS) meeting at CAES (12 attendees) *May 17*
- Was interviewed by Heather Burian, NBC, about gypsy moth *May 30*
- Was interviewed by Cassandra Day, Middletown Press, about the gypsy moth *June 5*
- Was interviewed by Jeannette Ross, Wilton Bulletin, about the lone star tick *June 5*
- Was interviewed by Alan Aronow about the gypsy moth fungus for the Haddam Bulletin *June 6*
- Spoke on ticks and tick-borne diseases at Holcomb Farm in Granby (100 attendees, 2 children) *June 8*
- Was interviewed by Patrick Skahill, WNPR, about the gypsy moth *June 12*
- Was interviewed by Heather Burian, NBC Universal, about gypsy moth *June 16*
- Was interviewed by Anna Bisaro, New Haven Register, about local gypsy moth activity *June 16*
- Staffed a display and answered questions about ticks at the Great Parks Pursuit event at Kettletown State Park, Southbury (approx. 200 adults and 300 children attended) *June 17*
- Was interviewed by Mike Puffer, Republican-American, about gypsy moth *June 19*
- Was interviewed by Susan Dunne, Hartford Courant, about managing gypsy moth droppings *June 19*
- Was interviewed about gypsy moth by Mike Morrissette, WILI Radio Willimantic *June 20*
- Was interviewed about gypsy moth by Madi Van Den Eynde, Journal Inquirer, Manchester *June 20*
- Was interviewed by Renee Chmiel, News 8 TV, about ticks and ehrlichiosis *June 22*
- Was interviewed by Gregory Hladky, Hartford Courant, about the gypsy moth outbreak *June 26*
- Was interviewed by Shawn Bourgeois, WINY Radio in Putnam about the gypsy moth outbreak *June 26*
- Was interviewed by Jesse Buchanan, Record Journal, about the gypsy moth *June 29*

STEVEN, BLAIRE T.

- Gave a talk on microbiology and climate change to the Hamden Rotary Club (approx. 15 attendees) *August 16, 2016*

- Gave the poster “Sudden Vegetation Dieback in a Coastal Wetland: A model for ‘Blue Carbon’” at the International Society of Microbial Ecologists General Meeting in Montreal, Canada *August 23*
- Gave a talk on “Generation of Axenic Mosquitoes Demonstrates Live Bacteria Are Not Necessary for Mosquito Development” at the Connecticut Symbiosis Symposium at the University of Connecticut in Storrs (30 students and 15 other attendees) *May 9, 2017*
- Gave an invited lecture “The Opportunities and Challenges of Phytobiome Research” to the Society of Plant Protection in Ste-Anne-de-Bellevue, Quebec, Canada (approx. 30 students and 20 other attendees) *June 8*

STONER, KIMBERLY A.

- Presented a scientific poster titled “Current Risk Assessments for Neonicotinoid Insecticides Do Not Adequately Address Risks to Bumble Bee Queens (*Bombus* spp.)” at the International Pollinator Conference at Penn State University, State College, PA *July 17, 2016*
- Organized, facilitated, and took notes on a meeting of the CT Native Plant, Pollinator, and Wildlife Working Group at the Valley Laboratory in Windsor (9 attendees) *July 28*
- Gave an introductory talk about Permaculture before the film “Inhabit” at Books and Company, Hamden (35 attendees) *August 10*
- Gave a talk, “Bees in the Schoolyard” to school and municipal groundskeepers at the UConn School and Municipal Turf/Grounds Workshop: Managing Without Pesticides at the East Lyme Middle School (105 attendees) *August 18*
- With Dr. Theodore G. Andreadis and Dr. Richard S. Cowles participated in Governor Malloy’s signing ceremony for Public Act 16-17, An Act Concerning Pollinator Health at the Governor’s Office in Hartford *August 30*
- Spoke as part of the Nursery and Landscape Research Tour at the Valley Laboratory on “The Push for Pollinators – Needs for Plants and Seeds” (30 attendees) *September 15*
- Presented a poster, “Natural Pollination is Generally Adequate for Pumpkin and Winter Squash, *Cucurbita* spp., in Connecticut” at the XXV International Congress of Entomology in Orlando, FL *September 28*
- Gave a talk at the annual meeting of the Connecticut Invasive Plant Working Group, “The Pollinator Victory Garden – The Bees” at the University of Connecticut in Storrs (100 attendees) *October 11*
- Participated in a panel on cover crops and pollinators in a workshop “Planning for Soil Health” sponsored by Connecticut Resource Conservation & Development, USDA-Natural Resources Conservation Service, CT NOFA & Northeast SARE, at Massaro Farm in Woodbridge (55 participants) *November 2*
- Was interviewed by Natalie Weglarz and Aurora Courcy, students at John Winthrop Middle School in Deep River, Connecticut, and members of the Nidz Kidz, an eighth grade competitive Lego Robotics team about bees and how to protect them *November 2*
- Spoke at the CACIWC (Connecticut Association of Conservation and Inland Wetlands Commissions) on “Native Plants for Pollinators” at the Sheraton in Rocky Hill (98 participants) *November 12*
- Was interviewed by Mary Wilson and Holly Kocet of Protect Our Pollinators in Newtown *November 17*
- Was interviewed by Eric Chiarillo, a high school senior at Farmington High School, who is creating a documentary-style public service announcement about bees *November 30*
- Spoke on “Increasing Pollinators by Increasing Plant Diversity” at the Annual CT NOFA Organic Land Care Meeting in Southington (135 attendees) *December 9*
- Was interviewed by Nicole Rivard, reporter for Friends of Animals magazine, about research on bees *January 5, 2017*

- Was interviewed by Judy Benson of the New London Day about the pollinator health bill and bee research *January 10*
- Spoke to the Fairfield County Regional Conservation Partnership on "Pollinator Health and Habitat" at the Wilton Public Library and a story about her presentation by Jeannette Ross was featured in the Wilton Bulletin on March 2nd (60 attendees from 19 towns in Fairfield County) *February 22*
- Participated in the Steering Committee meeting at the Radisson Hotel, Manchester, NH to plan the New England Vegetable and Fruit Conference for December 2017 with Cooperative Extension staff, growers, and representatives of grower organizations from all of the New England states and New York. Dr. Stoner is organizing and moderating a session on Wildlife Management (31 participants) *March 1*
- Organized a day-long workshop, "Creating and Improving Pollinator Habitat on Your Farm" for growers and beekeepers, and also made two presentations as part of the workshop: "Your Crop Depends on Bees!" and "Protecting Pollinator Habitat from Pesticides" in Jones Auditorium (24 participants) *March 9*
- Spoke at the Winter Conference of the Connecticut Northeast Organic Farming Association on "Planting for Crop Pollinators" held at Western CT State University in Danbury (45 attendees) *March 11*
- Convened a meeting of the CT Native Plant, Pollinator, and Wildlife Working Group at the Valley Laboratory in Windsor (9 participants) *March 15*
- Gave a talk on "An Act Concerning Pollinator Health: State Efforts to Protect Pollinators in Connecticut" at the Eastern Branch Meeting of the Entomological Society of America (50 attendees) *March 20*
- Participated in designing a trail, gardens, and outdoor exhibits on the theme, "Conservation in Your Own Backyard," at the White Memorial Conservation Center in Litchfield (12 participants) *March 31*
- Participated in a charrette at the White Memorial Conservation Center in Litchfield to design a trail with visitor displays of pollinator habitat and other ecological practices (14 participants) *April 3*
- Spoke on "Pollinators in the Garden" to the Milford Garden Club (67 participants) *April 11*
- Met with two legislative aides for US Senator Chris Murphy and discussed pollinator research *April 25*
- Gave the talk "Pollinators in the Garden" to the Institute for Learning in Retirement (7 participants) *April 26*
- Met with State Representative Steven Stafstrom of Bridgeport and discussed pollinator research *April 27*
- Served as a judge of presentations by high school student teams on permaculture designs at the annual Envirothon at the Tolland County Extension Center in Vernon *May 18*
- Organized and led a meeting of the Connecticut Native Plant, Pollinator, and Wildlife Working Group, meeting with representatives of the CT Department of Transportation about progress toward creating native plant and pollinator habitat along state roadways at the Audubon CT Preserve, Stratford Point (16 participants) *June 14*

THOMAS, MICHAEL C.

- Demonstrated insect collecting and preservation techniques to Terrestrial Arthropod classes of the University of Connecticut Entomology and Yale University at the Yale Forestry Camp in Norfolk (20 student attendees) *September 9-10, 2016*
- Co-instructed a lab-field trip to Archbold Biological Research Station in Venus, Florida, for the Yale University EEB Terrestrial Arthropod class (12 attendees) *October 19-23*

TRIPLETT, LINDSAY R.

- Spoke on a panel to high school students from all 50 states and 92 countries about biology and agriculture careers at the Yale Young Global Scholars Program in Biological and Biomedical

Sciences (220 youths) and conducted a question-and-answer panel for a select group (70 youths) *July 16, 2016*

- Presented a talk titled "Microbial Manipulation of Host Primary Metabolism Using a Type III Secreted Effector" at the 2016 Congress of the International Society of Molecular Plant-Microbe Interactions in Portland, OR. She also served as co-organizer and moderator of the session (280 attendees) *July 18*
- Organized an "APS Preview Seminar" for CAES staff and scientists in Jones Auditorium. Presentations were given by Drs. Lindsay Triplett, Quan Zeng, Roberto De La Torre-Roche, and Wade Elmer *July 28*
- Moderated the Effector Biology Session at the annual meeting of the American Phytopathological Society in Tampa, FL and as an invited speaker, gave the presentation entitled "Resistance of Carolina Gold Select Rice to African strains of *X. oryzae* pv. *oryzicola* is triggered by inactivated TAL effectors" (58 attendees) *August 3*
- Was interviewed by the Charleston (SC) Post and Courier on her research of disease resistance in heirloom rice for the article, "Could Carolina Gold be the answer to West Africa's rice woes?" *August 23*
- Arranged the visit of the October Lockwood Lecturer, Dr. Gregory Martin of the Boyce Thompson Institute who presented "Using natural variation in tomato to understand and improve the plant immune system" *October 3*
- Attended the 2016 Northeastern Division Meeting of the American Phytopathological Society, presided over a session of the Graduate Student Awards, and attended the forest tour and a tour of a private research farm *October 18-20*
- Presented a talk entitled "A decoy for a decoy? New layers of the arms race between rice and bacteria" to the inaugural New Haven Plant Symposium held in Jones Auditorium (40 attendees) *May 26, 2017*

VARRICCHIO, EMMETT

- Gave a talk on the biological control of mile-a-minute weed in Connecticut at the Connecticut Invasive Plant Working Group Symposium held at UCONN in Storrs (125 attendees) *October 11, 2016*

VOSSBRINCK, CHARLES R.

- Judged science exhibits at the 2016 BIG E AFFA Agriscience Fair *September 16, 2016*
- Presented a table display on figs and fig yield at the Natural Resource Conservation Fair in Derby *October 4*
- Held a demonstration on fig plant propagation at Lockwood Farm *April 8, 2017*
- Judged posters for the Sigma Xi Quinnipiac Local Chapter Science Fair *April 19*

WARD, JEFFREY S.

- Administered practical and oral examinations to arborist candidates for the Connecticut Tree Protection Examining Board *September 7, 2016*
- As Chair-Elect, participated in the Executive Committee meeting of the New England Society of American Foresters in Concord, NH *September 8*
- Gave two webinars on "Roadside Forest Management: Tree-by-Tree" for the Cornell University ForestConnect series (125 attendees) *September 21*
- Was interviewed about the effects of gypsy moths and drought on fall foliage color by Judy Benson for the New London Day *September 26*
- Spoke on effects of invasive species and their control at the CIPWG and DEEP Wildlife fall tour in Litchfield (31 attendees) *October 1*

- With Dr. Scott Williams, Mr. Joseph P. Barsky, Mr. Michael Short, and Ms. Megan Linske, staffed the CAES booth at the Southwest Conservation District's Natural Resource Conservation Fair held at Lockwood Farm (200 students and 6 teachers) *October 4*
- Was interviewed about gypsy moths and forest management by Judy Benson for the New London Day *October 6*
- Gave an invited talk "Biology and Control of Running Bamboo" at the CIPWG Invasive Plant Symposium in Storrs (150 attendees) *October 11*
- Was interviewed about the effects of invasive shrubs on the environment by Barry Yeoman of National Wildlife Magazine *October 20*
- Moderated the session on management of invasive insects at the 28th Annual Conference on Urban and Community Forestry in Plantsville *October 26*
- Participated in the Society of American Forester's House of Delegates at the national meeting in Madison *November 1-2*
- Presented a poster "Independent effects of invasive shrubs and deer herbivory on plant community dynamics" at the 2016 Society of American Foresters National Convention in Madison, WI *November 3*
- Participated in an Audubon Connecticut Science Committee meeting in Stratford *November 7*
- Spoke on roadside forest management at the Stormwise Workshop in Durham (37 attendees) *November 15*
- Gave an invited lecture on "Improving competitive status of oak regeneration using stand management and prescribed fires" for a forest ecology class at Wesleyan University in Middletown (16 students) *December 1*
- Administered practical and oral examination to arborist candidates for the Connecticut Tree Protection Examining Board *December 7*
- Participated in New England Society of American Foresters Executive Committee conference call *December 14*
- Was interviewed about invasive shrubs, ticks, and Lyme disease by Laura Tangley of National Wildlife Magazine *January 9, 2017*
- Spoke on "Right Tree, Right Place" at the Connecticut Tree Protective Association's 95th Annual Meeting in Plantsville (400 attendees) *January 19*
- Spoke on "Compartimentación de la descomposición en los árboles: Porque hacemos la poda así" at the Connecticut Nursery & Landscape Association Winter symposium & Expo in Plantsville (29 attendees) *January 26*
- Spoke on "Oak Health and Mortality after Gypsy Moth Defoliation and Drought" at the CT Society of American Foresters winter meeting in Rockfall (24 attendees) *February 27*
- Chaired the New England Society of American Foresters Executive Council meeting *March 7*
- Participated to the New England SAF, Northeastern Forest Pest Council and Maine Chapter of the Wildlife Society joined meeting "Adapt. Adopt. Advance: Resiliency in Natural Resource Management" in Bangor, ME *March 8-10*
- Spoke to landscape professionals about proper tree selection and planting techniques in Farmington (17 attendees) *March 16*
- Spoke on "Right Tree, Right Place" to Hamden Master Gardeners (10 attendees) *March 21*
- Was interviewed about the importance of Young Forests by Anna Bisaro of the New Haven Register *March 21*
- Spoke on "Oak Health and Mortality after Gypsy Moth Defoliation and Drought" and gave an afternoon tour of Lockwood Farm at the CT Professional Timber Producers Association Annual meeting in Hamden (68 attendees) *April 29*
- Spoke on "The Importance of Trees" for a combined meeting of the Lake Waramaug Association, Warren Land Trust, and Steep Rock Association in Washington (24 attendees) *April 30*

- Spoke on roadside forest management at the Stormwise Workshop in Durham (14 attendees) *May 23*
- Participated in the Yankee Division - Society of American Foresters meeting in Tolland *May 26*
- Administered practical and oral examinations to arborist candidates for the Connecticut Tree Protection Examining Board *June 7*
- Was interviewed about the effects of weather on acorn production by Christopher Escobar of the Weather Channel *June 20*
- Chaired the Executive Committee meeting of the New England Society of American Foresters in Concord, NH *June 21*

WHITE, JASON C.

- Was interviewed on the use of nanotechnology in agriculture by Melissa Pandika, a reporter for OZY *July 13, 2016*
- With Mr. Michael Cavadini, Mr. Joseph Hawthorne, Dr. Walter Krol, Mr. Craig Musante, Ms. Kitty Prapayotin-Riveros, Dr. Christina Robb, Mr. John Ranciato, and Ms. Terri Arsenault, hosted the FDA eLEXNET team for a one-day onsite training *July 21*
- Participated by WebEx in a career panel question-and-answer session with graduate students from the Duke University Center for the Environmental Implications of Nanotechnology (CEINT) (25 participants) *July 27*
- Participated by WebEx in a laboratory group meeting focusing on the fate of ingested nanomaterials with collaborations at the Harvard University School of Public Health (10 participants) *July 28*
- Attended the USDA NIFA AFRI Food Safety Program Project Directors annual meeting and gave a lecture entitled "Nanomaterial Contamination of Agricultural Crop Species" (55 attendees) *July 30*
- Attended the International Association for Food Protection (IAFP) annual meeting in St. Louis, MO and gave an invited lecture entitled "Engineered Nanoparticles in Food: Implications for Food Safety and Consumer Health" (150 attendees) *August 1-4*
- Hosted Margaret Horsfall Schadler, Anne Horsfall Thomas (daughters of former CAES Director James Horsfall), and David Thomas for a CAES tour and description of programs *August 4*
- Attended the 252nd American Chemical Society annual meeting in Philadelphia, PA and gave a lecture entitled "Nanoscale Nutrients Suppress Plant Disease and Increase Crop Yield" (15 attendees) *August 21-24*
- Attended to 6th International Conference on Soil Pollution and Remediation (SOILREM) in Hangzhou China and gave a presentation entitled "The Role of Endophytes in the Phytoremediation of Persistent Pesticides" *September 23-26*
- Attended the 13th International Phytotechnology Conference in Hangzhou China and gave a lecture entitled "Accumulation and Transfer of Engineered Nanoparticles in Terrestrial Food Chains: Correlating Physiological and Molecular Response" *September 26-28*
- Chaired a technical session entitled "Plant and Nanoparticle Interactions" at the 13th International Phytotechnology Conference *September 27*
- Chaired an Editorial Board meeting of the *International Journal of Phytoremediation* in Hangzhou China *September 27*
- Was interviewed by Catherine Meyers of Inside Science (https://www.insidescience.org/) about a recent publication in *Environmental Pollution* that demonstrated that plants exposed to nanoparticle cerium oxide were more resistant to drought *October 17*
- Attended the Ph.D. Dissertation Defense of Ms. Nele Eevers at Hasselt University in Hasselt Belgium; (Dr. White was a Co-Promoter on her committee) *October 20-22*
- With Mr. Michael Cavadini, Mr. Joseph Hawthorne, Dr. Walter Krol, Mr. Craig Musante, Ms. Kitty P.-Riveros, Dr. Brian Eitzer, Dr. Christina Robb, Mr. John Ranciato, and Ms. Terri Arsenault hosted Dr. Susan Audino of the American Association for Laboratory Accreditation (A2LA) for an on-site assessment of our FDA funded Manufactured Food Regulatory Program (MFRPS) *October 24-25*

- Gave a laboratory tour and description of department programs to State Senators Beth Bye and Clark Chapin *October 25*
- Was interviewed by Jan Spiegel of the CT Mirror concerning research on using nanoscale nutrients to suppress plant disease *October 27*
- Gave a lecture at the University of Massachusetts Amherst entitled “Phytoremediation of weathered hydrophobic pollutants” to a graduate level phytotechnologies course *November 8*
- Served on the “International Scientific Advisory Committee for the "International Conference on Nanotechnology Applications and Implications of Agrichemicals Towards Sustainable Agriculture and Food Systems” in Beijing, China, which was sponsored by the Chinese Academy of Agricultural Sciences (CAAS) and the US Department of Agriculture (USDA) and gave an invited plenary lecture entitled “Nanomaterials and the food supply: Assessing the balance between applications and implications” and a technical lecture entitled “Accumulation of engineered nanoparticles in food crops: Correlating physiological and molecular response *November 17-18*
- With Dr. Wade Elmer, met with Anna Bisaro, a reporter for the New Haven Register, to discuss recent work on the use of nanoscale nutrients to suppress crop disease *December 9*
- Gave a tour of Department laboratories and described programs to a group of students and faculty from the Norwich Technical High School *December 20*
- Hosted Professor Baoshan Xing of the University of Massachusetts Stockbridge School of Agriculture (and 12 members of his staff) for the CAES Seminar Series and discussed ongoing collaborative research projects *December 21*
- Hosted the Steven Reviczky, Commissioner of the Department of Agriculture, and staff, as well as growers from several CT farms, to discuss the US FDA Produce Safety Rule *December 29*
- Testified at a hearing of the Commission on Human Rights and Opportunities (CHRO) where the CAES Affirmative Action Plan was reviewed and officially approved *January 11, 2017*
- Presented an invited lecture entitled “Nanomaterials and the food supply: Assessing the balance between applications and implications” at the University of Connecticut Department of Pathobiology and Veterinary Science Seminar Series (30 attendees) *January 19*
- Gave an invited seminar entitled “Nanomaterials and the food supply: Assessing the balance between applications and implications” by WebEx to the 11 universities that are part of the NSF funded “Center for Sustainable Nanotechnology” (60 attendees) *January 20*
- Gave an invited talk at the University of Nebraska Water Center seminar series entitled “Nanomaterials and the Food Supply: Assessing the Balance Between Applications and Implications” *January 31-February 1*
- With all Department staff, hosted Maeve Taylor of Cheshire High School for a half-day shadowing program *February 2*
- Participated in a WebEx discussion with members of the multi-university Center for Sustainable Nanotechnology to discuss collaborative research and their funding of a CAES Post-doctoral researcher *February 2*
- Provided a welcome presentation to the CAES Experiment Station Associates Behind the Scenes tour and also discuss the Department of Analytical Chemistry programs and research (15 attendees) *February 15*
- Attended a meeting at the CT Farm Bureau to discuss a new report entitled “Economic Impacts of Connecticut’s Agricultural Industry” *February 16*
- Hosted Professor Phillip Demokritou of Harvard University as a Lockwood Lecturer *February 17*
- Gave a webinar entitled “Nanomaterials and the Food Supply: Assessing the Balance Between Applications and Implications” to the Florida Department of Agriculture and Consumer Services “Ag Science Café” (50 attendees) *February 23*
- Gave a tour of Analytical Chemistry Department facilities and programs to Ms. Makayla McLaughlin *February 24*

- Gave an invited lecture at the University of Connecticut Department of Nutritional Sciences seminar series entitled "Nanomaterials and the Food Supply: Assessing the Balance Between Applications and Implications" (20 attendees) *February 27*
- With Dr. Brian D. Eitzer and Ms. Terri Arsenault, attended the annual FDA FERN cCAP Technical Meeting in Kansas City, MO and gave a lecture on a recent poisoning case that the laboratory was involved with and an update on our participation in the FDA EU Milk Assignment (55 attendees) *March 14-16*
- Met at Southern CT State University with Biology faculty and students to discuss Department of Analytical Chemistry research and programs (20 attendees) *March 29*
- Hosted members of the NSF-funded Center for Sustainable Nanotechnology from the University of Wisconsin and University of Minnesota and discussed future collaborative research, including a Center-funded Postdoctoral Associate and visiting graduate students *March 30*
- Attended the 253rd American Chemical Society National Meeting in San Francisco, CA and presented a lecture entitled "Accumulation and Transfer of Engineered Nanomaterials in Terrestrial Food Chains: Correlating Physiological and Molecular Response" (30 attendees) and participated in the Editorial Advisory Board Meeting for Environmental Science & Technology and Environmental Science & Technology Letters *April 4-6*
- Participated in a "Red Team" meeting at the University of Minnesota as part of preparations for the upcoming NSF site visit of the Center for Sustainable Nanotechnology (the Center will be funding a CAES Postdoctoral Associate) *April 12-13*
- With Dr. Theodore Andreadis, met with two representatives of US Senator Chris Murphy's office and discussed CAES programs and research *April 25*
- With Dr. Wade Elmer, met with reporter Ms. Jan Spiegel on research involving the use of nanoscale nutrients to suppress crop disease *April 26*
- With Dr. Theodore Andreadis, met with State Representative Steven Stafstrom (Bridgeport) and discussed CAES research and programs *April 27*
- Gave a lecture at the Harvard School of Public Health entitled "Engineered Nanomaterials in Agriculture: Implications and Application" (25 attendees) *May 3*
- Discussed Department of Analytical Chemistry programs and research to student attendees at the CT Agriscience Fair (20 students) *May 4*
- With Dr. Theodore Andreadis, met with Dr. Rick Rhodes, who is the Executive Director of the Northeastern Regional Association of State Agricultural Experiment Station Directors (NERA), and discussed Station programs and research *May 10*
- Attended the annual USDA NIFA Project Directors meeting in Washington, DC and gave a presentation entitled "Nanoscale Elements Suppress Plant Disease, Enhance Micronutrient Use Efficiency, and Increase Crop Yield" (30 attendees) *May 18-19*
- Was an invited speaker at the International Symposium on Emerging Contaminants and Environmental Nanotechnology which was held at Nankai University in Tianjin China and gave a lecture entitled "Accumulation of Engineered Nanomaterials in Terrestrial Food Chains: Correlating Physiological and Molecular Response" (50 attendees) *May 22-26*
- Spoke with Jan Spiegel, a reporter writing a story on nanotechnology and agriculture *June 12*
- Hosted Professor Gregory Lowry of Carnegie Mellon University for a Lockwood lecture *June 13*
- Attended the Gordon Conference on Environmental Nanotechnology in Stowe VT and gave an invited lecture entitled "Nanomaterials and the Food Supply: Assessing the Balance Between Applications and Implications (125 attendees) *June 21-23*
- Participated by WebEx in Ms. Ilya Aidee Medino Velo's Proposal B Defense at the University of Texas El Paso *June 27*

WILLIAMS, SCOTT C.

- With Mr. Michael R. Short and Ms. Megan Linske, was shadowed by Jim Sopelak and his two sons, Hunter (14), and Logan (11) who are interested in pursuing a career in wildlife biology, Redding *August 18, 2016*
- Hosted a CAES informational table at the DEEP's First Annual Hunting and Fishing Day at Franklin Swamp Wildlife Management Area, North Franklin (200 attendees) *September 10*
- With Mr. Michael Short and Ms. Megan Linske, conducted a small mammal trapping demonstration and deer exclosure explanation to students in the Wildlife Management Techniques class in the Department of Natural Resources and the Environment at the University of Connecticut, Storrs (10 students, 1 teacher) *September 12*
- Gave an invited lecture to the East Hartford Rotary Club on ticks and tick-borne diseases, East Hartford (40 attendees) *September 21*
- Participated in the quarterly meeting of the Executive Board of the Connecticut Urban Forest Council, Hamden *September 30*
- As Executive Treasurer, participated in the 28th Annual Connecticut Urban Forest Council Conference and 12th Annual Forest Forum in Plantsville *October 26*
- Gave an invited lecture about environmental employment opportunities at Middlesex Community College, Middletown (9 students, 1 teacher) *November 1*
- With Mr. Michael Short, Mr. Joseph P. Barsky, and Ms. Megan Linske, hosted the Connecticut Future Farmers of America (FFA) Association's Forestry Career Development Event at Lockwood Farm. Thirty-two students from 8 different schools competed in their general forestry knowledge, forestry equipment, tree identification, wood products, tree measurements, and compass use *November 18*
- With Dr. Kirby Stafford, participated in the successful completion of the oral component of the comprehensive examination for UConn Ph. D. candidate advisee Ms. Megan A. Linske *December 5*
- With Ms. Megan Linske and Mr. Michael Short, hosted a Station visit for former CAES seasonal employee Emily Picard's Lyman Hall High School sophomore environmental career class (12 students, 1 teacher) *February 14, 2017*
- Spoke on medium-sized mammal abundances is suburban settings at the Forest Health Monitoring Workshop, New Haven *March 7*
- Participated in the Annual Meeting of the Executive Board of the Northeast Section of The Wildlife Society, Norfolk, VA *April 9*
- Hosted the Annual Meeting of the membership of the Northeast Section of The Wildlife Society, Norfolk, VA *April 10*
- Gave an invited lecture titled "Bugs and Bushes; Connecticut Ag Station Research on SCCRWA Lands" at the South Central Connecticut Regional Water Authority's recreation permit holders meeting in New Haven (20 attendees) *April 12*
- Presented "Diversity and Dilution: Impacts of Medium-Sized Mammal Diversity on *Borrelia burgdorferi* Prevalence in Fragmented and Unfragmented Habitats in Connecticut" at the Northeast Natural History Conference in Cromwell (25 attendees) *April 23*
- Was interviewed by Mike Puffer of the Waterbury Republican-American about tick resurgence in CT *April 27*
- Hosted the 1st grade and 5th grade classes of St. Thomas's Day School with short informational talks by Ms. Amanda Massa, Mr. Mark Creighton, Ms. Katherine Dugas, Dr. Gale Ridge, Dr. Christina Robb, and Ms. Terri Arsenault (37 students, 6 teachers) *May 24*
- Presented an invited lecture titled "An Integrated Tick Management Program to Reduce Risk of Lyme Disease in a Residential Endemic Area" in the Zoonotic Disease Symposium at the International Urban Wildlife Conference at San Diego State University, San Diego, CA (50 attendees) *June 5*
- With Mr. Michael Short and Ms. Megan Linske, was interviewed about ticks, rodents, and tick-borne diseases by two reporters from the Weather Channel *June 20*

- Spoke on “Ticked Off. The Lowdown on Ticks in Guilford” at the Guilford, CT Conservation Commission's Living with Wildlife Speaker Series (150 attendees) *June 21*

ZENG, QUAN

- Presented a poster presentation “Comparative genomic analyses of Acidovorax pathogens provide insights into the emergence of a new turfgrass disease and the host specificity” (~150 attendees) and co-organized the Bacteriology Committee Meeting as the vice chair, attended the APHIS Widely Prevalent Bacterial Committee meeting at the Annual Meeting of the American Phytopathological Society (APS) in Tampa, FL *July 31-August 2, 2016*
- Met with Dr. Steven Young, director of the Northeastern IPM center at Cornell University, and gave a research update of the ongoing projects with NEIPM center and a tour of the organic pesticide testing plot at Lockwood Farm *September 14*
- Presented an invited seminar “Emergence and evolution of a turfgrass pathogenic bacteria pathogen *Acidovorax avenae*” at the Stockbridge School of Agriculture at the University of Massachusetts-Amherst and met with Dr. Dan Cooley, Dr. Michelle DaCosta, and Ms. Elizabeth Garofalo from the Stockbridge School of Agriculture at UMass and Dr. Li-Jun Ma from the Department of Biochemistry and Molecular Biology at UMass *October 24*
- Presented an invited presentation “Streptomycin resistance of fire blight pathogens in Northeastern U.S.” at the Second Annual Integrated Pest Management (IPM) Online Conference *November 9*
- Gave a guest lecture and lead laboratory practices on “Plant Bacteriology” at the University of Connecticut *November 16*
- Attended the Connecticut Pomological Society Meeting and discussed drought and disease issues with growers *November 29*
- Visited Shanghai Jiaotong University and gave an invited presentation titled “Bistable gene expression of the type III secretion system genes in plant pathogenic bacteria” (23 attendees) and met Dr. Lifang Zou and Dr. Gongyou Chen and discussed putative areas of collaboration *December 27* and toured the School of Agriculture and Biology, experimental farm, and research facilities at Minhang campus *December 28-29*
- Hosted a job shadow for two Cheshire high school students, Mr. Drew Bellina and Ms. Catherine Goncalves *February 3, 2017*
- Met with Dr. Shrikant Mane from Yale Center for Genomic Analysis and discussed next generation sequencing technologies *March 24*
- Talked to Biology majored undergraduate students at Southern Connecticut State University about potential internship opportunities at CAES (15 students and 8 adults attended) *March 29*
- Gave a presentation “How does the “fire” spread around in your orchards?” at the twilight meeting of the CT Pomological Society at March Farm in Bethlehem (40 attendees) *May 19*
- Presented the talk “Disease Epidemiology and Management of Fire Blight, a Bacterial Disease of Apple” at the inaugural New Haven Plant Symposium held in Jones Auditorium (40 attendees) *May 26*

ZUVERZA-MENA, NUBIA

- With Dr. Roberto De La Torre-Roche, Dr. Chuanxin Ma, and Dr. Sanghamitra Majumdar, toured students from UMass through the laboratories in the Analytical Chemistry Department *December 21, 2016*
- Participated in the job-shadowing event for Cheshire High School students *February 2, 2017*
- Presented “Accumulation and toxicity of engineered nanoparticles in plants: Nano-specific physiological and molecular response” at the NanoImpact International Conference held in Monte Verita, Switzerland *March 12-17*
- Presented the talk “The Good/Bad and the Unknown about Nanotechnology” as part of the CAES Seminar Series in Jones Auditorium *March 24*

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 based on submitting agency is shown below.

Source of Sample	Numbers of samples analyzed
Department of Agriculture	181
Department of Consumer Protection	297
Department of Energy and Environmental Protection	113
FDA, Health Depts., Cities/Towns, Misc. Foundations	199
Proficiency Test Samples	10
University Research Collaborators	202
CAES Departments	685
Grand Total	1,687

I. SERVICE ACTIVITIES

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

1. ANALYSES ON BEHALF OF CONNECTICUT DEPARTMENT OF AGRICULTURE

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

a. Animal Feeds:

- Analyst: John Ranciato, Nubia Zuverza-Mena, Brian Eitzer
- 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 collected by inspectors from DoAg. Analytical results are reported to DoAg, who in turn report the findings to the product dealer and/or manufacturer and conduct regulatory response as required.
- Results: From July 1, 2016 to June 30, 2017, we received and completed analysis of 23 feed samples. These samples were analyzed for protein, fat, moisture, fiber, and select micronutrients. Samples deficient in one or more analytes (determined according to the investigational allowances outlined in the Official Publication of the Association of American Plant Food Control Officials) numbered 10 (44%). Analytical findings are turned over to CT DoAg for regulatory response. Joint funding with the DoAg has been acquired from the FDA to facilitate inclusion in the Animal Feed Regulatory Program Standards (AFRPS); this 5-year cooperative agreement will allow the Department to bring aflatoxin analysis in animal feeds by liquid chromatography high resolution mass spectroscopy (LC-HRMS) under the scope of ISO accreditation. This reporting period, methods for aflatoxin extraction and analysis (by LC-HRMS)

in corn-based feed were validated and 13 samples were received from DoAg for analysis as part of the AFRPS. Five samples were officially logged out with no aflatoxins detected; analysis of the remaining 8

is ongoing.

b. Fertilizers:

- Analysts: John Ranciato
- Goal: To assure products are in compliance with stated label guarantees.
- Summary: This was one of the primary analyses of the Station in 1875. Products from residential and commercial agricultural operations are collected by DoAg inspectors. Analytical results are reported to DoAg, who in turn report the findings to the product dealer and product manufacturer and take regulatory response as needed.
- Results: From July 1, 2016 to June 30, 2017, we received and completed analysis of 47 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 36 (77%). Analytical findings are turned over to the CT Department of Agriculture for regulatory action.

c. Analysis of seaweed samples

- Analysts: Terri Arsenault, Craig Musante, Michael Cavadini, Brian Eitzer
- Goal: To assess potential contamination of seaweed prior to release for sale.
- Summary: A newer program with the CT DoAg Bureau of Aquaculture involves the chemical and microbial analysis of seaweed being grown commercially in CT for sale to restaurants. Chemical analysis happens in the Department of Analytical Chemistry; the microbial analysis happens at the Department of Public Health (DPH) Laboratory Environmental Microbiology Section. During the current reporting period, 8 samples were received for analysis of moisture content, pesticides by both liquid and gas chromatography with mass spectrometry (LC-MS; GC-MS), as well as polychlorinated biphenyls (PCBs) by GC with electron capture

detection (GC-ECD), and select heavy metals by inductively coupled plasma mass spectrometry (ICP-MS). Results are reported to DoAg Aquaculture staff for a decision on regulatory action. Analysis is still underway at this time but in past years, all samples analyzed were 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 on food and consumer product samples submitted by the CT Department of Consumer Protection (DCP) are important to public safety. The results of these analyses are reported quickly and can lead to the recall of products that have levels of chemical residues, heavy metals, fungi/mold, or fecal contamination that are deemed unacceptable by DCP. If products are imported into CT from other states or countries, the US Food and Drug Administration will lead the regulatory response.

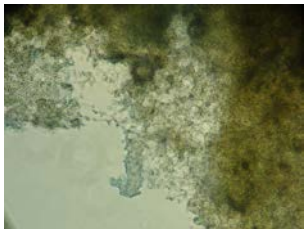
a. Pesticide residues in food:

- Analysts: Walter Krol, Brian Eitzer, Christina Robb, Michael Cavadini, Terri Arsenault
- Summary: As part of the Manufactured Food Regulatory Program Standards (MFRPS), we determine concentrations of pesticides and total arsenic in fresh and processed foods from local, domestic, and imported sources offered for sale in CT and assure compliance with established tolerances. MFRPS survey samples are collected by DCP Inspectors and results are published in periodic Station Bulletins available by mail and at www.ct.gov/caes. From July 1, 2016 through June 30, 2017, a total of 121 samples of food were analyzed for pesticide residues. Of the 121 samples analyzed, 60 (49.6%) contained a total of 129 residues. Of these 60 samples, there were 3 samples each containing a total of 4 violative residues. There were 44 different pesticide active ingredients found at an average concentration of 0.210 µg/Kg, and the average number of pesticide residues per sample was 2.15.

- With US FDA funding and support, the Department has received new equipment and, after 5 years of preparation, has received ISO/IEC 17025 Accreditation from the American Association for Laboratory Accreditation (A2LA) for this program.
  Impact: The Department's MFRPS serves as the sole surveillance and monitoring effort in the state, assuring that the food supply within CT is safe and free from chemical and heavy metal contamination.

b. Miscellaneous samples

- Analyst: John Ranciato, Brian Eitzer
- Summary: From July 1, 2016 to June 30, 2017, 126 consumer complaint samples were submitted by CT DCP for analysis, including foreign material identification, fecal content determination,

product adulteration or tampering. For some samples, we rely on the expertise in other CAES Departments, including Plant Pathology and Ecology, Entomology, and Forestry and Horticulture.

3. Analyses on behalf of Department of Consumer Protection, Liquor Control Division

a. Beverages/products for ethanol content

- Analyst: Terri Arsenault
- Goal: To provide percent ethanol content for label registration and taxation purposes.
- Summary: We analyzed 13 products such as beers, wines, and liquors for ethanol content. Results were submitted to DCP in support of product label registration.

b. Beverage authenticity

- Analyst: Terri Arsenault, Brian Eitzer
- Goal: To determine if products offered to customers at CT establishments are authentic as to brand.
- Summary: Twenty-nine alcoholic products were examined for authenticity; 14 samples were found to not match the gas chromatographic or elemental profile of comparison authentic samples. These results are returned to the DCP Division of Liquor Control, who determine appropriate regulatory action. A conductivity meter that was supplied to Liquor Control inspectors for field determination of vodka authenticity continues to be successfully used. Elemental profile as determined by inductively coupled plasma with mass spectrometry (ICP-MS) or optical emission spectroscopy (ICP-OES) is now also used during adulteration investigations.

4. Analyses on behalf of Department of Energy and Environmental Protection (DEEP), Waste Management Bureau

a. Analysis of PCBs (polychlorinated biphenyls)

- Analysts: Michael Cavadini, Terri Arsenault, Brian Eitzer
- Goals: To determine the extent of polychlorinated biphenyl (PCB) contamination in submitted samples, with matrices including soil, water, oil, sediments, and surface wipes.

- Summary: From July 1, 2016 to June 30, 2017, 38 samples were analyzed from pre-existing sites or new locations in CT. Sample collection is performed by the DEEP PCB Enforcement Unit as part of mandatory long-term monitoring of these areas. The findings are reported to DEEP for assessment of continued regulatory compliance. In addition, two proficiency tests were successfully completed as part of this program.

b. Analysis of pesticides

- Analysts: Brian Eitzer, Terri Arsenault

• 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. Submitted sample matrices include soil, water, oil, sediments, tank mixes and surface wipes. By request, select samples can be analyzed for glyphosate using liquid chromatography-mass spectrometry (LC/MS).

• Summary: From July 1, 2016 to June 30, 2017, 29 samples were analyzed under this program.

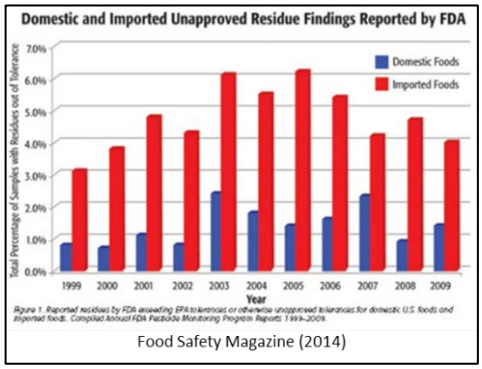
Impact: The analysis of samples collected from surveillance programs for soil, surface/groundwater and sediments, as well as those that are part of active misapplication investigations, enable DEEP to enforce current state and federal regulations on pesticides and to promote overall environmental and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

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, Michael Cavadini, Jason C. White

• Summary: The Department of Analytical Chemistry continues its work with the FDA as part of the Food Emergency Response Network Chemistry Cooperative Agreement Program (FERN cCAP). This program enables research and analyses on contaminants in food such as pesticides, poisons, toxins, and heavy metals. Staff participated in an FDA surveillance assignment where milk bound for export to the European Union was tested for heavy metal content using a method validated by the Department. Staff scientists are participating in an active surveillance assignment of imported foods within CT; four separate analytical platforms are being used to screen food for poisons, toxins, pesticides and heavy metals. The Department participated in several FDA and USDA FSIS proficiency tests and challenge exercises. Dr. Christina Robb has begun investigating methods related to the detection of the plant toxins ricin and abrin, as well as their biomarkers ricinine and abrine. Lastly, Brian Eitzer and Ms. Terri Arsenault both served as instructors for FDA courses on LC-MS and GC-MS FERN methods, respectively; these training courses are open to FDA staff and other state laboratories.



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

b. Analysis of samples for municipalities, law enforcement and other groups

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

• Summary: From July 1, 2016 through June 30, 2017, Department staff analyzed several dozen samples for municipalities or other groups. As in

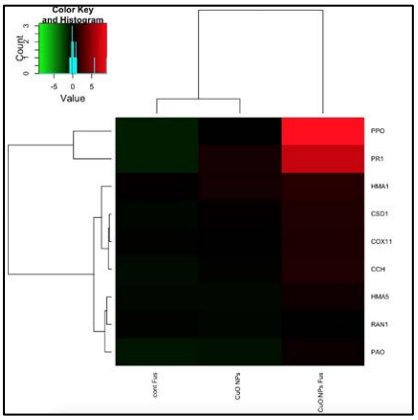
previous years, this included the analysis of soils from schools and various other locations (community gardens, municipal property) for heavy metals. We also analyzed foods and other products for heavy metals at the request of the New Haven Health Department. In one incident this year, the laboratory was contacted by the FBI Joint Terrorism Task Force (JTTF) and the CT Department of Public Health regarding a potential poisoning case at Yale University. The incident involved a community coffee machine and 4 staff fell ill over a six-hour period. Various samples were submitted by the Yale University Police Department, including coffee, water from several sources, mugs/cups and the coffee machine itself. The analytical request was for sodium azide, a poison similar to cyanide, and our laboratory received the call because no other laboratory in the state could provide the analysis. CAES staff utilized several FDA FERN validated methods; azide was detected in several of the liquid samples, with concentrations ranging from 10-340 mg/L. Our results were subsequently confirmed by the FBI laboratory in Quantico, VA.

Impact: The findings of a highly toxic poison in samples associated with a community coffee pot assisted federal and university law enforcement in their investigation and highlights the importance of FERN equipment and funding to the health of citizens in the state.

6. ANALYSES ON BEHALF OF OTHER STATION DEPARTMENTS

a. Elemental and Molecular Analysis - Department of Plant Pathology and Ecology

- Analyst: Craig Musante, Roberto De La Torre-Roche, Jason C. White
- Summary: In conjunction with Dr. Wade Elmer of the Department of Plant Pathology and Ecology, elemental and molecular analysis of several hundred samples of various crops grown in the presence or absence of nanoscale micronutrient amendments was again conducted. Dr. Elmer and Dr. White are in the second year of a USDA AFRI NIFA grant focused on this topic; the $480,000 grant began March 1, 2016 and includes co-investigators at the International Fertilizer Development Center in Muscle Shoals, AL and the University of Texas, El Paso. 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, Christina Robb, Brian Eitzer, Craig Musante, Michael Cavadini, Nubia Zuverza-Mena
- Summary: Annual proficiency testing samples related to our FDA FERN work, FDA ISO Accreditation program (MFRP), Animal Feed Regulatory Program (AFRP), as well as performance evaluation samples for our polychlorinated biphenyl (PCB) regulatory program, were completed during the reporting period. All of these testing regimes serve to ensure accurate and reliable laboratory results.

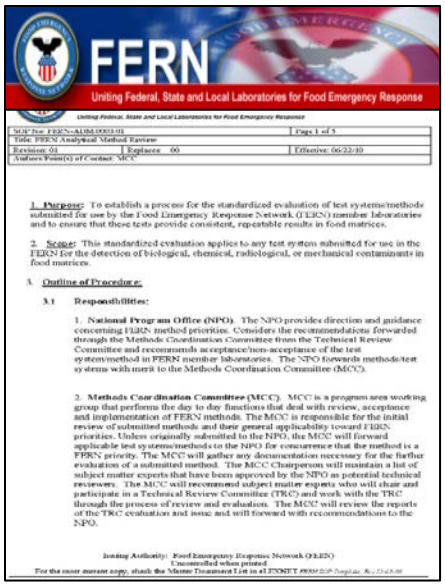
II. RESEARCH ACTIVITIES

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

1. FOOD SAFETY

Project 1: *Improvement of analytical methods for determination of pesticide residues in food*

- Investigators: Brian Eitzer, Terri Arsenault, Walter Krol, Christina Robb, Michael Cavadini, Craig Musante, Joseph Hawthorne, Jason C. White
- Summary: We continue to participate in or lead several FDA coordinated research projects. Department staff were involved in the development of a triage-based protocol for handling samples with unknown contaminants for the FDA. Staff also served on the FDA FERN Method Coordination Committee, which reviewed a LC-MS multilaboratory method validation submitted by the FERN


FERN
Uniting Federal, State and Local Laboratories for Food Emergency Response

1. Purpose: To establish a process for the standardized evaluation of test systems/methods submitted for use by the Food Emergency Response Network (FERN) member laboratories and to ensure that these tests provide consistent, repeatable results in food matrices.

2. Scope: This standardized evaluation applies to any test system submitted for use in the FERN for the detection of biological, chemical, radiological, or mechanical contaminants in food matrices.

3. Outline of Procedure:

3.1 Responsibilities:

1. National Program Office (NPO). The NPO provides direction and guidance concerning FERN method priorities. Considers the recommendations forwarded through the Methods Coordination Committee from the Technical Review Committee and recommends acceptance/non-acceptance of the test system/method in FERN member laboratories. The NPO forwards methods/test systems with merit to the Methods Coordination Committee (MCC).

2. Methods Coordination Committee (MCC). MCC is a program area working group that performs the day to day functions that deal with review, acceptance and implementation of FERN methods. The MCC is responsible for the initial review of submitted methods and their general applicability toward FERN priorities. Unless originally submitted to the NPO, the MCC will forward applicable test systems/methods to the NPO for concurrence that the method is a FERN priority. The MCC will gather any documentation necessary for the further evaluation of a submitted method. The MCC Chairperson will maintain a list of subject matter experts that have been approved by the NPO as potential technical reviewers. The MCC will recommend subject matter experts who will chair and participate in a Technical Review Committee (TRC) and work with the TRC through the process of review and evaluation. The MCC will review the reports of the TRC evaluation and issue and will forward with recommendations to the NPO.

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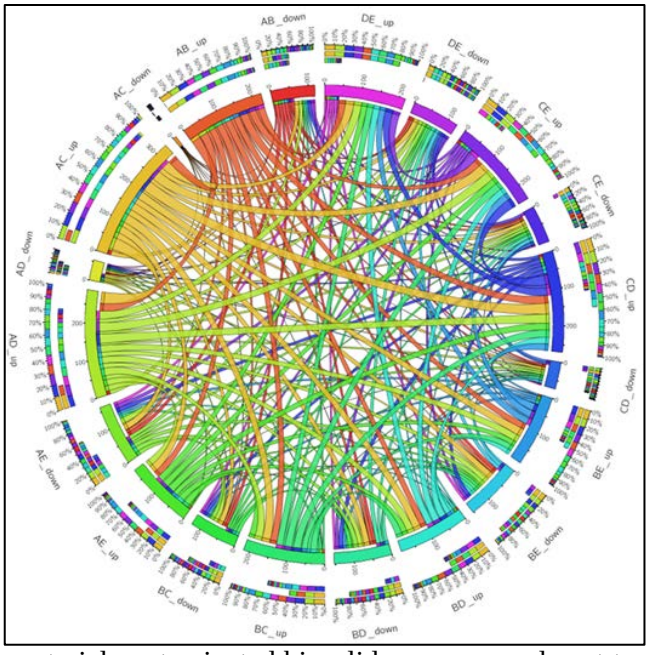
chemistry labs. Separate work on the use of high resolution LC-MS and LC-MS/MS platforms for the screening of pesticides, toxins (fungal, plant) and poisons continued. We are participating in a working group focused on validating software for a newly acquired GC-MS from the FDA. We also also achieved ISO Accreditation for one FDA program (MFRPS) (MFRPS) and are continuing efforts to bring a second (AFRPS) (AFRPS) under the scope of accreditation. These accreditation accreditation efforts will be required for future FDA FERN participation. Last, we have initiated projects investigating the the presence of abrin and related compounds in seeds from various plant species. The overall goal of these projects is to develop robust and accurate methods that the FDA could deploy deploy as part of large-scale surveillance programs.

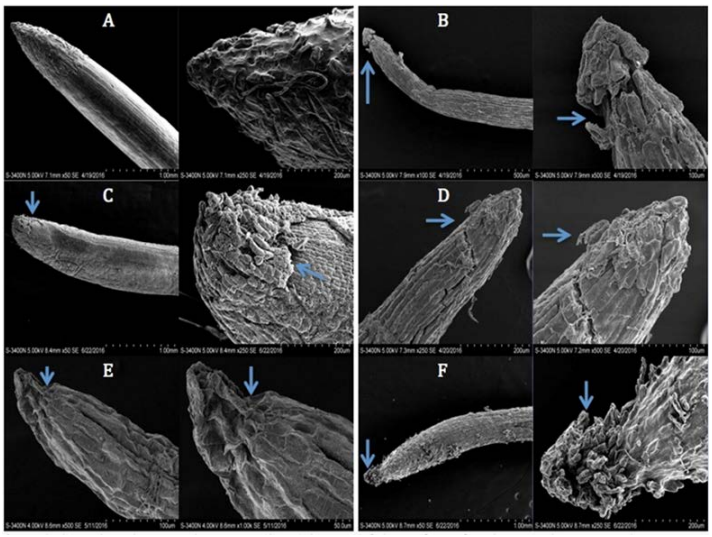
Impact: The development and validation of new, more sensitive equipment and analytical techniques will enhance food safety surveillance activities in the state and serve to better protect the public against incidental or intentional adulteration.

Project 2: *Nanoparticle fate in agricultural systems*

- Investigators: Craig Musante, Roberto De La Torre-Roche, Chuanxin Ma, Nubia Zuverza-Mena, Jason C. White

• Summary: Nanomaterials (NM), with at least one dimension less than 100 nm (one billionth of a meter), have unique physical and chemical properties not observed at the bulk scale. Nanotechnology, which takes advantage of these useful nanoscale properties, has become widely used in numerous sectors, including electronics, health-care, cosmetics, agriculture, pharmaceuticals, and food processing. Although use has been widespread and is increasing rapidly, the consensus among the scientific community is that understanding of the fate and effects of nanomaterials in the environment is currently inadequate to accurately assess risk. We are interested in nanomaterials in agricultural systems, whether by direct use in nano-enabled agrichemicals or through indirect exposure from the application of nanomaterial-contaminated biosolids as an amendment to aid plant growth. Research in our laboratory has been focusing on defining the impact (physiological and molecular toxicity, accumulation) of NMs on food crops, with a focus on the risk posed to humans from exposure to these contaminated plants. Recent work has focused on the potential trophic transfer of these materials from soil to food crops (lettuce, zucchini, potato) to herbivores (crickets, darkling beetles) to secondary consumers (mantids, wolf spiders).





Studies have shown that significant variability exists across species and soil type and that weathering of the nanomaterials in soil may result in size-specific transformation processes that impact availability and risk. Additional studies are focusing on how exposure to NM can impact the accumulation and toxicity of other contaminants, including pesticides such as chlordane and imidacloprid, and pharmaceuticals such as tetracycline and carbamazepine. In addition, studies were conducted to assess the impact of exposure to binary combinations of NM; here, results showed that toxicity to a binary combination of NM was often significantly different from

exposure to either material alone, with additive, synergistic and antagonistic effects being observed. Additional collaborators on this project include colleagues at the University of Massachusetts, Texas A & M University, State University of New York College of Environmental Science and Forestry, Southern Illinois University-Carbondale, University of Texas El Paso, the US National Institute of Standards and Technology, The University of Parma in Italy, Hasselt University in Belgium, Peking University in China, The Ocean University of China, Zhejiang University and Nanjing Agricultural University.

Impact: Our research has demonstrated that the toxicity of nanomaterials to crops can be significantly different from that of the corresponding bulk material. Current investigations have also shown the NM may also transfer from one trophic level to the next, presenting significant potential for food chain contamination. In addition, co-exposure to a NM can significantly alter the fate and effects of other organic and elemental contaminants, including additional nanomaterials. Last, molecular investigations are now being used to develop more sensitive endpoints of exposure/effects and to provide more useful information in support of accurate and meaningful risk assessment for nanomaterials.

2. ENVIRONMENTAL MONITORING/REMEDIATION

Project 1: *Analysis of Pesticides in Connecticut Pollen - Baseline Survey*

- Investigators: Brian Eitzer, Kim Stoner (Department of Entomology)
- Summary: We continue to examine the exposure of honey bees to pesticides at our long-term monitoring sites. Long-term studies can be used to track changes that occur due to different pesticide use practices or the introduction of new pesticides. We are currently monitoring two locations using traps to collect pollen balls from the bees as they return to the hive. During any individual collection period, the honey bees can visit a wide variety of crops bringing very different pollen back to the hive. Each of these different crops could have different amounts of pesticides. Each of the samples is then subjected to pesticide analysis using liquid chromatography/mass spectrometry. As might be

expected, when you examine these over the course of a growing season there is a wide variety of pollen in the collections and the pesticides present from those plants can also vary widely; they vary in which pesticides are found, when they are found, and how much of them are found. ***Impact:*** Honey bees are being exposed to pesticides. Long-term monitoring from the same hives and locations provides baseline data that can be used to assess temporal trends and changes in pesticide exposure.

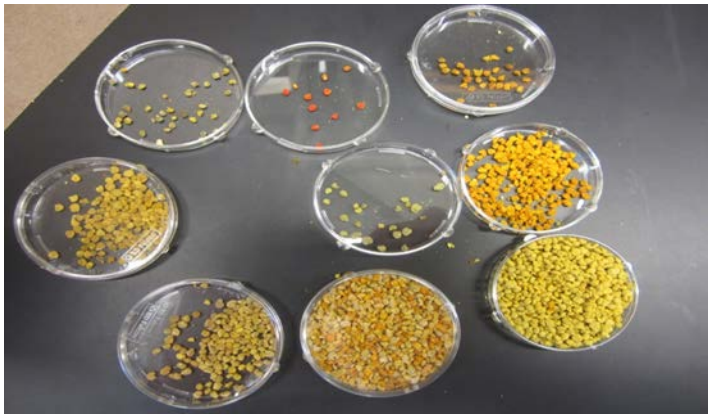
Project 2: *Pollination security for fruit and vegetable crops in the Northeast*

- Investigators: Brian Eitzer, Kim Stoner (Department of Entomology), Anne Averill (University of Massachusetts), Frank Drummond (University of Maine), Bryan Danforth (Cornell University).
- Summary: We have been participating in a multi-year study to examine pollination security in specialty crops. Four crops are being studied: apples in New York, cranberries in Massachusetts, blueberries in Maine, and cucurbits in Connecticut. Among the factors being examined for each crop is the levels of pesticides present in each system. During the past year, we have been completing the remaining analyses of pesticides related to this project, which is coming to its conclusion. One new part of this project was conducted by our University of Maine collaborators. They wanted to examine the movement of pesticides into honey bee colonies following pesticide application. Bees were caged within a sprayed blueberry plot. Samples of adult bees, pupae, larvae, wax, nectar, and pollen were collected one, three, and six weeks after spraying. These samples were sent to the CAES and examined for pesticide uptake using our liquid chromatography/mass spectrometry procedures. These measurements allowed the dynamics of pesticide exposure to be examined.

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

Project 3: *Quantifying exposure of honey bees and bumble bees to neonicotinoids in nectar and pollen of ornamental plants*

- Investigators: Brian Eitzer, Kim Stoner (Department of Entomology), Richard Cowles (Valley Laboratory), Douglas Dingman (Department of Entomology)
- Summary: The potential harm to pollinators caused by neonicotinoid pesticides is a topic that has been the focus of much recent attention. This attention has led to public calls for "bee safe" plants. The nursery and bedding plant industry is concerned because they use some of these compounds to protect their plants and need to sell those plants to the public. In the past year, we analyzed pollen collected by honey bees at three nurseries in Connecticut. The pesticide load of each sample was converted to a hazard quotient by looking at the toxicity of the pesticides found in each sample. The individual samples that had the highest toxicity were then sorted by pollen color, and re-analyzed for pesticides. Next those colors of the high toxicity samples that had the highest toxicity were sent for palynological analysis to determine which particular plant species were the highest contributors to honey bee toxicity within the sample. We have been also examining the pollen and nectar of model plants to determine which pesticide use practices will lead to the lowest pollinator pesticide exposures.



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

PUBLIC OUTREACH

Telephone/Internet Inquiries: We receive approximately 200 calls and emails from the public each year requesting information on issues such as pesticides in food and the environment, as well as 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 periodically published by our Department. These bulletins are available in printed form and on the CAES website (www.ct.gov/CAES). 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 Insect Information Office (IIO). Staff in this office answer insect-related questions and identify insects and related arthropods for the public, government agencies, growers, and business organizations. All scientists provide information to citizens of Connecticut by answering telephone inquiries, making farm visits, participating in meetings of growers and other groups, and speaking on their research. Most of the research in the Department has a major applied aspect, addressing the integrated management of ticks, pests of field crops, nurseries, and orchards, wood-boring insects, invasive insects, and honey bees and other bee pollinators.

The Office of the State Entomologist at the Connecticut Agricultural Experiment Station, created by the Connecticut General Assembly in 1901, is part of the Department of Entomology with responsibility, in part, to ensure our nursery industry is free of plant pests and certify their products for shipment to other states and outside the United States. The Connecticut Green Industry (i.e., nursery, greenhouse, floriculture, sod, Christmas trees) is the largest agricultural business in Connecticut. The industry estimates that environmental horticulture generates $1.022 billion gross income supporting 48,000 full- and part-time jobs in Connecticut. In conjunction with regulatory activities, Department staff conducts a surveillance program in Connecticut for a variety of established pests and for exotic plant pests, some of regulatory concern, that represent a threat to our green industry, forests, and urban ornamental trees and shrubs. Surveillance for plant pests is performed in partnership with the United States Department of Agriculture (USDA) through the Cooperative Agricultural Pest Survey (CAPS) program and the U.S. Forest Service. In addition, we participate in a Forest Pest Survey and Outreach Program supported by the USDA. For plant diseases of regulatory concern, we work closely with the Plant Disease Diagnostic Laboratory in the Department of Plant Pathology and Ecology. We also conduct forest health surveys and a statewide aerial survey for gypsy moth defoliation (and any defoliation by other insects) and a gypsy moth egg mass survey. The results of our plant and forest surveys for 2016-2017 may be found later in the Department's research activities along with summaries of our regulatory activities. The Office of the State Entomologist and the Apiary Inspector also oversee registration of beekeepers and inspection of honey bee colonies for pests and disease.

The Insect Information Office.

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

SERVICE ACTIVITIES

Insect Inquiry Office: Dr. Gale E. Ridge works out of the New Haven insect information office. Insect identification services date back to nearly the inception of the institution (1875) 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 away from traditional communication such as mail and visitors to mostly cell phone calls and the internet. Phone calls remain the primary citizen contact followed by emails inquiries.

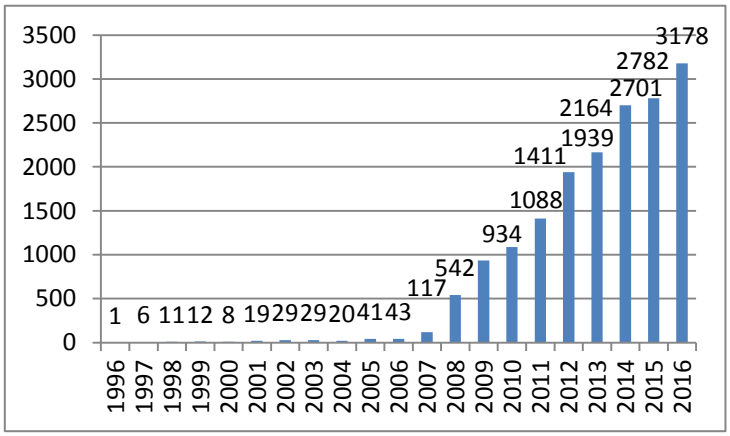


Table 1. Number of bed bug inquiries from FY 1996 to 2016.

The office serves private citizens, pest management professionals, the real estate industry, nurseries, land care businesses, arborists, health departments, other medical professionals, charities, manufacturing, the hospitality industry, schools, colleges, and universities, housing authorities, museums, municipalities, libraries, law enforcement, state government, and the media. Between July 1, 2016 and June 30, 2017, the insect information office handled at least 15,870 recorded inquiries. There were 571 categories of inquiries including insects, arachnids, animal, pesticide use, insect damage, general entomology, and horticultural issues. Categories were condensed this year. Delusory Parasitosis (DP) cases continued to rise from 189 in 2016 to 243 this fiscal year. These are time-consuming psychological cases that encompass multiple phone calls, emails, and visits which often involved medical professionals. In March 2017, Dr. Ridge's work with DP sufferers was reported in STAT, an online magazine affiliated with the Boston Globe. This brought national attention to the condition. The article was written by Eric Boodman and titled, "Accidental therapists: For insect detectives the trickiest cases involve the bugs that aren't really there." Following a mild winter due to possible "climate change," tick populations, especially American dog ticks *Dermacentor variabilis* were very high. Blacklegged tick *Ixodes scapularis* populations were also high with in excess of 200 public submissions to the Station for Lyme disease testing per day at the busiest time. Many of these submissions passed though the insect information office with mistaken tick identifications from the public returned to the office for a correction of identification. In addition, non-native but North American established insects enjoyed an elevation in populations. For example, the spotted Mediterranean cockroach *Ectobius pallidus* first introduced to Cape Cod in the early 1940s,

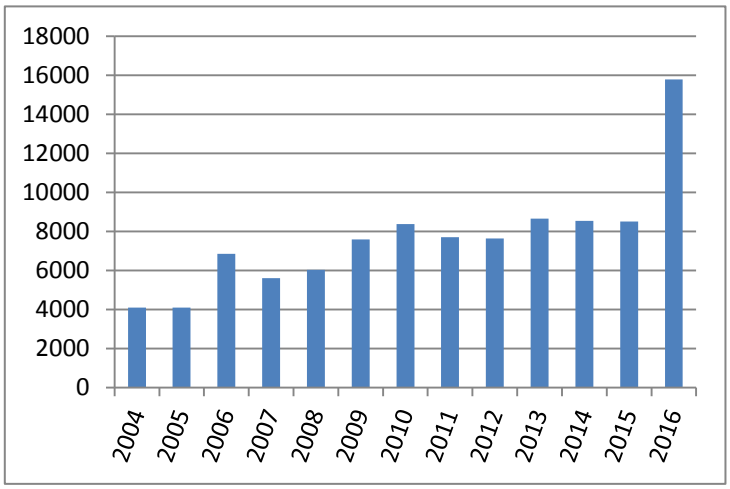
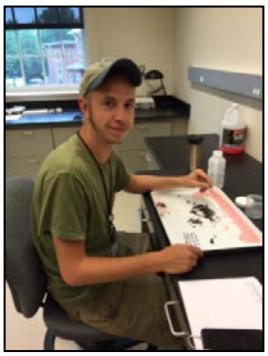


Table 2. Number of inquiries from FY 2004/2005 to FY* 2016/2017.

became well established along the Connecticut shoreline as far south as Milford and inland up the Quinnipiac River valley as it expanded its range (12 positive identifications).

The Gypsy moth (*Lymantria dispar dispar*) outbreak far exceeded all other inquiries during the spring of 2017 with 6,764 calls. Many callers took the opportunity to ask additional arthropod questions inflating numbers further. The second highest inquiry was bed bugs (3,178), ticks (392), DP (243), then animals (especially rodents) and pollinators. Not including the Gypsy moth calls, inquiries were the highest on record with 9,106. Of these, 58% were natural resources, 39% man and medical issues, 1% undetermined, and 2% food-related. Bed and bat bug inquiries remain a leading inquiry, rising to 3,178 (35%) up from last year. Dr. Ridge ran a number of trainings on bed bugs including Mattress Recycling Council trainings as part of a requirement written into the Connecticut mattress recycling law, Act 13-42.

Dr. Ridge, in collaboration with Haralabos Tsolakis and Salvatore Ragusa of the Universita di Palermo, Italy, made a revision in the taxonomy of the predatory mite *Neoseiulus fallacis* first identified by Garman in 1948 to a new species *Neoseiulus garmani*. Findings were published in the *International Journal of Acarology*. Dr. Ridge also identified a genus of minute brown scavenger beetle (Latridiinae: Deinerella spp.), which was confirmed by the Systematics Entomology Laboratory (SEL) at the Smithsonian from a shipment of wooden candy sticks shipped from China. Dr. Ridge intercepted a species of treehopper (Membracidae) from cacti bought from Walmart and SEL and identified the species as *Ophiderma tricinata* Ball, native to Arizona and classified by them as a "new pest." The Systematics Entomology Laboratory (SEL) confirmed Dr. Ridge's identification of Khapra beetle, *Trogoderma granarium*, found in Stamford.



Summer assistants Zachary Brown and Joanne Klein sort and identify survey samples.

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 2017, CAPS is surveying for a number of oak and maple insect pests in nurseries and forest landowner properties, as well as for non-native Cerambycids in Christmas tree farms. Additional grape and *Phytophthora ramorum* surveys are supported by the Farm Bill. The FPSOP program's main objective is outreach and education about handling the loss of ash from the emerald ash borer and also works with the national Don't Move Firewood Campaign and Connecticut Master Gardeners. The FPSOP also includes a biosurveillance program for exotic beetles related to the emerald ash borer using the native *Cerceris* wasp.

Bird & Butterfly Garden: The Bird & Butterfly Garden is a partnership of the Federated Garden Club of Connecticut, the Spring Glen Garden Club of Hamden, and The Connecticut Agricultural Experiment Station. Most maintenance and improvements to the garden are done by farm manager Richard Cecarelli and his staff. The garden is open to the public Monday-Friday, 8:30 a.m. to 4:00 p.m., and closed on 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 12 different butterfly species, 14 species of birds, and 13 other species around the garden during Plant Science Day on August 3, 2016.

Butterflies & Moths	*Birds*	*Other*
Cabbage White	Northern Mockingbird	Green Frog
Eastern Tiger Swallowtail	Mourning Dove	European Honey Bee
Silver-spotted Skipper	American Robin	Bumblebee spp.
Peck's Skipper	Tree Swallow	Large Milkweed Bug
Tawny-edged Skipper	Northern Cardinal	Carolina Locust
Monarch	Gray Catbird	Wandering Glider (dragonfly)
Dun Skipper	Red-winged Blackbird	Common Green Darner (dragonfly)
Eastern Tailed-Blue	House Finch	Golden Milkweed Aphid
Broad-winged Skipper	Chimney Swift	Carpenter Bee
Spicebush Swallowtail	American Goldfinch	Annual Cicada
Common Buckeye	Red-tailed Hawk	European Paper Wasp
Pearl Crescent	Brown-headed Cowbird	Great Golden Digger Wasp
	Song Sparrow	
	American Crow	

Act Concerning Pollinator Health (Public Act 16-17) and an Act Concerning Bee Inspections (Public Act 17-21). A new law concerning pollinator health was enacted by the state of Connecticut in the 2016 legislative session (Public Act 16-17). Among other things, the Act created a Pollinator Advisory Committee consisting mainly of staff of the Experiment Station, required a study of the *Varroa* mite attacking honey bees by the State Entomologist, an evaluation of the possibilities of breeding bees that are resistant to the mites, and required the Experiment Station to create a citizen's guide to model pollinator habitat. Suggestions for updating the Connecticut statutes pertaining to the registration and inspection of honey bees (Sec. 22-89; 22-90) in the *Varroa* mite report were adopted in Public Act 17-21. The following were appointed to the pollinator advisory committee: Dr. Richard Cowles (CAES); Mr. Mark Creighton, State Apiary Inspector (CAES); Mr. Nelson DeBarros (DEEP); Dr. Kirby Stafford III, State Entomologist (CAES); and Dr. Kimberly Stoner (CAES).

On May 3, 2016, **An Act Concerning the Rights and Responsibilities of Landlords and Tenants Regarding the Treatment of Bed Bugs (Public Act 16-51)** passed the Connecticut house and Senate to become law and the law was officially signed by Governor Malloy on October 11, 2016 (Figure 1). Written by attorney Judith R. Dicine (CCABB legal counsel) assisted by Dr. Ridge and the board, and lead by Representative Larry Butler (Waterbury), it took five years to get the law enacted.

The signing of Public Act "Act Concerning the Rights and Responsibilities of Landlords and Tenants Regarding the Treatment of Bedbug Infestations"
Govenor Dannel P. Malloy
2 PM Tuesday October 11, 2016
Govenors' Office
210 Capital Avenue
Hartford, Connecticut

RESEARCH ACTIVITIES

Integrated Tick Management (ITM)

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

A new interdepartmental integrated tick management project was initiated in 2016-2017 in a cooperative agreement with Dr. Andrew Li at the USDA-Agricultural Research Service. Dr. Kirby C. Stafford (Department of Entomology), Dr. Scott C. Williams (Department of Forestry and Horticulture), and Dr. Goudarz Molaei (Department of Environmental Sciences), initiated baseline tick and mouse sampling in several neighborhoods in Guilford, CT where five-year study will be conducted. The USDA-ARS is funding the study. The neighborhoods in this ITM study will consist of different combinations of an untreated controls and homes treated with combinations of spray applications of the entomopathogenic fungus *Metarhizium anisopliae* (Met52® EC), the fipronil-based rodent bait box (Select TCS™) and the 4-poster passive acaricide application station for the treatment of white-tailed deer (*Odocoileus virginianus*). The 4-posters will be put in place in Fall 2017 and other treatments will begin in summer 2018.

4-poster station and fipronil-based rodent bait box

Technicians Heidi Stuber, Megan Linske, and Michael Short assisted with sampling of blacklegged tick (*Ixodes scapularis*) and white-footed mouse (*Peromyscus leucopus*) populations with seasonal resource assistants Sarah Hemstock and Brianna Byrne in 2017. Mallery Breban assisted Dr. Molaei with the tick testing. Host-seeking ticks were sampled by dragging the perimeter of each property biweekly May-August and white-footed mice (*Peromyscus leucopus*) were live-trapped monthly using Sherman box traps. Each captured mouse was sedated, marked with a unique ear tag, processed for ticks, and a blood sample was taken for serological analysis.

Tick Overwintering Study

With support from the Northeast IPM Center, the second year of a study looking at the survival of *I. scapularis* nymphs and adults of the lone star tick, *Amblyomma americanum*, under different environmental conditions was conducted by Dr. Kirby Stafford and Dr. Scott Williams at CAES and Charles Lubelczyk at the Maine Medical Research Center Institute (MMRCI) over the winter of 2016-2017. Snow and leaf litter can moderate temperatures and provide moisture. This study examined survival with no cover, leaf litter cover, snow cover, or both leaf litter and snow cover. Nymphal blacklegged ticks and adult lone star ticks were placed in special “tick pots” buried in the ground (white top in left picture in leaf litter below) with temperature and humidity data loggers. The study was conducted at Lockwood Farm in Hamden, Connecticut and in Cape Elizabeth, Maine. Similar to the previous year, the lowest survival (38%) in Connecticut was observed for the blacklegged ticks where both leaf litter and snow were removed. Survival of lone star ticks ranged from 38-69%, indicating this tick can overwinter in Connecticut. There has been a slow increase in submissions of lone star ticks to the CAES Tick Testing Laboratory, although the numbers still represent a small proportion of the total tick submissions (2-3%).


Nymphal *I. scapularis* (photo Scott Bauer, USDA) and adult female *A. americanum* (CDC).

Pesticides in Honey Bee Pollen from Ornamental Plant Nurseries

Consumers purchasing plants for their gardens have expressed concern in recent years that systemic pesticides, such as neonicotinoids, used in production of ornamental nursery plants could affect pollinators visiting those plants after they have been planted in the landscape. In this project, we put honey bee hives onsite at three ornamental plant nurseries and collected pollen brought back to the hive by the bees. The objectives of this study were 1) to determine the extent to which pesticides used in ornamental plant production would move into pollen used by honey bees and present a hazard to bee health, and 2) to identify specific plant species from which the most toxic pollen came. Pollen trapped from the honey bees was collected weekly from two hives at each site, frozen in the lab, and analyzed for pesticides using high pressure liquid chromatography and mass spectrometry. We found that most samples from the three nurseries were low in acutely toxic pesticides, but there were a series of samples from one of the nurseries in August that had high levels of acutely toxic pesticides. Identification of the plants that were the sources of pesticide contamination is being carried out by palynology (microscopic examination of the pollen grains) and using molecular methods. This project was funded by the Connecticut Department of Energy and Environmental Protection. Dr. Kimberly Stoner, Dr. Brian Eitzer, Dr. Richard Cowles are the investigators, assisted by Mark Creighton, Dr. Alejandro Chiriboga (of the University of Connecticut), Andrea Nurse (of the University of Maine), Dr. Douglas Sponsler (of Penn State University), Morgan Lowry, and Tracy Zarrillo.

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 a tool for detecting and monitoring emerald ash borer and other invasive buprestid species by intercepting its prey as female wasps return to their nest. The wasp was responsible for the first detection of EAB in Connecticut, and remains our main tool for detecting and monitoring EAB in the state. We are in the 8th year of our Wasp Watcher program. Over the course of the program we have trained 125 watchers. In 2017, 22 watchers from previous years are signed-on, as well as 24 new watchers. Since 2010, Watchers have collected over 8,000 beetles and detected EAB in 37 new towns. We have also used this system to examine the native buprestid fauna of Connecticut, and have detected over 70 species of beetles with this tool. Of these, 21 are new state records. One of these, *Agrilus smaragdifrons*, detected in 2015 in Berlin, CT, is a newly detected non-native species from Asia. While little is known about its biology, it appears to feed on Tree of Heaven.

New Wasp Watchers at Edison Magnet School in Meriden pursue *Cerceris fumipennis*.

Classical Biological Control of Emerald Ash Borer

Larvae of the endoparasitoid *Tetrastichus planipennisi* and the remains of an EAB larvae. CT.

Following the detection of EAB in Connecticut, the determination was made to join the USDA APHIS/ PPQ biological control program for EAB. In May 2013, Dr. Claire Rutledge began releases of the gregarious endoparasitoid, *Tetrastichus planipennisi* and the egg parasitoid *Oobius agrili* in Middlebury and Prospect, CT. The parasitoids are shipped from the USDA APHIS emerald ash borer mass-rearing facility in Brighton Michigan. Releases have been made in 11 towns in Connecticut altogether, the others being Hamden, Sherman, Cromwell, Litchfield, Plymouth, Simsbury, East Haddam, Weston and East Windsor. Each release site receives parasitoids for 2 years.

After releases, the next step is to determine if the parasitoids have established in the environment. Our first 2 release sites, Middlebury and Prospect did not receive any releases in 2015. In fall 2015, we peeled trees at those sites, and parasitized by *T. planipennisi*. We found them both at the initial release site, and at sites nearby looking for EAB larvae up to 2.5 m from the original site, strongly suggesting that the parasitoid has established in Connecticut, and is spreading. We also found T. planipennisi in Sleeping Giant State Park in fall 2016 after releases in 2014 and 2015. We are still attempting to recover the much smaller, and elusive *O. agrili*. In summer 2017, we set up yellow pan traps to look for *O. agrili* and *T. planipennisi* in both Hamden and Litchfield.

Boosting Resistance to Emerald Ash Borer in Ash and White Fringetree using Methyl Jasmonate

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

Emerald ash borer is known to attack and kill all species of North American Ash (genus *Fraxinus*). In 2014, it was discovered that EAB can also attack and kill another native tree, White Fringetree (*Chionathus virginicus*), which is in the same family as ash. While white fringetree is more resistant to EAB than white ash, both trees are less resistant to the beetle than their Asian con-geners. Recently published work suggested that green ash dosed with methyl jasmonate, a plant stress hormone, becomes more resistant to emerald ash borer. In the summer of 2017, in collaboration with Dr. Adriana Arango-Velez, experiments were conducted to compare the ability of methyl jasmonate to increase resistance of white fringetree and white ash to emerald ash borer. Larval establishment, survival and growth rate, were all measured. In addition, several measures of tree response, such as callous formation, production of defensive chemicals, and microstructure of cell walls will be measured. If this technique is shown to have a strong impact on the ability of trees to defend themselves against emerald ash borer larvae, it may provide an alternative to more traditional pesticides.

Southern Pine Beetle in Connecticut, Expansion of Geographical and Host Range

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.

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 in October, 2014. It was discovered in Connecticut in March 2015 on Red Pine in Wharton Brook State Park. Since this initial discovery, we have detected SPB across the state in all counties except Tolland and Windham and in six species of tree, Red Pine, Scotts Pine, Pitch Pine, Norway Spruce White Spruce and White Pine. Traps set along a north-south gradient in 2015 found live beetle in only the southernmost sites, suggesting that SPB did not survive winter in northern Connecticut. However, in summer 2016, traps at the same sites found SPB in both the southern sites and two more northern sites. In 2017, numbers of individuals trapped are still very low, and only one new tree infestation has been found but the suggestion that SPB is overwintering is of concern. Work is ongoing to understand the potential impact of this beetle in Connecticut. This project is being done in collaboration with Dr. Adriana Arango-Velez.

Modifying Emerald Ash Borer Trapping Tools for use with Bronze Birch Borer

Emerald ash borer, *Agrilus planipennis*, is an Asian cousin of our native bronze birch borer *Agrilus anxius* Bronze birch borer (BBB) is generally a secondary pest of North American birch species, but it can become an outbreak pest during times that birches are under stress from drought. It is also a well-known primary pest of non-North American birch species, such as European White Birch, that are widely used in landscaping. As of yet, BBB is not known to be found in Europe. However, the European Plant Protection Organization is concerned that if BBB were to become established in Europe it would pose a serious threat to birch in Europe. In summer 2017, in collaboration with PRESPYS (Pest Risk Evaluation

Bronze birch borer on an Asian species of birch.

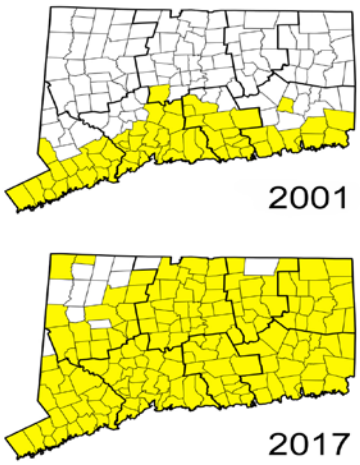
and Pest Management Systems https://www.forestry.gov.uk/fr/prepsys), my laboratory started a pilot project examining the use of two trap-types widely used in trapping EAB for trapping BBB. Purple prism traps, and green Lindgren funnel traps were hung in girdled and un-girdled ash and birch trees at 7 sites around Connecticut for a total of 104 traps. Based this summer's results, we will continue to work on this project in summer 2018.

Range Expansions of Exotic and Native Insects

The Japanese cedar longhorned beetle (*Callidiellum rufipenne*) was first detected in Connecticut in 1998 after its larvae had bored into living arborvitae in garden centers. Based on an extensive survey conducted between 1999 and 2001, this new threat to woody plants in the cedar family was found to be confined largely to the southern four counties. During this initial survey, beetles were detected by capturing adults on sticky bands around 2-foot sections of cedar trunks or by rearing adults from infested wood.

After adults of this invasive beetle were reared from the dead wood of eastern red cedar (*Juniperus virginiana*) in Tolland County in 2014, Dr. Maier, assisted by Morgan Lowry and Tracy Zarrillo, decided to conduct a second distributional study to determine how far north the beetle had spread. This second survey, conducted in 2016 and 2017, relied on a less labor-intensive sampling method. Cross-vane panel traps baited with various ketones, including an attractant for adults of this longhorned beetle, were deployed in stands of eastern red cedar, the favorite larval host in the wild. During the 2-year survey, Dr. Maier and his team found that the Japanese cedar longhorned beetle had spread throughout the state. It was discovered in 155 of the 169 towns in Connecticut. Potted or unhealthy plants in the cedar family probably are now at risk of attack in garden centers and nurseries throughout the state.

Another alien insect that is expanding its distributional range in Connecticut and elsewhere is the viburnum leaf beetle (*Pyrrhalta viburni*), a pest of wild and cultivated viburnum species. Both larvae and adults of this species eat the foliage of viburnum, sometimes killing plants. In Connecticut, this Eurasian beetle was first found on potted viburnum imported from New York in 2004. Dr. Maier conducted the first statewide survey for this invasive beetle in 2009 and 2010 by beating branches of viburnum to dislodge adults from foliage. This initial survey showed that this invasive beetle was concentrated in the northern one-half of the state. In 2016, he initiated a 2-year study to reevaluate distributional range of the viburnum leaf beetle. Thus far, he has determined that this viburnum pest has spread to every county in the state. In several locations, the beetle has killed wild viburnum species.



Distribution of the Japanese cedar longhorned beetle in 2001 and 2017. Towns with beetles are shown in yellow.

While Dr. Maier and his assistants were investigating invasive species in Connecticut over the last 2 decades, they encountered an unfamiliar cricket. The species was determined to be the jumping bush cricket (*Orocharis saltator*), which previously was not known north of

the middle of New Jersey. Based on sampling with a variety of methods, they ascertained that this cricket now occurs in at least 5 counties in Connecticut, and it is particularly common in the southern half of the state. Thus, both native and introduced species are on the move in Connecticut.

Hosts of the Lily Leaf Beetle

The lily leaf beetle (*Lilioceris lilii*) feeds upon Asiatic, Oriental, and native lilies that grow in Connecticut. Both the larvae and the red adults of this European beetle consume the foliage and the flowers of lilies, often killing cultivated plants wherever beetle populations are high. Although this invasive beetle prefers Asiatic lilies, it has damaged wild lilies, such as the Canada lily (*Lilium canadense*) and the Turk's-cap lily (*L. superbum*).

Dr. Maier and his assistants previously documented that the lily leaf beetle can have a severe negative effect upon the growth of Canada lilies. In 2016, Dr. Maier began to investigate how this invasive beetle might also injure other wild liliaceous plants. In 2016, he found both adults and eggs on uncaged twisted stalk (*Streptopus lanceolatus*), a relatively uncommon native species. In 2017, Dr. Maier put mated pairs of adult beetles in cages over 4 species of native liliaceous plants to determine how the beetle would impact them. He found that adults would eat all of the species, but especially Indian cucumber (*Medeola virginiana*), Solomon seal (*Polygonatum pubescens*), and twisted stalk (*Streptopus lanceolatus*). A small number of eggs were laid on twisted stalk, but no larvae developed on them. Biweekly checks of 10 species of uncaged wild plants showed that no plants had adults, eggs, or larvae in 2017. Thus, based on these initial results, it appears that, with the exception of wild lilies (*Lilium* spp.), native liliaceous species of Connecticut may not be suitable hosts for this foreign beetle.

Longhorned Beetles of Connecticut

Most larvae of longhorned beetles, or Cerambycidae, bore into the wood of dead or dying trees and shrubs or occasionally into herbaceous plants. Pestiferous species feed upon the wood of living trees, firewood, or cultivated herbaceous plants. Dr. Maier, assisted by Morgan Lowry and Tracy Zarrillo, has been investigating the biology of these borers especially to improve our understanding of species diversity, distribution, and hosts in Connecticut. To acquire new data, they capture adult beetles in traps baited with various sex pheromones or host volatiles, rear adults from wood infested by the larvae, collect adults on flowers, attract adults to light-traps, capture adults in flight interception and fermenting bait traps, and examine label data on specimens in museums.

Round-headed apple tree borer (*Saperda candida*), a longhorned beetle that attacks living apple trees in the Northeast.

Thus far, Dr. Maier and his team have recorded 198 species of longhorned beetles in Connecticut. They have collected 171 species (86.4% of total) by sampling with diverse methods. The remaining 27 species (13.6% of total) are known only from museum species and may no longer exist in the state. At least 30 species (15.2% of total) were recorded from the state for the first time. Of the 198 species recorded from Connecticut, 5 (2.5% of total) are non-native species.

Ninety-nine species of longhorns were reared from the wood of dead or stressed woody plants in the northeastern United States. The rearings have revealed the presence of species not previously known from Connecticut and have provided more than 100 new host records. Among the reared species, the red-

headed ash borer (*Neoclytus acuminatus*) had the broadest host range, developing in 36 woody species, which included both gymnosperms and angiosperms.

Over the past 10 years, Dr. Maier and his assistants regularly have added new biological information to a database that now has over 17,000 entries, representing more than 22,000 specimens of longhorned beetles encountered during their studies or housed in museums. Biological information compiled in this database includes floral hosts, larval hosts, distribution, activity periods, and methods of sampling. These data should assist in developing management plans for destructive species of longhorned beetles and possibly for species of conservation concern. The ultimate goal of their project is to provide an annotated checklist of the longhorned beetles of Connecticut.

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 Jeffrey Fengler and Tia Blevins, Apiary Inspector Mark Creighton, and State Survey Coordinator Katherine Dugas.

Nursery Inspection and Certification. Two-hundred seventy-one nurseries were certified to conduct intra- and interstate business. There were 500 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, thrips, lily leaf beetle, imported willow leaf beetle, red headed flea beetle, boxwood leaf miner, and powdery mildews.

Japanese Beetle Certification to Canada. Eight Connecticut nurseries, which met the inspection requirements of the US/Canada Japanese Beetle Harmonization Plan, shipped 30,556 plants to Canada in 2016.

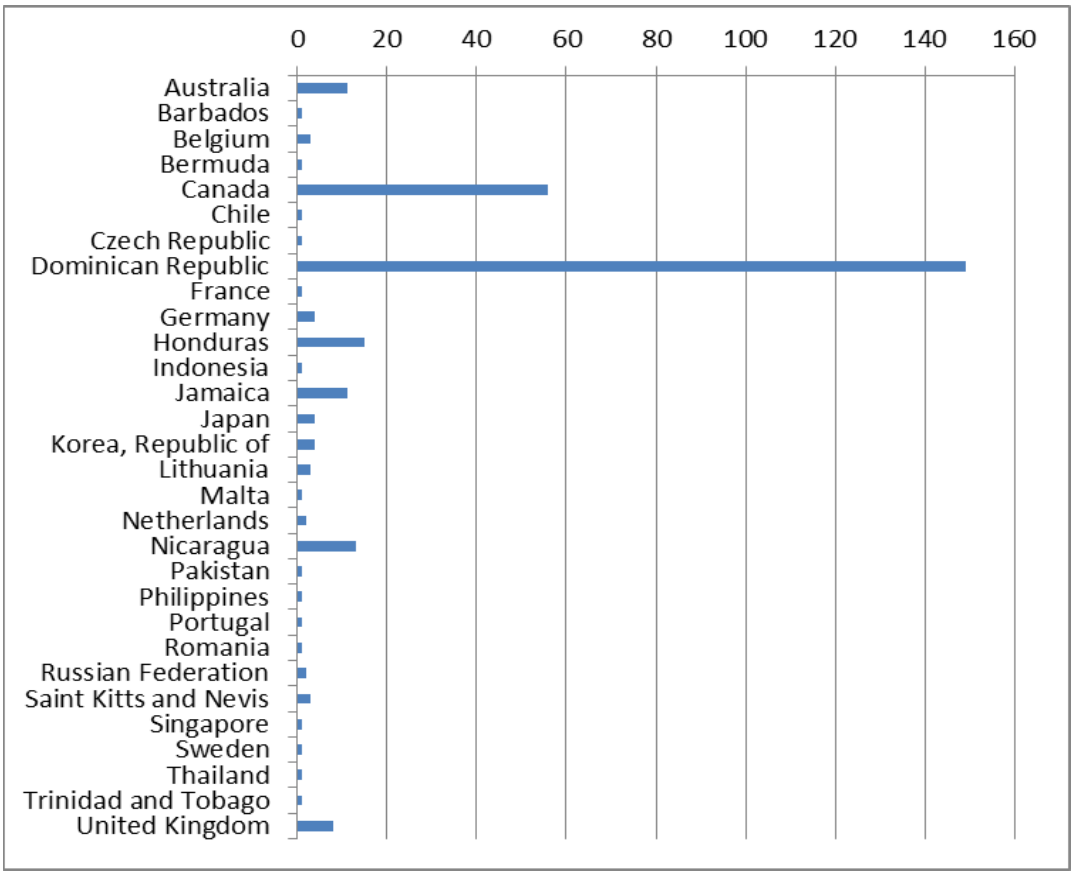
Nursery Dealer Permits. Nursery dealer permits were issued to 156 firms. One hundred twenty-three of these companies operate individual outlets. The remaining businesses have more than one outlet each. In total, there were 479 outlets.

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

Product	Quantity
Apples (cartons)	4,000
Apricot /walnut shells, mixed (ground, drums)	4
Bulbs & Tubers (Dahlia & Gladiolas) (# bags)	32
Bulbs & Tubers (Dahlia & Gladiolas) (kilos)	8
Chinese Tree Peony (plants)	26
Greenhouse plants	
Rhizomes	116
Plants	58
Nursery stock	
Bare root stock	2
Plants (B and B)	29,644
Orchids (plants)	6,392
Pecan shells (ground, pounds)	10
Perennials	

Bare root plants	1,287
Potted plants	350
Seeds (bags)	145
Seeds (kilos)	133
Tobacco	
Bales	68,802
Bundles	56,002
Cartons	9,922
Pounds	3,850
Vegetable ivory (ground, drums)	4
Walnut shells (bags)	88
Walnut shells (drums)	425

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

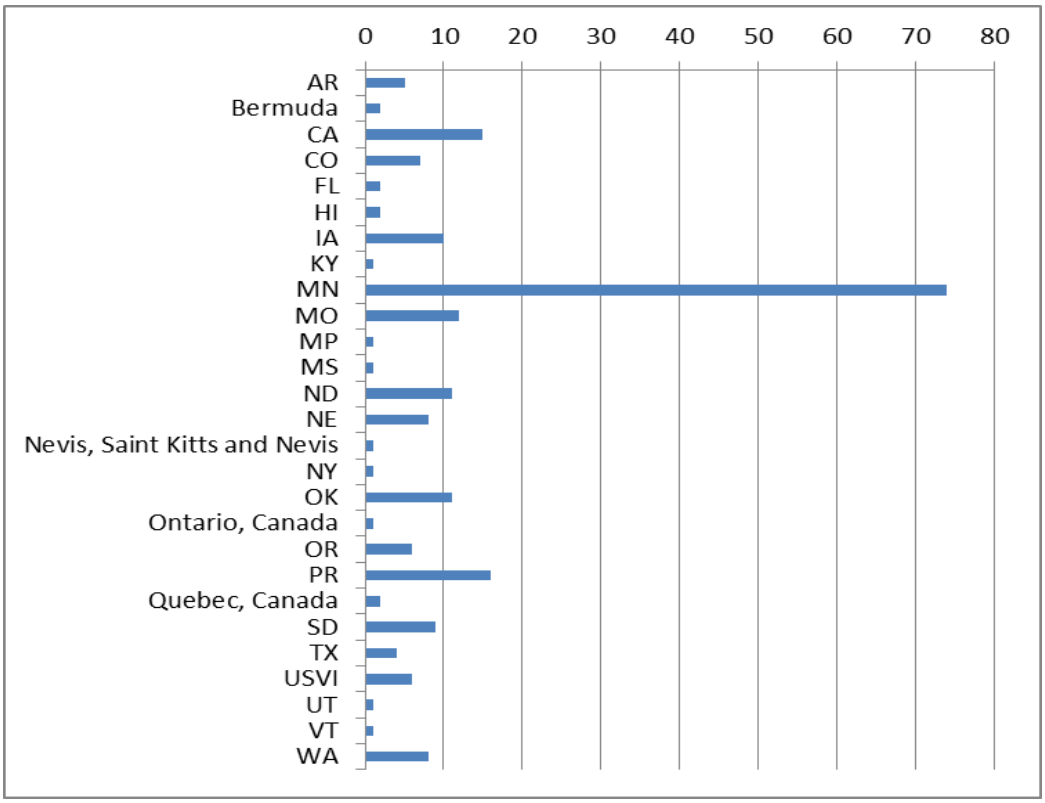


Sixty-seven inspections were made to assist nurseries moving the following plants interstate, either to destinations in other states, to the CITES port, or to US Territories and Puerto Rico (12 listed destinations). Twenty-eight consignments were bound for Puerto Rico, thirteen to Washington, and ten to California.

Product	Quantity

Nursery stock (containers)	150
(bare root plants)	1,000
Greenhouse plants	1,059
Seed (# Bags)	53
Orchids	22

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



Special Inspections. Eleven inspections were made for 186 individual plants to assist homeowners moving out of state.

Permits to move live plant pests, noxious weeds, and soil. In 2016, there were seventy-four PPQ 526 Permits (Permit to move live plant pests, noxious weeds, and soil) approved in CT. There was one Controlled Import Permits issued. There was one permit for Post Entry Quarantine approved.

Boxwood Blight compliance agreements for shipment to Pennsylvania. Four nurseries met requirements for shipment of boxwood nursery stock to Pennsylvania.

Chrysanthemum White Rust. In 2016, we inspected 10,000 plants for CWR, caused by *Puccinia horiana*. No positives were detected.

Gypsy Moth. Due to drought conditions in spring and early summer of 2016, the fungus that usually keeps gypsy moth larvae in check did not "kick in," and there was considerable damage due to larval feeding. We observed defoliation due to gypsy moth on 204,167 acres, mostly in Middlesex, New Haven, and New London counties. In November and December 2016, a gypsy moth egg mass survey was conducted in 80-95% favorable host sites on a 7-mile grid (102 sites) throughout Connecticut. Egg mass counts were very high in many locations, indicating a high potential for another outbreak in 2017.

Asian Longhorned Beetle. We conducted 55 inspections of 4,453 trees in all counties of CT for presence or signs of ALB infestation.

Hemlock Woolly Adelgid and Elongate Hemlock Scale. These pests have been present in CT for many years, and continue to cause patchy damage and decline among the remaining population of hemlocks. Statewide in 2016, 1,677 acres were affected by HWA, and 3,456 were affected by EHS. Scale insects, such as elongate hemlock scale and circular scale, are increasing in some areas, and may be more of a factor in tree damage and mortality than HWA.

Emerald Ash Borer. Emerald ash borer has been detected in all eight counties; the quarantine for this insect was extended statewide to encompass all of Connecticut. Detections and outreach efforts included monitoring of *Cerceris* colonies, trapping was suspended when the state became fully quarantined. During aerial survey, we mapped 6,194 acres defoliated by EAB, and expect acreage and mortality to increase in the coming years.

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

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

Forest Tent Caterpillar. Damage due to forest tent caterpillar was detected on 3,026 acres, in New London County, near the Rhode Island state line.

White Pine Needle Decline. We recorded only 802 acres affected by white pine needle decline.

Locust Leaf Miner. We recorded 243 acres affected by locust leaf miner, detected by ground survey.

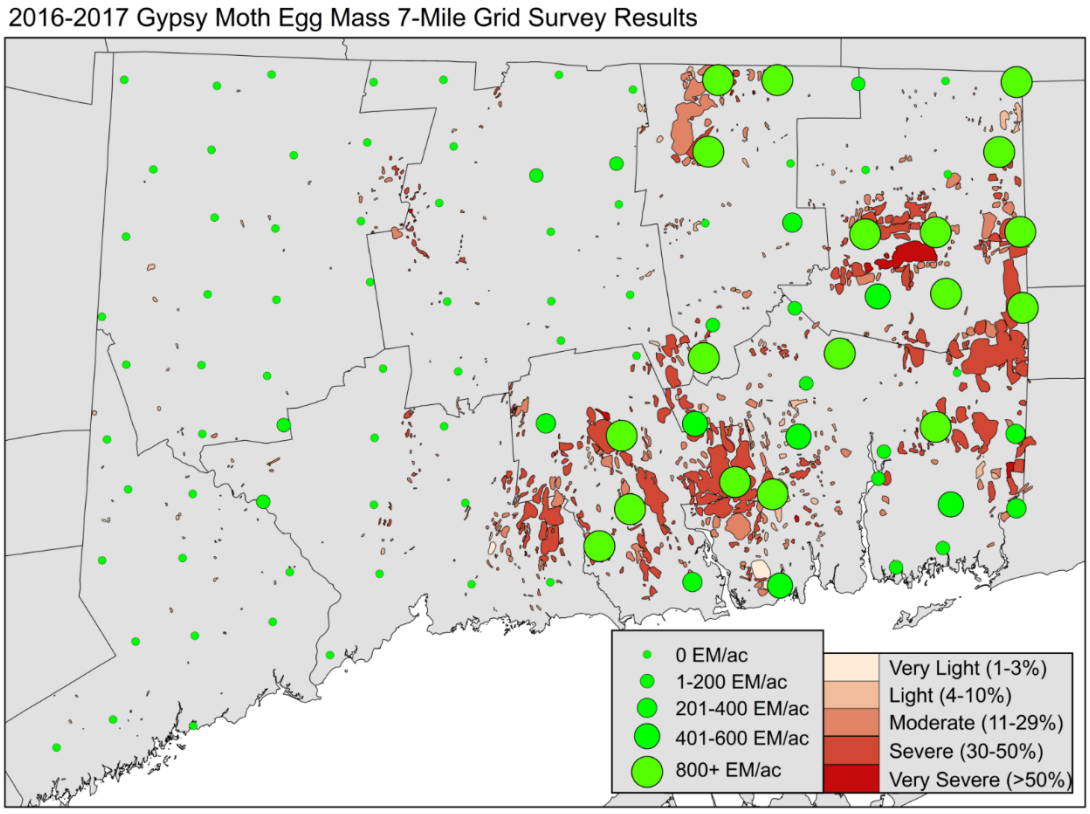
Cynipid Gall Wasp. Cynipid gall wasp was detected on the Bluff Point Coastal Reserve in New London County and adjoining areas in the town of Stonington in late 2014. The infestation has not been delimited.

Apiary Inspection. During the 2016 season Connecticut had 1,655 registered beekeepers maintaining 8,023 hives. In 2016, one thousand three hundred hives were inspected. Unofficial estimates indicate that there could be another 400 beekeepers/800 colonies that have yet to register. Unofficial estimates indicate that over 4000 packages of Honey bees were imported into Connecticut for sales to new beekeepers and to replace losses. American foulbrood was detected in three hives; these were destroyed by burning. Colony inspection determined Varroa mite infestation and the viral complex associated with Varroa infestation as the primary reason for colony mortality. CT beekeepers continue to lose colonies overwinter in higher numbers; the Bee Informed Winter Loss report for CT in 2016 was 44.4%; the winter loss was 39.5%. (An increase of 18%) These losses are slightly higher than regional and nationwide trends. The viral pathogens that cause deformed wing virus (DWV), Israeli acute paralysis virus (IAPV), acute bee paralysis virus (ABPV), and even the rare chronic bee paralysis virus (CPBV) were detected in Connecticut as part of the USDA Honey Bee Pests and Diseases Survey. Due to high winter losses in 2016, local beekeepers struggled to replace losses with package bees from southern states. Despite these challenges, beekeeping interest is still strong with over 800 new beekeepers being trained this winter. There were one hundred sixty Apiary Certificates of Health issued. Six certificates were issued for export out of CT, and one hundred fifty-four certificates for interstate movement of honey bees.

CT participated in the USDA APHIS National Honey Bee survey to document presence/absence of diseases and pests of honey bees. Samples taken from 192 colonies were submitted to the laboratory at the University of Maryland; results are pending.

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

The 2016 ADS data (Aerial Survey) overlaid with the 2016-2017 gypsy moth egg mass 7-mile grid survey results.



4. Special activities:

Email/telephone inquiries concerning emerald ash borer, 1 July 2016 through 30 June 2017: 25
Email/telephone inquiries concerning Asian longhorned beetle, 1 July 2016 through 30 June 2017: 13

Defoliation caused by the gypsy moth around Green Fall Pond Voluntown, CT (30 June 2017). Photo by Plant Inspector Tia Blevins.

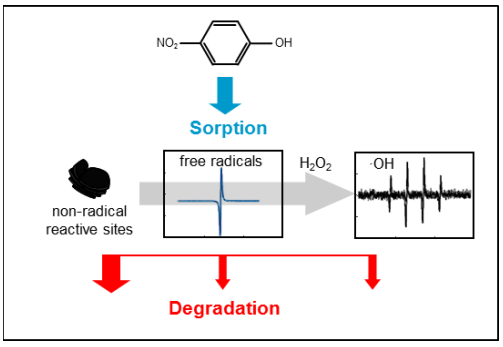
Environmental Chemistry

(Dr. Joseph Pignatello)

A. Interactions of Contaminants with Environmental Particles

1. Degradation of p-Nitrophenol by Lignin and Cellulose Chars: H_2O_2-Mediated Reaction and Direct Reaction with the Char (Dr. Joseph Pignatello Jing Yang).

Chars and other black carbons are reactive towards certain compounds. Such reactivity has been attributed to reduction of O_2 to H_2O_2 by persistent free radicals in the solid. The H_2O_2 then back-reacts with the solid to generate reactive oxygen species (ROS), most importantly hydroxyl radicals HO·. We studied the decomposition of *p*-nitrophenol (PNP) by pure lignin and cellulose chars that were either aged in moist air or a vacuum for up to a month at room temperature. In air, the chars chemisorbed oxygen, a portion of which was liberated as H_2O_2 when the char was submerged in water. The evolved H_2O_2 was simultaneously decomposed by the char. PNP reacted predominantly in the sorbed state and only reduction products (phenol, catechol) were identified. Aging in air sharply (within hours) reduced H_2O_2-producing capacity and free radical concentration, but more gradually reduced PNP decay rate over the month-long period. PNP decay was only modestly suppressed (12-30%) by H_2O_2 removal (with catalase), and had little effect on the free radical electron paramagnetic resonance (EPR) signal (< 6 radicals annihilated per 1000 PNP reacted). Contrasting with previous studies, the results show that direct reaction of PNP with char predominates over H_2O_2-dependent reactions, and the vast majority of direct-reacting sites are non-radical in character. Non-radical sites are also responsible in part for H_2O_2 decomposition, and there was some overlap in the reactive domains of H_2O_2 and PNP, since H_2O_2 pre-treatment depleted PNP reactive sites. The Fe impurity in lignin played no role. Lignin char was generally more reactive than cellulose char, indicating the aromatic/nonaromatic character of the precursor biomass may be important. The results are relevant to the fate of pollutants in black carbon-rich environments and the use of carbons in remediation.

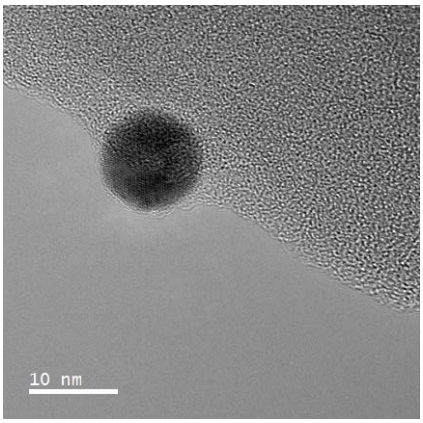


Non-radical reactive sites on biochar are the most reactive toward *p*-nitrophenol.

2. Surface Interactions between Gold Nanoparticles and Biochar (Minori Uchimiya, Joseph J. Pignatello, Jason C. White, Szu-Lung Hu, Paulo J. Ferreira)

Engineered nanomaterials are applied directly to the agricultural soils as a part of pesticide or fertilize formulations. Examples of commercially available fertilizers and pesticides claiming to contain engineered nanomaterials include Primo Maxx (plant growth regulator by Syngenta), Nano-Gro (Agro Nanotechnology), nano-Ag answer (PKN fertilizer), and nano-5 organic fertilizer (Uno Fortune). Additional routes of entry to agricultural soils include the land-application of sludge and manure containing incidental quantities of engineered nanomaterials. Despite the increasing agricultural use of nanomaterials, few prior reports are available on nanoparticle interactions with particles of soils or soil amendments such as biochars. The current global market value of gold nanoparticles (nAu) is estimated to be $1.34 billion, and is projected to increase to $8 billion by 2022. To date, no prior published reports exist on surface interactions between nAu and black carbon (biochar).

Retention of citrate-capped nAu on 300-700 °C pecan shell biochars occurred rapidly and irreversibly even at neutral pH where retention was less favorable. Uniform layers of citrate on nAu were observable by TEM and these layers were preserved after binding to biochar. Binding resulted in aggregation on the surface or alignment along the edges of multisheets of the biochar structure. Retention of nAu on biochars was (i) greater than on a sandy loam soil, (ii) increased with ionic strength, (iii) decreased with pH, and (iii) at pH 3 varied with pyrolysis temperature at which the char was produced: 500 < 700 << 300 °C. Collectively, the results show that carboxyl-enriched 300 °C biochar likely formed strong hydrogen bonds with the citrate layer of nAu. The charge transfer between the conduction band of nAu and π* continuum of polyaromatic sheets is likely to dominate on 700 °C biochar. Surface area-normalized retention of nAu on biochars (1.8×10^{9}-1.3×10^{11} nAu particles per m^2) was several orders of magnitude higher than retention on negatively charged hydroxyl-bearing environmental surfaces (e.g., sand), indicating the importance of black carbon materials in the environmental fate of engineered nanomaterials.



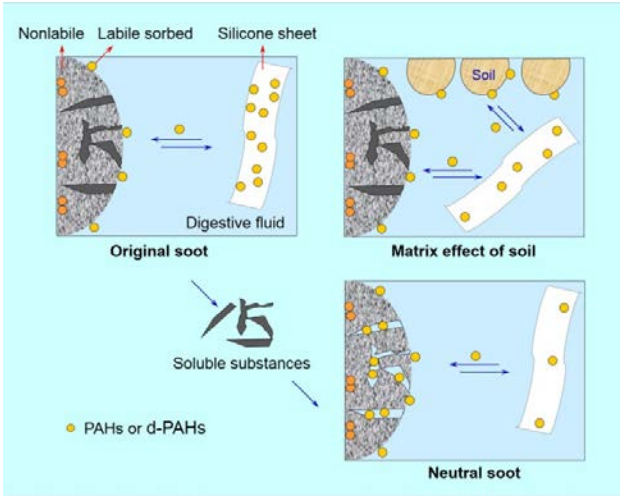
Phase contrast TEM images of a gold nanoparticle (nAu) bound to a pecan shell biochar (made at 700 ^{o}C) showing the uniform citrate layers preserved on the surface of nAu particles retained by biochar.

B. Bioavailability of Contaminants in Environmental Particles

1. Bioaccessibility of PAHs and PAH derivatives in a fuel soot assessed by an in vitro digestive model with absorptive sink: effects of aging the soot in a soil-water mixture (Yanyan Zhang, Joseph J. Pignatello, and Shu Tao).

Combustion-derived soot particles distribute widely in the environment through atmospheric and fluvial transport. Soot and other environmental black carbon (BC) substances such as vegetation chars often contain high levels of polycyclic aromatic hydrocarbons (PAHs) and PAH derivatives (d-PAHs). Mixed with soil or dusts, BC can enter the human digestive tract through hand- or object-to-mouth transfer, especially in children under the age of six who tend to more frequently engage in mouthing behavior. The gastrointestinal bioaccessibility of native PAHs and d-PAHs in BC as a result of unintentional ingestion of environmental particles is therefore of great interest. Previously, we reported how digestive fluid chemistry affects the bioaccessibility of 11 PAHs, one nitro-PAHs, and four oxygenated PAHs in a composite fuel soot sample using an *in vitro* digestive model that includes silicone sheet as a third-phase absorptive sink in the small intestinal stage. We showed that the third-phase absorptive sink increases bioaccessibility by promoting desorption, and that bioaccessibility is increased under feeding relative to fasting conditions due to the promotional effects of bile acids, increased pH, and dietary lipids accompanying food ingesting have on desorption. Those studies were conducted using the "raw" (original) soot, and therefore did not include the potential effects of "aging" the soot may undergo in the natural environment.

Aging soot in soil under neutral aqueous condition for 30 days significantly ($p < 0.05$) reduced the apparent gastrointestinal bioaccessibility (B_{app}) of polycyclic aromatic hydrocarbons (PAHs) and PAH derivatives (d-PAHs) natively present in a composite fuel soot sample. B_{app} was determined under fasting conditions by a previously developed in vitro digestive model that includes silicone sheet as a third phase absorptive sink in the small intestinal stage. Redistribution of contaminants from soot to soil, determined in independent experiments, was too small to affect B_{app}. Prior uptake by soot of a commercial humic acid representing dissolved soil organic matter had no impact on B_{app}. We identified two causes for the reduction in B_{app} by soil and found they were approximately additive. One is an aging time-independent "matrix effect" attributable to competitive sorption by the soil of labile contaminant that is desorbed from the soot during the digestion test. The other is the dissolution of soluble substances from the soot during the aging process that increases soot surface area and nanoporosity. The increased surface area and nanoporosity drive contaminants from labile to nonlabile states in the soot and decrease their desorption into the digestive fluid. The former contributes most to the reduction in B_{app}. The present study shows that mixing of raw soot with soil has important effects, both aging and non-aging, on the bioaccessibility of soot-borne contaminants.

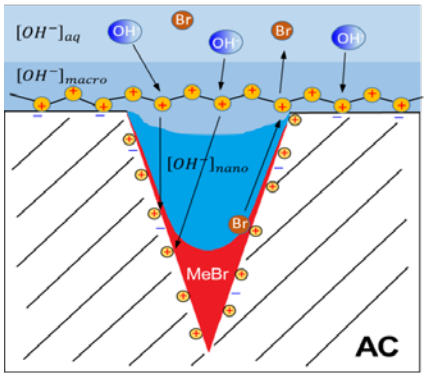


Schematic of the effects aging of soot particles in soil have on *in vitro* gastrointestinal bioaccessibility of contaminants in the soot particles.

C. Pollution Prevention and Remediation

1. Modification of Activated Carbons for Enhanced Nucleophilic Substitution Reactions of Adsorbed Methyl Bromide (Hsin-Se Hsieh and Joseph J. Pignatello).

Activated carbons (ACs) are commonly used to remove organic contaminants from waste streams by adsorption. Methyl bromide (CH_3Br, MeBr) is a quarantine and pre-shipment fumigant commonly used in international trade and regulated as an ozone-depleting compound. Activated carbon (AC) is a highly effective adsorbent for removal of MeBr from fumigation vent streams, but uses of AC for this purpose require desorption of MeBr prior to its destruction in a separate step. Here, we describe the development of quaternary ammonium (QA)-modified ACs for catalyzing base hydrolysis of MeBr directly *in the adsorbed state*. Modifications included irreversible adsorption of a QA polyelectrolyte, poly (diallyldimethylammonium) chloride (PDADMAC), and covalent grafting of QA groups *via* reaction with epoxy intermediates derived from commercial chlorohydrin-functionalized QA precursors (Quat188 and Quab360). In suspensions of



Scheme showing how PDADMAC coating and Quat188 or Q360 grafting catalyze the base hydrolysis of AC-adsorbed methyl bromide. Arrows represent flux of reagent (OH^-) and produced (Br^-) ions. Blue colors indicate OH^- in different concentration regions.

AC in 1 M NaOH at 55 ^{o}C under conditions where hydrolysis in the aqueous phase was negligible, degradation rates were first order in MeBr and were accelerated by up to a factor of 5.7 by QA modification in the order, Quab360 > Quat188 > PDADMAC. Combined modification of Quat188 with PDADMAC was superior to individual modifications. Hydrolysis is accelerated by the attraction of hydroxide ions to created anion exchange sites on the modified carbon, as revealed by the effects of QA modification on anion exchange capacity, point of zero charge, and isoelectric point, and by competition experiments with inert monovalent anions (Br^- and ClO_4^-). Recyclability tests show that these surface modifications are robust for at least five addition-degradation cycles. QA modification also enhances "neutral" hydrolysis (pH 8.6-10.1) and nucleophilic reaction by thiosulfate. QA modification of carbons is a promising approach for trapping and treating MeBr or other hydrophobic compounds requiring reaction with anionic reagents. (Manuscript in preparation).

Mosquito Trapping and Testing Program

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

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

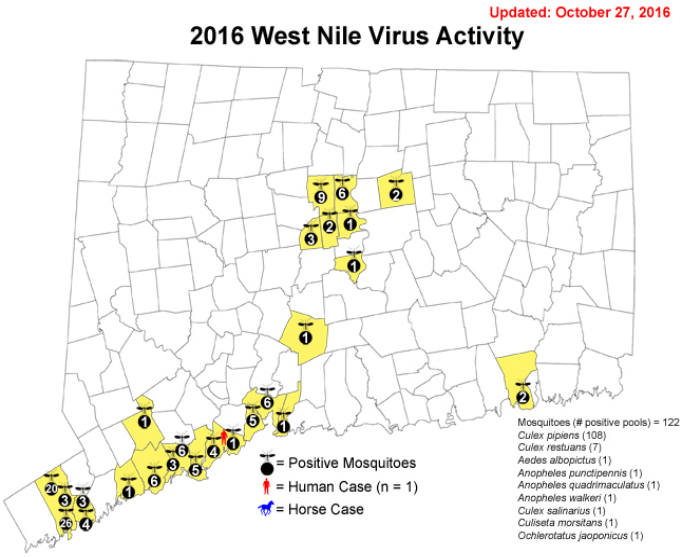
In 2016, statewide mosquito trapping was conducted from May 31 through October 13. Approximately one-third of the sites were located in densely populated residential locales along an urban/suburban corridor in the coastal southwestern corner of the state extending up through the Connecticut River Valley. Trap sites typically included parks, greenways, golf courses, undeveloped wood lots, sewage treatment plants, dumping stations, and temporary wetlands associated with waterways. Trapping locations in the other regions of the state were established in more sparsely populated rural settings that included permanent fresh-water swamps (red maple/white cedar) and bogs, coastal salt marshes, horse stables, and swamp-forest border environs.

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

Female mosquitoes were pooled in groups of 50 or fewer by species, collection date, trap type, and collection site and stored at -80°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 2016, a total of 173,988 mosquitoes (13,221 pools) representing 41 species were trapped and tested from 91 locations statewide between May 31 and October 13. A total of 122 isolations of WNV were made from 8 mosquito species: *Culex pipiens* =108, *Cx. restuans* = 7, *Aedes albopictus* = 1, *Anopheles punctipennis* = 1, *An. quadrimaculatus* = 1, *An. walkeri* = 1, *Cx. salinarius* = 1, *Culiseta morsitans* = 1, *Ochlerotatus japonicus* = 1 collected at 25 sites in 20 towns in 5 counties (Fairfield, Hartford, Middlesex, New Haven, and New London). The first positive mosquitoes were collected on July 6, and the last on September 28. The majority of WNV activity was detected in densely populated urban and suburban regions in Fairfield, Hartford and New Haven counties. One human case of WNV-associated illness was locally acquired (encephalitis/meningitis). Date of onset was during the third week of August. This human case was temporally and spatially consistent with WNV isolations from mosquito pools. No horse cases of WN virus infection were reported. There was one EEE virus isolation made from mosquitoes: *Culiseta melanura* = 1 in New London county and no equine or human cases have been reported. Other mosquito-borne viruses isolated included: Jamestown Canyon virus = 26 isolates from seven species (June 8 – Sept. 1) and LaCrosse = 1 isolate from 1 species (Sept. 22).



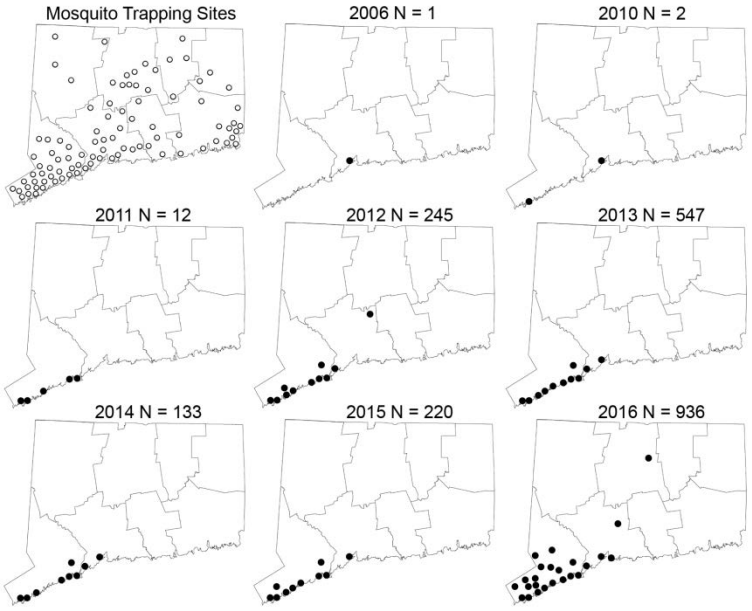
Impact: Participation in the statewide surveillance program provides timely information about levels of virus activity in the mosquito population which is used to monitor virus amplification within enzootic transmission cycles, and assess risk of human infection. This information is used inform the public and health care providers of these risks, guide disease prevention and mosquito control efforts, and prevent disease outbreaks. In addition, this large-scale sampling effort also informs out 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.

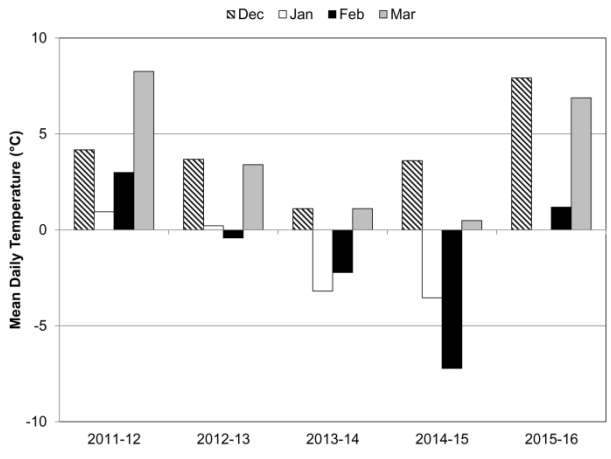
Population Genetics of Mosquitoes and Epidemiology of Mosquito-borne Viral Diseases

A. Northern Range Expansion of the Asian Tiger Mosquito (*Aedes albopictus*): Analysis of Mosquito Data from Connecticut, USA (Dr. Philip M. Armstrong, Dr. Theodore G. Andreadis, Mr. John J. Shepard, and Mr. Michael C. Thomas)

The Asian tiger mosquito (*Aedes albopictus*) is an invasive species and important arbovirus vector that was introduced into the U.S. in the 1980s where it continues to expand its range. Winter temperature is an important constraint to its northward expansion, with potential range limits located between the 0° and -5°C mean cold month isotherm. Connecticut is located within this climatic zone and therefore, *Ae. albopictus* was monitored statewide to assess its northern range expansion and to delineate where populations can stably persist. *Ae. albopictus* females were monitored at fixed trapping sites throughout Connecticut from June-October over a 20-year period, 1997-2016.

Distribution of *Ae. albopictus* in Connecticut





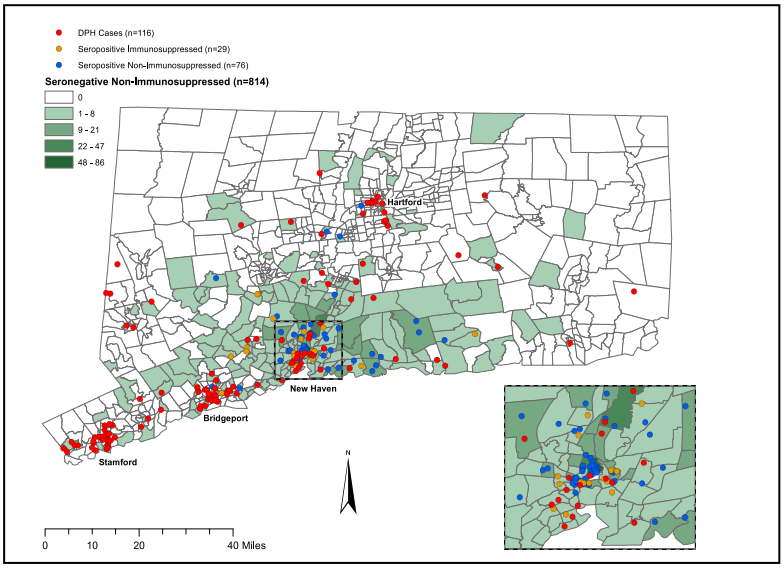
In addition, *Ae. albopictus* larvae and pupae were collected from tire habitats and tires were retrieved from the field in the spring and flooded to evaluate overwintering success of hatching larvae. *Ae. albopictus* was first detected during statewide surveillance when a single adult female was collected in 2006. This species was not collected again until 2010 and was subsequently detected each successive year with increasing abundance and distribution except following the unusually cold winters of 2014 and 2015. *Ae. albopictus* mosquitoes were most abundant in urban and suburban locations along the southwestern shoreline of Connecticut; however, single

specimens were occasionally detected in central parts of the state. Field-collected females were also screened for arbovirus infection yielding two isolations of Cache Valley virus and one isolation of West Nile virus, highlighting the threat posed by this mosquito. *Ae. albopictus* overwintered in Connecticut under mild winter conditions as shown by recovery of hatched larvae from field collected tires in spring and by early season detection of larvae and pupae. This study documents the establishment and expansion of *Ae. albopictus* at the northern boundary of its range in the northeastern U.S. and provides a baseline for monitoring the future spread of this species anticipated under climate change.

Impact *Aedes albopictus* is an invasive mosquito species that originated from East Asia and appears to be undergoing northward range expansion in the U.S. *Ae. albopictus* mosquitoes are aggressive human biters and can spread several disease-causing viruses including, chikungunya, dengue, Zika, and West Nile virus. In this study, the team monitored these mosquitoes statewide over a twenty-year period, 1997 to 2016 as a part of a state-supported mosquito-borne disease surveillance program. This is the first documentation of *Ae. albopictus* range expansion and overwintering in New England and this data demonstrates how mild winters affect the seasonal abundance and overwintering success of this mosquito. This suggests further expansion and build-up of this species with projected climate change. Its aggressive biting behavior and ability to transmit a cadre of human disease-causing viruses warrant further study and close monitoring.

B. Immune responses define susceptibility to infection with West Nile virus in Connecticut (Dr. Philip M. Armstrong and Dr. Theodore G. Andreadis in collaboration with Megan E. Cahill, Yi Yao, David Nock, Maria A. Diuk-Wasser, and Ruth R. Montgomery)

Infection with West Nile virus (WNV) is mainly asymptomatic but some individuals develop severe disease, especially the elderly. During studies on immunity in aging, we assessed serum samples from over 1100 subjects in Connecticut for reactivity to WNV envelope protein. Unexpectedly, we found 8.5% of healthy subjects and 16.8% of immunosuppressed subjects had previous exposure to WNV. To understand factors determining susceptibility, we mapped locations of the seronegative and asymptomatic seropositive subjects and of laboratory-confirmed symptomatic cases reported to the Connecticut Department of Public Health (n=116). The overlapping geocodes of all subjects support a key role for individual responses in determining susceptibility to severe infection upon WNV exposure. Age was not a significant factor in seroconversion among asymptomatic subjects, but remains an important factor in disease, as symptomatic DPH-reported cases are older than asymptomatic seropositive subjects. Immune system variation appears to be a key driver in susceptibility to infection and disease severity.



Impact: Seroprevalence among immunosuppressed individuals is more than double that of non-immunosuppressed individuals. These results, combined with the increased susceptibility to symptomatic disease in older subjects, strongly suggest a key role for individual immune factors. Ongoing research is seeking to further define the immune system attributes that lead to increased risk for WNV severity. In

addition to other health elements involved in aging, immune system variation may be a key driver in susceptibility to infection and disease severity, and in the differing seroconversion rates among neighbors.

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

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

Tick Management and Epidemiology of Tick-borne Diseases

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

Lyme disease (LD) represents the most frequently diagnosed human tick-borne disease in North America. A variety of prevention and control methods, including personal protective measures, habitat modification, applications of biological and natural compounds, and host-targeted control measures, have been examined for reducing tick abundance and risk for LD. We are investigating the efficacy and associated costs of several existing and new tick control measures individually and in the framework of the ITM approach to reduce the number of infected ticks in the inland LD endemic neighborhoods in Redding, CT. The primary objectives of this CDC-funded project are to: 1) develop a reduced

risk/integrated tick management (ITM) approach to tick control, 2) measure efficacy of individual methods and an ITM approach to reduce infected ticks, infected reservoirs, and questing tick populations, 3) determine most effective timing and method of implementation of each tick control method and analyze costs for individual components of an ITM program, and 4) create a "LD decision support system," By incorporating entomological data and other information acquired by the proposed project into our decision support system, we will provide guidance on the most effective control measures that will help stakeholders to protect themselves in an environmentally safe manner. The approach and findings generated from this project will easily be extended to other LD endemic regions.

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

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

C. Spatiotemporal Modeling of Human Lyme Disease and Tick Distributions in Connecticut
(Dr. Goudarz Molaei, Dr. Eliza Little, Dr. John Anderson, Dr. Kirby Stafford III)

This study focuses on examining potential relationship between human Lyme disease cases and tick testing data in Connecticut generated at the CAES Tick Testing Program. The datasets include human Lyme disease cases, number of identified ticks, tested ticks and positive ticks for *Borrelia burgdorferi*, the causative agent of Lyme disease. Our results indicate that human Lyme disease cases are highly correlated with the number of identified positive ticks. Moreover, there is strong space and time correlation in the data and towns with more cases are tended to cluster. Additional analyses are being conducted and a manuscript is also being prepared for submission upon completion of the analyses.

D. Evaluation of Temperature-dependent Physiological Parameters Associated with Disease Transmission in Blacklegged Tick, An Epidemiologically Important Arthropod Disease Vector
(Dr. Goudarz Molaei, Dr. Kirby C. Stafford III)

Climate models predict that the environment will warm in the tick geographic ranges. Historical data on tick dispersal patterns has been incorporated into recently developed computer-based models to predict how this warming climate will alter the biogeography of this arthropod vector. However, conspicuously little or no empirical information is available on the potential association between increasing temperature and physiological processes that influence tick vector competence. The overall aim of this proposed project is to reduce this knowledge gap by quantifying the effect of a warming environment on a defined set of disease transmission-relevant physiological parameters in blacklegged tick (*Ixodes scapularis*). Specific aims of the project are: 1) Determine if a warming environment alters the density of endogenous symbiotic bacteria. *I. scapularis* house endogenous symbiotic bacteria that mediate several aspects of its host's physiology, including vector competence. We will determine whether a warming environment alters the dynamics of the microbial population by quantifying the relative density of endogenous symbionts present within blacklegged ticks maintained at elevated temperatures, relative to their

counterparts maintained under normal insectary conditions, and 2) Determine if a warming environment alters the transmission dynamics of *B. burgdorferi* within *I. scapularis*. We will investigate whether a warming environment alters the infection dynamics of *B. burgdorferi* within blacklegged ticks. Specifically, we will expose *I. scapularis* to infectious blood meals, and then a) quantify the percentage of hosts infected, and b) the pathogen burden of infected hosts. These infection parameters will be quantified in individuals maintained at both elevated and conventional temperatures.

E. Integrated Tick Management for Suppression of Blacklegged Tick Populations in the Suburban Landscape
(Dr. Kirby C. Stafford III, Dr. Scott Williams, Dr. Goudarz Molaei)

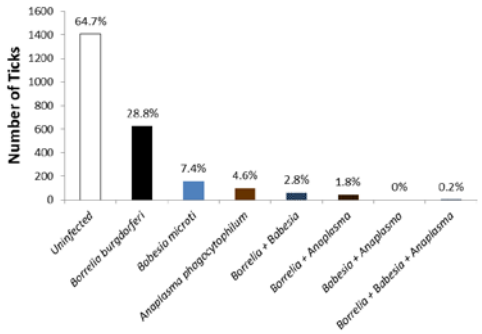
The main goal of this research project is to develop Integrated Pest Management (IPM) strategies to achieve area-wide suppression of populations of the blacklegged tick and other major tick species in the Northeast of the United States. The objectives of the project are to: 1) Assess population density and infection status of ticks in natural areas and surrounding residential areas in suburban environment, 2) Determine roles of white-tailed deer in maintaining and spreading ticks by GPS tracking of deer movements between natural areas and surrounding residential areas, 3) Evaluate tick control efficacy of deer-targeted (4-poster), rodent-targeted (Damminix, Select TCS) and area spray of pesticides, when used alone or combination, 4) Determine if and how different ecological settings may affect the level of suppression of host-seeking ticks achieved through the implementation of host-targeted tick control technologies, 5) Develop and validate anti-tick vaccines that can be used to control ticks on deer and rodents, particularly white-footed mice, and 6) Generate practical guidelines to assist design and implementation of Integrated Tick Management Projects at municipal, county and state levels.

F. Tick Testing Program for Lyme and Allied Diseases
(Dr. Goudarz Molaei assisted by Alex Diaz, Mallery Breban, Pauline Dutka, and Kristina D'Agostino)

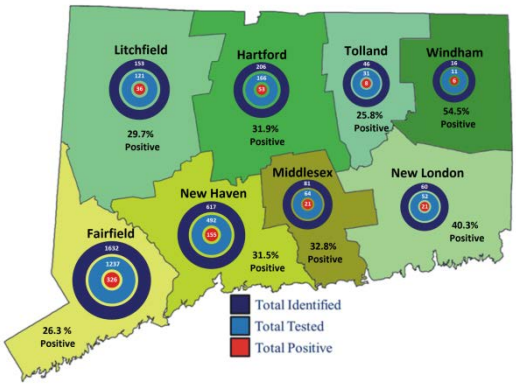
Tick-associated illnesses including Lyme disease (LD) constitute a major threat to human health in Connecticut. The disease was first described in 1977 following the investigation of a cluster of children with arthritis-like symptoms in Lyme, Connecticut.

Ixodes scapularis commonly referred to as the blacklegged or deer tick is the primary vector of *Borrelia burgdorferi*, the bacterium that causes LD. Connecticut has had pervasive populations of *I. scapularis* in all of its eight counties since 1998 and remains a hotspot of disease transmission. In 2015, 95% of reported LD cases in the United States were reported from 14 states, including Connecticut. Connecticut had the 5th highest number of reported cases (n=2,541) following Pennsylvania, New Jersey, New York, and Massachusetts, and the 5th highest incidence rate (confirmed cases per 100,000 persons) of 52.2 after Vermont, Maine, Pennsylvania, and Rhode Island.

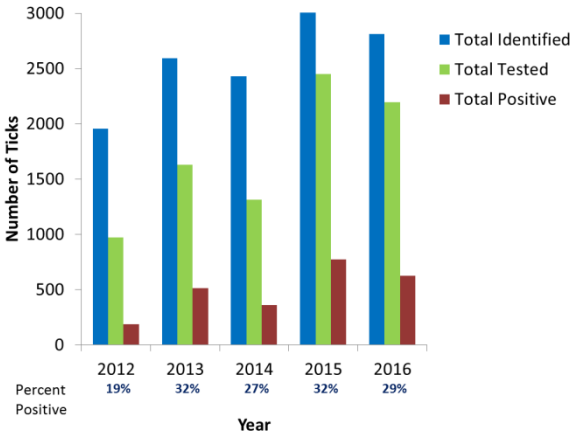
The Tick Testing Program at the Connecticut Agricultural Experiment Station was established in 1990. Each year, an average of 3,000 ticks are submitted for testing. In the past, testing was limited to *Borrelia burgdorferi*, the LD agent, but in view of increasing human cases of tick-related illnesses in the state, testing has been expanded to include *Anaplasma phagocytophilum*, the causative agent of Human Granulocytic Anaplasmosis, and *Babesia microti*, the causative agent of Babesiosis. Of the 5,808 ticks submitted by Connecticut residents, health departments and/or physicians' offices during fiscal year 2016-2017, 3,748 were examined, of which 1,164 (31.1%) tested positive for LD; 227 (6.1%) for babesiosis; and 189 (5.0%) for anaplasmosis.



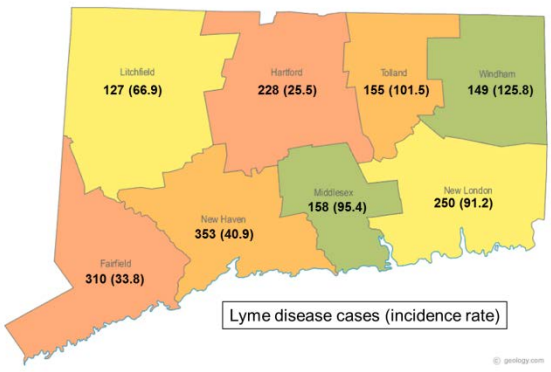
Tick Testing Results and Coinfection Rate, 2016.



Tick testing results by county in Connecticut, 2016.



Number and percentage of *Ixodes scapularis* ticks tested for infection with *Borrelia burgdorferi* Connecticut, 2012-2016.

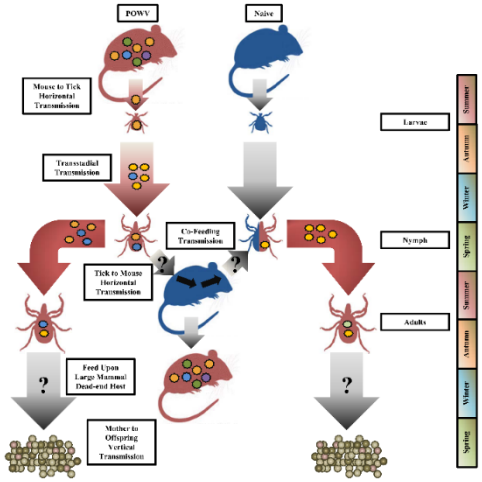


Lyme diseases cases in Connecticut residents, 2016.

Virus-Vector Interactions

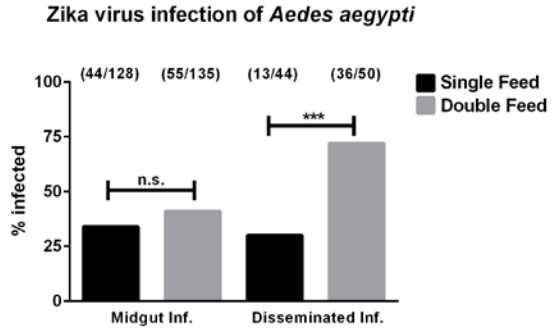
A. Deer Tick Virus Population Dynamics during Infection of *Ixodes Scapularis* Ticks (Dr. Doug Brackney, Dr. Phil Armstrong, Dr. John Anderson, Ms. Angela Bransfield)

Arthropod-borne RNA viruses exist within hosts as heterogeneous populations of viral variants and, as a result, possess great genetic plasticity. Understanding the micro-evolutionary forces shaping these viruses can provide insights into how they emerge, adapt, and persist in new and changing ecological niches. While considerable attention has been directed toward studying the population dynamics of mosquito-borne viruses, little is known about tick-borne virus populations. Therefore, using a mouse and Ixodes scapularis tick transmission model, we examined Powassan virus (POWV; Flaviviridae, Flavivirus) populations in and between both the vertebrate host and arthropod vector. We found that genetic bottlenecks, RNAi-mediated diversification, and selective constraints collectively influence POWV evolution. Together, our data provide a mechanistic explanation for the slow, long-term evolutionary trends of POWV, and suggest that all arthropod-borne viruses encounter similar selective pressures at the molecular level (i.e. RNAi), yet evolve much differently due to their unique rates and modes of transmission.



B. Factors influencing vector competence (Dr. Doug Brackney, Dr. Philip Armstrong, Ms. Angela Bransfield)

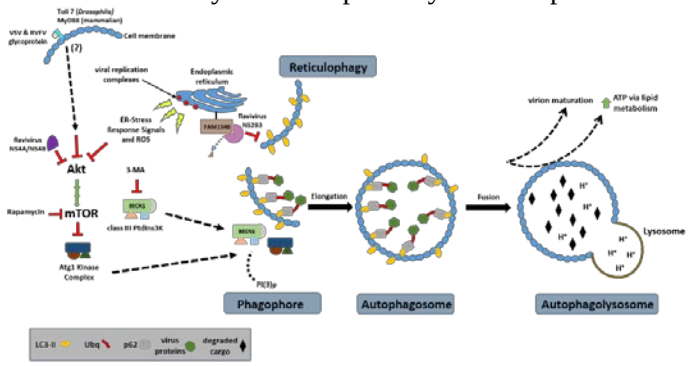
The emergence and re-emergence of arthropod-borne viruses (arboviruses) over the last 40 years constitutes a continued and significant public health threat. Determining the relative risk for transmission is typically assessed in the laboratory by performing vector competence studies. Vector competence is the ability of an arthropod vector (e.g. mosquitoes) to become infected with a pathogen, permit replication and ultimately transmit the pathogen to a naïve vertebrate host. This can be determined by providing the local vector populations with an infectious bloodmeal containing the pathogen of interest (e.g. Zika virus). Subsequently, individual mosquitoes are assayed at varying time points post-bloodmeal to determine if the gut became infected, if the virus was able to escape the gut and enter the hemolyph (i.e., the open circulatory system), and to determine if the pathogen is being transmitted in the saliva. This basic procedure has been utilized for the better part of a century; however, for some species such as *Aedes aegypti* mosquitoes, it doesn't take into consideration the natural habits of the mosquito. For instance, it is well documented that *Ae. aegypti* mosquitoes take a bloodmeal every two to three days in the wild. Therefore, we have recently begun studying the effects that multiple feeding episodes may have on the vector competence of *Ae. aegypti* and *Ae. albopictus* to Zika virus, dengue virus and chikungunya virus. Surprisingly, we have found that non-infectious



bloodmeals provided after the initial infectious bloodmeal significantly enhanced the rates in which the virus is able to escape the gut and infect the salivary glands. These paradigm shifting findings will change how risk assessments of vector-borne disease outbreaks are determined and help explain the explosive epidemic potential of viruses transmitted by mosquitoes.

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

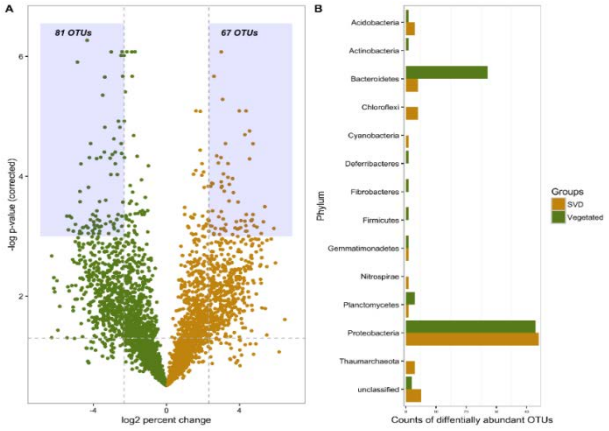
Autophagy can be induced in metazoans by developmental stimuli or in response to various types of stress such as starvation, hypoxia, or microbial infection. During normal growth conditions, autophagy maintains cellular homeostasis by degrading unwanted or damaged organelles and protein aggregates. In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



Environmental Microbiology

A. Alterations in sediment microbial communities associated with sudden vegetation dieback in a coastal wetland
(Dr. Blaire Steven and Dr. Wade Elmer)

There is an increasing recognition of the role coastal vegetated ecosystems play in atmospheric carbon sequestration. However, the development of sudden vegetation dieback (SVD), a phenomenon which causes the rapid death of *Spartina alterniflora*, followed by no or slow recovery, has affected large-scale alterations in Atlantic coastal systems. In 1999, Hammonasset Beach State Park in Connecticut experienced the initial appearance of SVD. After more than a decade, the plants have not recovered. Yet,



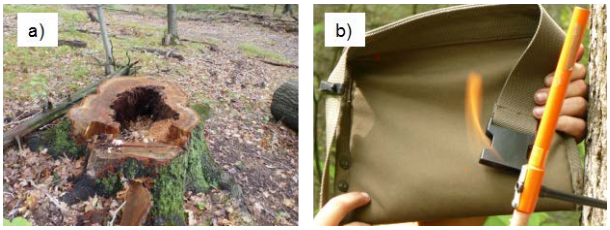
sediment chemistry was similar between vegetated and SVD affected sites, with the exception of water loading, which was significantly higher in the SVD affected sites. Soil CO_2 flux, a proxy for soil respiration, was reduced by 64% in SVD sites compared to sites that remained vegetated. This suggests that SVD has affected large changes in carbon cycling in the wetland sediments. The microbial communities between vegetated and SVD sites were significantly different, as assessed by 16S rRNA gene sequencing. The vegetated sediments harbored significantly higher populations of Bacteroidetes related bacteria, whereas the SVD affected sediments contained a significantly enriched relative abundance of sulfate-reducing bacteria, predominantly within the genus *Desulfobulbus* (Fig 1). Thus, the development of SVD appears to favor anaerobic metabolic pathways at the expense of saprophytes. Greenhouse experiments testing if the alterations in the sediment microbial communities were associated with differences in *S. alterniflora* germination or growth were also pursued. Although small differences in growth and disease ratings were noted between seedling and transplants grown in soil mix (control), autoclaved SVD sediments, or non-autoclaved (natural) SVD sediments, mortality was not significantly different, indicating that the alterations in the sediment communities are not likely responsible for SVD, or a primary cause for the failure of *S. alterniflora* to recolonize the SVD sites.

SVD-affected site in Hammonasset Beach State Park, CT. A). Bacterial species and their abundance in vegetated and SVD-affected sediments. The species within the blue boxes show significantly different abundances between the vegetated and SVD-affected sites. B). Groups of bacteria altered in response to SVD. Data from PBIOMES-09-16-0006-R.

B. Mapping the arboreal microbiome and determining the metabolic pathway for in-tree methane production

(Dr. Blaire Steven)

Deadwood, long recognized as playing an important role in storing carbon and releasing it as CO_2 in forest ecosystems, is more recently drawing attention for its potential role in the cycling of other greenhouse trace gases (Fig. 2). Across three Northeastern and Central US forests, mean methane (CH_4) concentrations in deadwood were 23 times atmospheric levels (43.0 μL L^{-1} ± 12.3; mean ± SE), indicating a lower bound, mean radial wood surface area flux of ~6 × 10^{-4} μmol CH_4 m^{-2} s^{-1}. Site, decay



(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)

class, log diameter, and species were all highly significant predictors of CH_4 abundance in deadwood, and diameter and decay class interacted as important controls limiting CH_4 concentrations in the smallest and most decayed logs. Nitrous oxide (N_2O) concentrations were negatively correlated with CH_4 (r2 = −0.20, $p < 0.001$) and on average ~25 % lower than ambient (276.9 nL L−1 ± 2.9; mean ± SE), indicating net consumption of nitrous oxide. Oxygen (O_2) concentrations were uniformly near anaerobic (355.8 μL L^{-1} ±1.2; mean ± SE), and CO_2 was elevated from atmospheric (9336.9 μL L^{-1} ± 600.6; mean ± SE). Most notably, our observations that CH_4 concentrations were highest in the least decayed wood, may suggest that methanogenesis is not fueled by structural wood decomposition but rather by consumption of more labile nonstructural carbohydrates.

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

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

Figure 3. 2014 Fire blight epidemic in Northeastern United States. A) Apple trees with severe fire blight strikes in Fairfield County, CT; **B)** A 3-year-old pear tree killed by fire blight in Hartford County, CT; **C)** A 30-year-old pear tree killed by fire blight in New London County, CT.

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

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

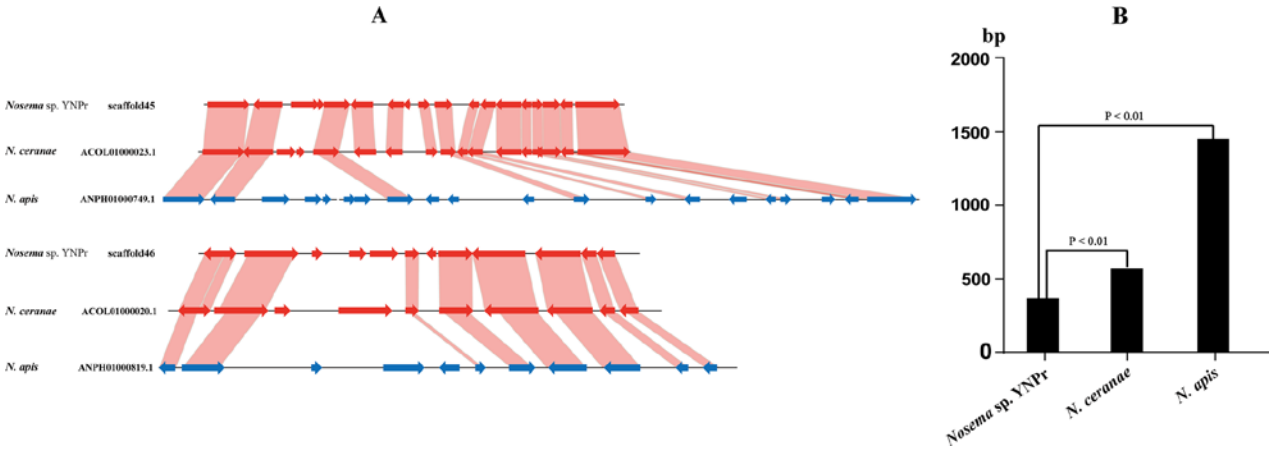
The presence of host associated microbiota (the collection of bacteria living on or in animals) is a commonality shared among all animals including mosquitoes. Because of their importance in mediating mosquito development and their ability to influence disease transmission, there is considerable interest in understanding these relationships. It is currently known that the mosquito microbiome is composed of ~50-200 bacterial species and that this community is temporally dynamic with large shifts in community composition between different life stages. This suggests that mosquito microbiomes, in their natural state, are composed of complex and dynamic communities. However, while informative, these studies have been descriptive and have failed to empirically test the ecological mechanisms mediating microbial colonization, development, stability, or transmission. Despite these knowledge gaps, efforts to utilize this host-microbiome relationship for the purposes of controlling mosquito-borne diseases have already been tested. This approach, known as paratransgenesis, utilizes symbiotic microbes to express anti-pathogen effector molecules within the mosquito. Mosquito paratransgenesis attempts thus far have focused on employing a single paratransgenic strain. A key condition impacting the success of mosquito paratransgenesis is the assurance that paratransgenic strains are resilient to replacement by competing environmental strains. Studies in mice suggest that low complexity microbiomes are unstable, easily invaded, and quickly replaced by environmental competitors. However, it remains unknown if mosquito based paratransgenic mono-cultures will remain stable in the presence of competing environmental bacteria and conversely, whether complex paratransgenic communities are more resilient to invasion and replacement. Another important consideration when assessing the feasibility of mosquito paratransgenesis is the likelihood that such approaches can be introduced and propagated amongst natural populations.

Current literature suggests that mosquito microbiomes, at least in part, can be transmitted transovum and that members of this community can colonize emerging larvae. The implications of these findings are profound and may provide a drive mechanism by which paratransgenic bacteria can be transmitted trans-generationally. However, the implications of these findings have not been examined in the context of paratransgenic communities. Furthermore, the transmission efficiency or stability of these communities has not been assessed. Filling these fundamental gaps in knowledge will be critical if we are to fully harness the potential of novel paratransgenic countermeasures. Our goal is to better understand the ecology of the microbiome within vector mosquitoes. The objectives of this proposal are 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.

Evolution of Genome Size in Microsporidia

(Dr. Charles Vossbrinck)

Microsporidia have remarkably small genomes which appear to both grow and shrink over evolutionary time. We have shown, by comparative genomic analysis, that the Microsporidia can reduce their genome size by developing smaller genes, shorter introns, smaller intervening sequences and decreased signal sequence length. While the host cell can provide many compounds necessary for the growth and reproduction of the Microsporidia, the idea that the Microsporidia have small genomes because they don't need many genes is not an evolutionary explanation. We hypothesize that the microsporidial genome is growing and shrinking because there is a tradeoff between having a small genome to reproduce faster and a larger genome with which to challenge the host. We are attempting to test this hypothesis through genomic analysis.



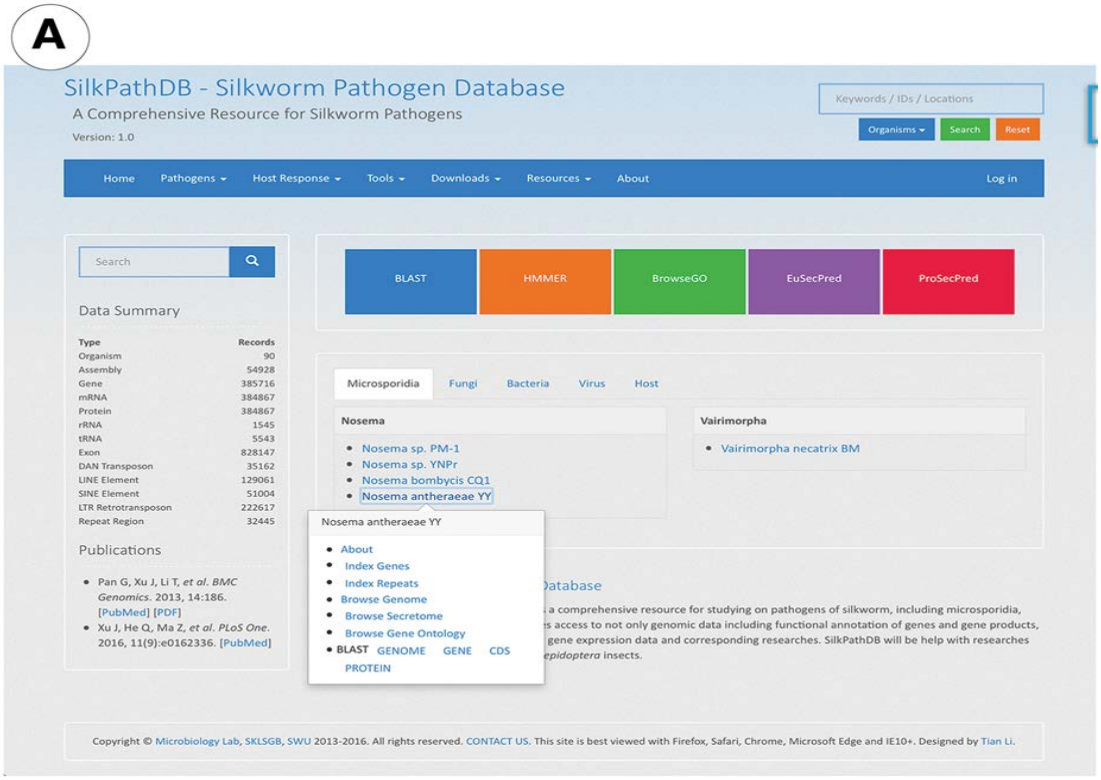
Syntenic and intergenic comparisons of three microsporidial species showing differences in intergenic size. From Xu and Vossbrinck, 2016.

Silkworm Pathology Database

(Dr. Charles Vossbrinck)

Silkworm pathogens have been heavily impeding the development of sericultural industry and play important roles in lepidopteran ecology, and some of which are used as biological insecticides. Rapid advances in studies on the omics of silkworm pathogens have produced a large amount of data, which need to be brought together centrally in a coherent and systematic manner. This will facilitate the reuse of these data for further analysis. We have collected genomic data for 86 silkworm pathogens from 4 taxa (fungi, microsporidia, bacteria and viruses) and from 4 lepidopteran hosts, and developed the open-access

Silkworm Pathogen Database (SilkPathDB) to make this information readily available. The implementation of SilkPathDB involves integrating Drupal and GBrowse as a graphic interface for a Chado relational database which houses all of the datasets involved. The genomes have been assembled and annotated for comparative purposes and allow the search and analysis of homologous sequences, transposable elements, protein subcellular locations, including secreted proteins, and gene ontology. We believe that the SilkPathDB will aid researchers in the identification of silkworm parasites, understanding the mechanisms of silkworm infections, and the developmental ecology of silkworm parasites (gene expression) and their hosts. Database URL:http://silkpathdb.swu.edu.cn



Invasive Aquatic Plant Program

(Mr. 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 230 Connecticut lakes and ponds (Figure 1). A total of 56 waterbodies have been resurveyed to determine how invasive plants are changing the quality of lakes over time. In fiscal year 2016-2017, Gregory Bugbee (Figure 2) and staff mapped the aquatic vegetation in three new and 12 previously surveyed waterbodies (Table 1). Lake Candlewood, Connecticut's largest lake, was surveyed for the ninth consecutive year to determine the effects of alternate year deep and shallow winter drawdown and recently introduced grass carp *(Ctenopharyngodon idella)* on Eurasian

watermilfoil (*Myriophyllum spicatum*), minor naiad (*Najas minor*), and curlyleaf pondweed (*Potamogeton crispus*). Lakes Lillinonah, Zoar and Squantz Pond were also surveyed. We established transects in each waterbody, using global positioning systems, to quantify changes in native and invasive aquatic species abundance and distribution.

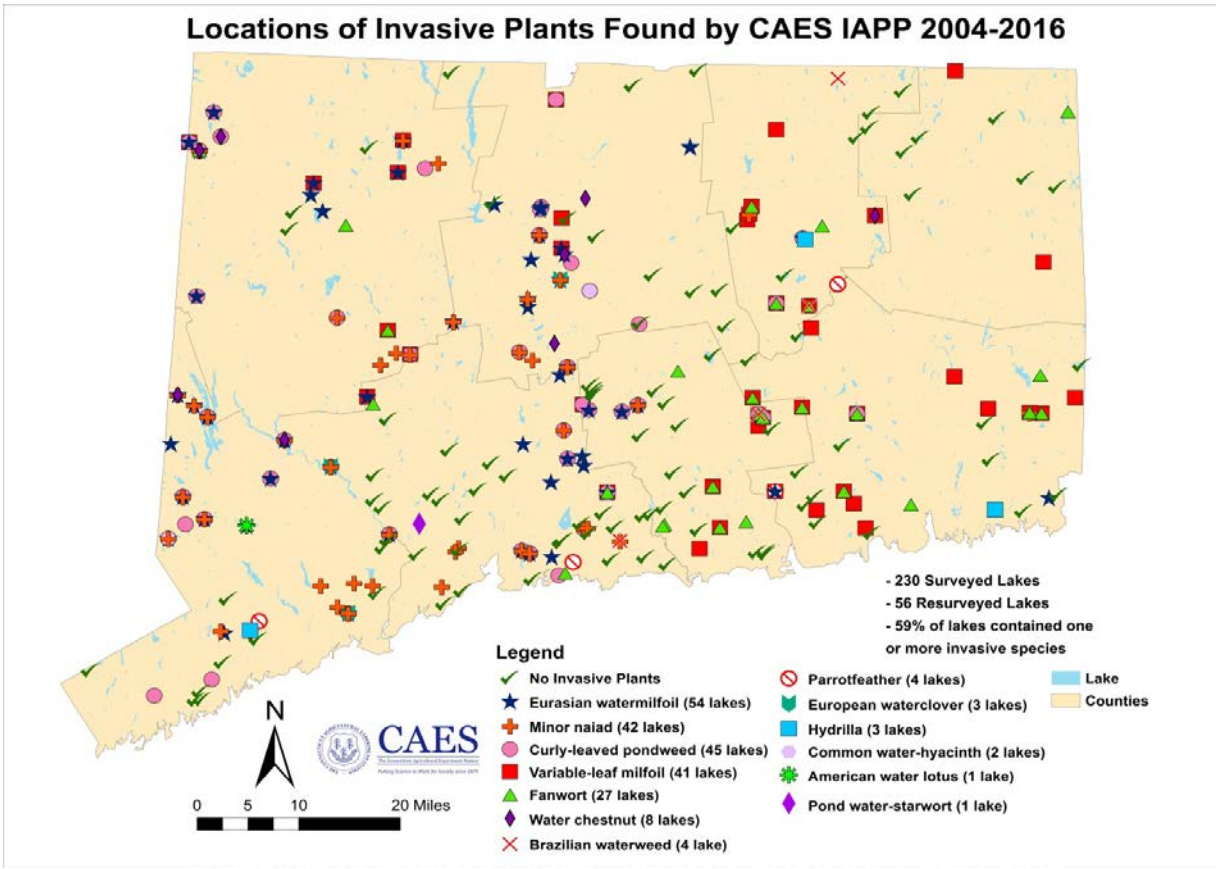


Figure 1. Locations of invasive plants in Connecticut's lakes and ponds as found in CAES IAPP surveys from 2004-2016.

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

Nearly 60 percent of the waterbodies contained one or more invasive plant species and some lakes contained as many as four invasive species (Figure 1). The most common invasive plants are Eurasian watermilfoil, variable watermilfoil (*Myriophyllum heterophyllum)*, minor naiad, curly leaf pondweed, and fanwort *(Cabomba caroliniana*). Less common 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 technologies.

Figure 2. Gregory Bugbee searching for a state-listed aquatic plant species in Crystal Lake (Middletown) in order to protect the plant while expediting control of curlyleaf pondweed.

B. Control Technology

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

Table 1. Lakes and ponds surveyed by CAES IAPP in fiscal year 2016-2017 (* = resurvey).

Lake	Town	Acres
Ajellos Pond	Seymour	6
Bashan Lake*	East Haddam	273
Bushy Pond*	Clinton	9
Candlewood Lake*	Danbury etc.	5064
Coopers Pond	Stamford	2
Elizabeth Park Pond	West Hatford	2
Fence Rock Lake*	Guilford	17
Lake Lillinonah*	Bridgewater etc.	1547
Lake Quonnipaug*	Guilford	99
Lake Zoar*	Southbury etc.	920
Lower Moodus Reservoir*	East Haddam	126
Mamanasco Lake*	Ridgefield	86
Squantz Pond*	New Fairfield etc.	266
Upper Moodus Reservoir*	East Haddam	440
Wyler Pond*	Weston	1

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 16th year of research involving the use of spot applications of the herbicide 2,4-D to control variable watermilfoil in Bashan Lake. We have largely restored the lake to preinfestation conditions. Our resurvey of Bashan Lake in 2014 found an approximate 99 percent reduction in variable watermilfoil and an increase in the number of desirable native species from 12 to 19. In the fall of 2014, the water level in the lake was lowered 18 feet for dam repairs, with the prospect for the refilling to take two years. A survey of Bashan Lake in 2016 found a few sparse patches of variable watermilfoil and a number of areas where phragmites (*Phragmites australis*) had become established. With support from the Bashan Lake Association (BLA), CAES IAPP performed a targeted herbicide application of the phragmites in late September with considerable success. In June 2016, we surveyed the lake for phragmites and found the plant sporadically along the shore. In addition, variable milfoil was observed in a few locations. CAES is procuring the necessary CT DEEP permits to assist the BLA with its treatment in September.

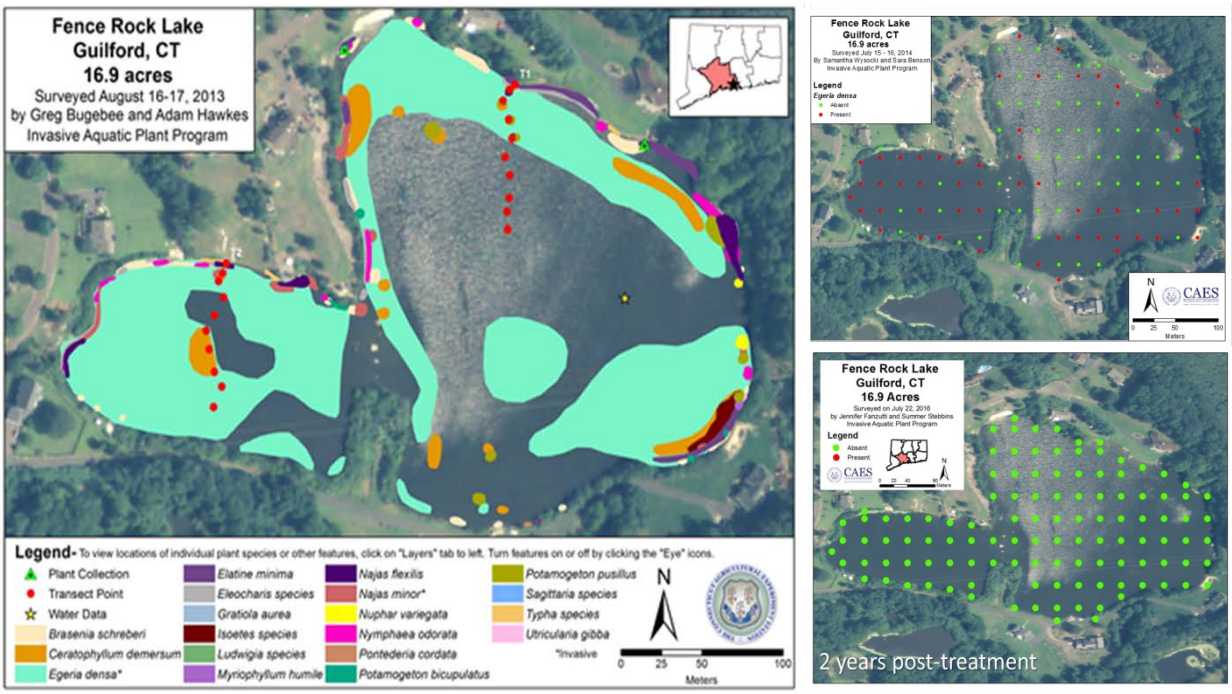


Figure 3. Brazilian waterweed in Fence Rock Lake in 2013 (top left), pretreatment 2014 (top right), and two years post treatment (bottom right). The invasive species was completely eliminated.

Fence Rock Lake - Guilford, CT - CAES IAPP discovered Brazilian waterweed in Fence Rock Lake in 2009 and has since documented its yearly expansion (Figure 3). Because this plant is the first documented case of large scale invasion of this plant in CT and no information is available on its control, we arranged for testing the herbicide diquat (6,7-dihydrodipyrido (1,2-a:2',1'-c) pyrazinediium dibromide) in the summer of 2014. The herbicide was applied by bottom injection to the shoreline areas of the lake in July. A pretreatment survey on over 100 georeferenced points in July 2014 (Figure 3, top right) found 59 points were occupied by Brazilian waterweed. A post-treatment survey, one year later, found only one point with the plant. Another treatment was performed in late July 2015. We resurveyed the lake in July 2016 and determined the plant was completely eliminated without harm to the native plant community.

2. Winter water level drawdown and grass carp.

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 (1 m) and deep (3 m) water level reductions. Drawdown timing and duration varies depending on the hydrogenerating needs of FirstLight Power Resources. These variables and inconsistencies in winter weather result in differences in milfoil control. The coverage of

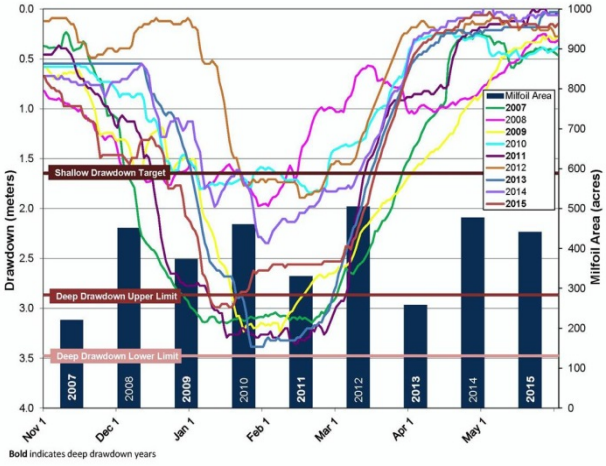


Figure 4. Comparison of drawdown depth and duration on the acreage of Eurasian watermilfoil in Candlewood Lake.

milfoil shows a negative relationship to drawdown depth and duration (Figure 4). In 2015, fish called grass carp were introduced into the lake. These fish eat aquatic vegetation and our work will determine their effectiveness. Our yearly report to The Federal Energy Regulatory Commission, FirstLight Power Resources, CT DEEP, Candlewood Lake Authority and other stakeholders provide data that is crucial for making decisions on future drawdown and grass carp introduction practices for Connecticut's largest lake.

3. Benthic Barriers.

Lake Quonnipaug - Guilford, CT. Benthic barriers are blankets designed to be placed over nuisance vegetation in lakes and ponds. They provide an alternative to herbicides and are thought to control vegetation by blocking the light aquatic plants need to grow. Benthic barriers are not new; they are typically placed over weed beds early in the growing season and removed in the fall. Recently, marketers of benthic barriers have claimed that their products need only be placed over weeds for a few weeks and then moved to another location or removed. To test this practice, we collaborated with the Town of Guilford and placed twenty-one 50' X 20' benthic barriers at Lake Quonnipaug's public beach for the second straight year (Figure 5). The beach has had an increasing problem with Eurasian watermilfoil and fanwort. We placed the benthic barriers in early April and removed them prior to the opening of the beach on Memorial Day weekend. The results from last year were very promising with little vegetative regrowth throughout the summer. The vegetative reduction was notable prior to this year's placement and as of June 30, 2017 the weed control was excellent. Further tests are needed to determine more information on why these barriers provide impressive weed control even when they are used for short periods of time.

Figure 5. Amanda Massa installs a benthic barrier at Lake Quonnipaug, Guilford.

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

Figure 6. Gregory Bugbee speaking at a CAES IAPP invasive 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 Laboratory

(Mr. Gregory Bugbee)

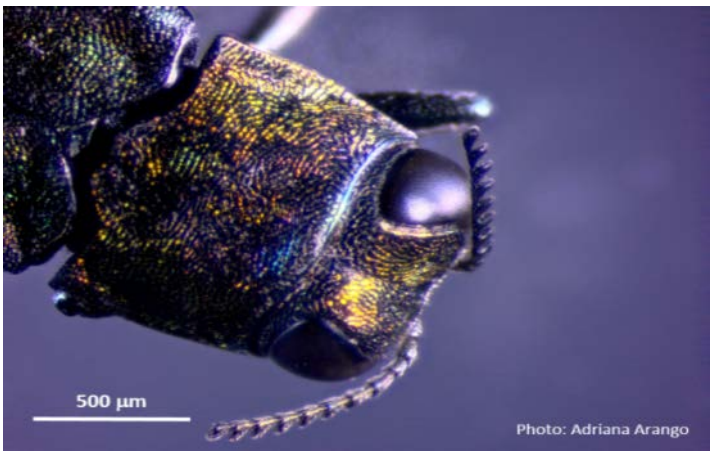
Testing soil samples for fertility and suggesting methods for growing better plants are a continuing service for citizens of Connecticut. At the laboratory in New Haven, 5,939 samples were tested and approximately 1,500 related inquiries were answered.

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

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

Emerald ash borer establishment affected by an induced plant hormone (MeJA)

Emerald ash borer, EAB, (Buprestidae*: Agrilus planipennis*) has caused the death of millions of native North American ash trees. This insect was discovered in southeast Michigan and in Ontario in 2002, where it was devastating ash trees (*Fraxinus* spp.). It has since expanded throughout much of the eastern US and Canada in both urban and forest landscapes. Early studies reported that EAB was specific to ash species. However, more recently white fringetree (*Chionanthus virginicus*), a new naïve host in the Oleaceae family, was reported as a host of EAB in Ohio.



Emerald ash borer (*Agrilus planipennis*)

Ash species are economically and ecologically important for wildlife as a food source and nesting sites for a diversity of species, and has also been widely planted as a street tree in urban areas. Trees can be killed between 1-4 years after symptoms. However, dendrochronological evidence had shown that EAB populations can be established up to 10 years before they are discovered. Despite quarantine boundaries and suppression efforts in areas where EAB has been detected by natural resources and regulatory agencies, it has spread to 20 states and 2 Canadian provinces. The beetle has increased its range rapidly, due to the movement of logs, firewood, and nursery trees. The beetle was detected in Connecticut in 2012 and has spread throughout the state. Aerial surveys of Connecticut in 2015 found 551 hectares of ash tree defoliation, and 188 hectares of dead ash trees in forests and urban settings.

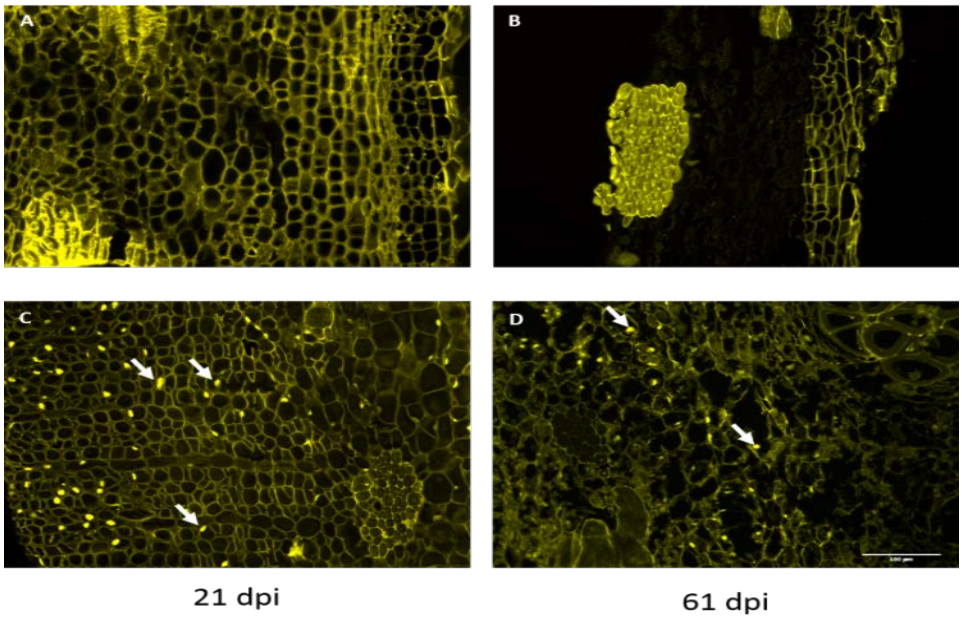
Unlike North American species of *Fraxinus*, Asian ash species coevolved with EAB. Thus, these species display a constitutive defense against attack by the beetle; a defense that only breaks down when the tree is no longer robust enough to maintain those defenses. Induced defenses can be triggered through exogenous application of chemical elicitors such as methyl jasmonate (MeJA). Hence, Drs. Adriana Arango-Velez, Claire Rutledge and Sourav Chakraborty with the help of Joseph Barsky, began a study using seedlings of fringetrees and ash that have been exposed to methyl jasmonate (MeJA) to evaluate the changes elicited by MeJA application and EAB establishment capacity. MeJA is a volatile derivate of the stress-eliciting hormone jasmonic acid. Little is known about the involvement of MeJA in the anatomical changes for tree defense in angiosperms, and particularly against EAB. To elucidate the induced defense of MeJA in naïve white ash and fringe trees, we are examining the endogenous defenses (lignin and soluble phenolics), anatomical changes in cell wall structure, leaf carbohydrates and larvae development of fringe and white ash trees 28 days post-infestation.

Larva of emerald ash borer in ash trees after 28 days post infestation.

To test if MeJA affected the biology of EAB, larval development is being measured by head capsule width, as well as body mass and tunnel width. Bark/wood samples were collected for anatomical and chemical analyses, and leaf samples to test systemic induced response to MeJA applications. Physiological and chemical analyses just begun and we anticipate completing this study in spring 2018.

Emerald ash borer and drought interaction in *Fraxinus* tree defense responses

Last year, Drs. Arango-Velez and Rutledge noted that emerald ash borer (EAB) larvae development was affected by drought stress in both white ash and fringetrees, and that EAB development in fringetrees was slower compared with white ash. Building on this research, Dr. Arango-Velez with the collaboration of



White ash (top) and fringetrees (bottom) cross sections 21 and 61 days after infestation of EAB. Callose deposition (arrows) at 21 and 61 days post infestation.

Dr. Sourav Chakraborty (Central Connecticut State University) are now studying histological and chemical cues responsible for the slower larval development observed in fringetrees compared with ash, and how drought might have affected these responses. Previous studies have shown the involvement of callose, a polysaccharide that exists in the cell walls of a wide variety of higher plants, in plant response against multiple biotic and abiotic stresses. Under stress, callose is deposited at the plasma membrane and cell wall interface within minutes of damage, inducing the production of salicylic acid, which increases resistance to biotic agents such as pathogens.

Although there are no prior reports of callose production in relation to insect attack, our preliminary results indicate abundant callose deposition in fringetrees exposed to EAB at 21 and 61 days post infestation. In contrast, no callose deposition was observed in white ash. Additional histological and chemical analysis, such as leaf carbohydrates content and phenolics are underway; and results are expected by the end of 2017.

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

The salinization of roadside soils by application of salt to melt snow increases the risk of soil toxicity, because salinity can accumulate in soils over many years and can remain high. Most of the current knowledge on plant adaptation mechanisms has been acquired through studies of herbaceous annuals or short-lived perennials; but little is known about the effects of elevated soil salinity on trees, especially in urban settings. Understanding the physiological adaptive traits related to salinity and drought is of particular importance for urban tree management and tree planting under the predicted scenarios of climate change.

Accordingly, Dr. Arango-Velez with the collaboration of Dr. Wade Elmer and Joseph Barsky is focused on the development of better practices for maintaining and preserving common urban tree species growing under conditions of high salinity and drought stress. This study aims to assess the individual and combined value of biochar and mycorrhizae in alleviating salt stress on sugar maple (salt and drought intolerant) seedlings.

Mycorrhizae and/or biochar treatments were applied during summer of 2016, and drought and salinity treatments will be conducted in July 2017. Physiological thresholds of tree responses to salt toxicity and water stress will be then quantified by analyses of stem hydraulics, root length, root and wood anatomy, leaf chlorophyll measurements, and leaves analyses (Ca and Mg) and root analyses (Na, Cl, K, P, Zn, Cu and Mg), will be measured to determine if mycorrhizal inoculation and/or biochar improves tree performance.

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.

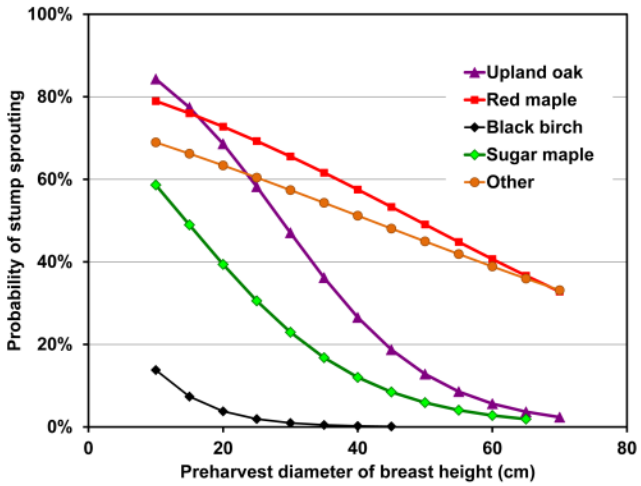
Stump Resprout Study

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 have been 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 with the assistance of Joseph Barsky, Michael Short, and Megan Linske, and in collaboration with the Wildlife Division of the Connecticut Department of Energy and Environmental Protection and the South Central Connecticut Regional Water Authority, selected four sites throughout the state (Bozrah, Burlington, Litchfield, and Madison) where timber management has recently occurred. Three of the four sites were recently clearcut for New England cottontail (*Sylvilagus transitionalis*) habitat and the fourth was part of a timber sale. 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. 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 to improve sample size as only about half of monitored stumps actually produced sprouts.

Measuring the height of stump sprouts.

In addition, on nine recently harvested areas in southern New England, we recorded the number of sprouts, height of tallest sprout, and whether there had been browse damage to the terminal buds of 2,091 stumps. For each of eight species groups, logistic regression was used to model the probability of a cut stump producing sprouts using stand and canopy position (upper vs. lower canopy) as factors, and initial stem diameter as a continuous independent variable. A separate analysis was run for trees with DBH < 35 cm to exclude large trees that were in the lower canopy because they were either declining or had crowns severely damaged by storms.

Stump sprouting decreased with preharvest diameter for upland oaks, red maple, sugar maple, and black birch. At typical merchantable diameters, harvested red maples were twice as likely to sprout as upland oaks. On four new clearcuts, we examined the influence of white-tailed deer browsing on 4-year growth and survival of oak stump sprouts. For those oaks that did sprout, browsing reduced height growth by 1.5 m, but did not prevent sprouts from growing tall enough to be above the browse line. However, the reduction in height growth of oak stump sprouts was sufficient to reduce the proportion of stumps with at least one free-to-grow sprout from 84% of stumps protected from deer to only 44% for unprotected stumps.



Smaller trees were more likely than larger trees to form sprouts after cutting.

Delaying harvest of oaks past merchantable diameters will greatly reduce the number of free-to-grow sprouts in new stands, especially if deer browse damage can be expected. Therefore, when developing a management prescription to regenerate a stand, managers should be cognizant that larger, older oaks are less likely to produce sprouts and that those that do sprout are less likely to produce sprouts that are free-to-grow after four growing seasons. Where there are abundant red maple and where deer browse damage can be expected, management prescriptions should anticipate implementation of practices to minimize their impact on development of free-to-grow oaks.

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

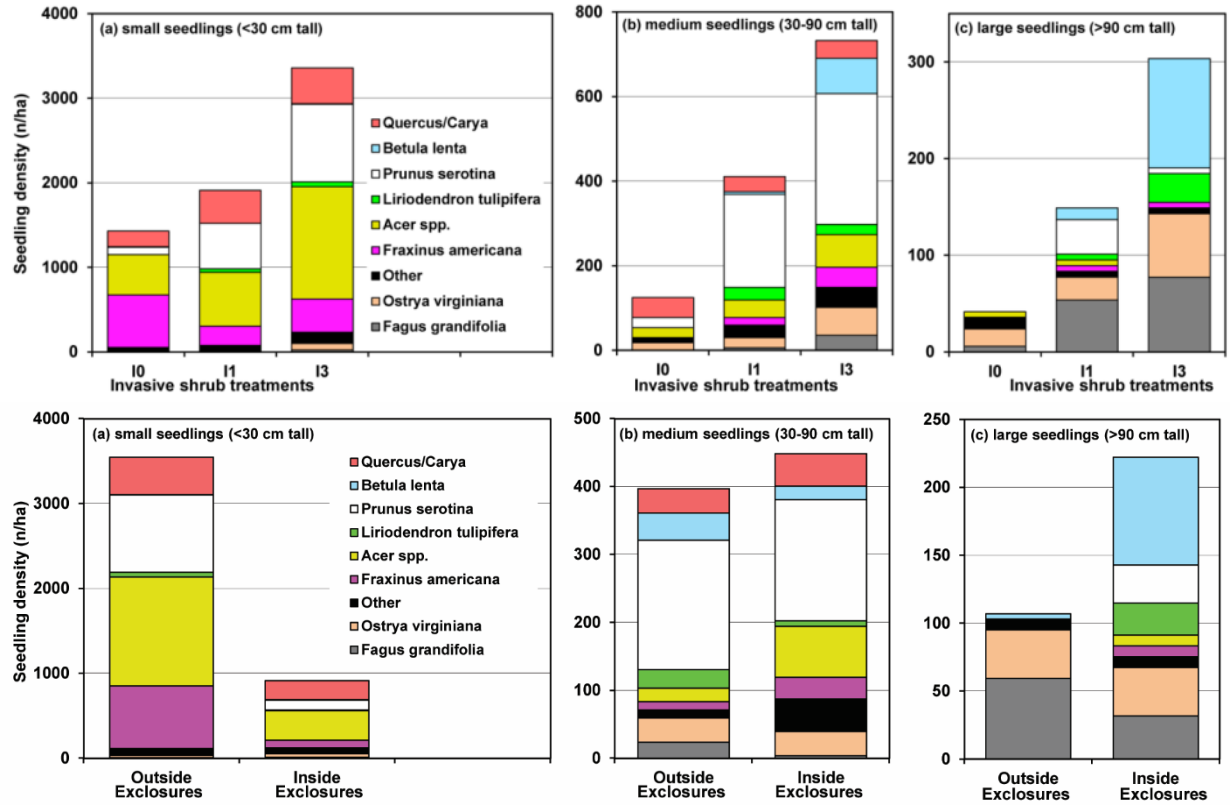
One method to study the impact of deer on natural ecosystems is to compare growth rates and species diversity of vegetation protected from white-tailed deer (*Odocoileus virginianus*) herbivory to unprotected plots. Drs. Scott Williams and Jeffrey Ward with the assistance of Michael Short and Megan Linske collected within sixteen deer exclosures and sixteen adjacent control plots throughout the state. Deer exclosures prevent deer from accessing and browsing on vegetation. Growth rates and species diversity of protected vegetation will be compared with that of an adjacent control plot, where deer can freely browse unprotected 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 also included 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 2006-2016. Late-summer sampling was conducted from 2005-2016 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 2017. Results from this study will reveal plant species composition and growth rates in the absence of browsing deer. Additionally, in collaboration with the CT Department of Energy and Environmental Protection and the Metropolitan District Commission, four more exclosures were erected in spring 2017 on the MDC's Barkhamsted Reservoir property.

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

Interaction of Deer Browse Impacts and Barberry Infestations on Plant Communities

While both chronic white-tailed deer overbrowsing and invasive shrubs have been linked to native regeneration failure in temperate hardwood forests, little is known of the relative importance and possible synergistic effects of these two stressors. Beginning in 2007, Drs. Jeffrey Ward and Scott Williams with the assistance of Michael Short, Megan Linske, and Joseph Barsky began a study to examine the interaction of three levels of invasive shrub control (primarily Japanese barberry, (*Berberis thunbergii* de Candolle) and absence/presence of deer herbivory (white-tailed deer, *Odocoileus virginianus* Zimmermann) on forest regeneration over nine years.

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 at each tract, ten 4 m^2 circular plots were established on a 5 x 5 m grid. Stems of woody regeneration were tallied within each plot in 2007, 2008, 2009, 2010, 2012, 2013, and 2015. For tree species capable of forming part of the upper canopy in a mature forest, we recorded the species and

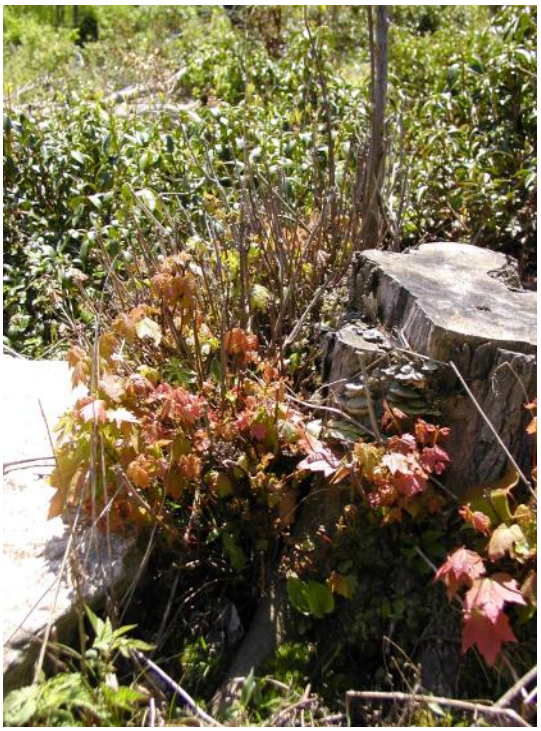


Composition of forest regeneration is affected by both deer browsing and the presence of invasive shrubs.

height class for all stems with a diameter < 2.5 cm at 1.4 m aboveground. Seedling height class was defined as the highest live bud and measured with a height class pole.

Because of low stem counts of woody regeneration in the larger height classes, stems were assigned to one of three height classes: < 30 cm tall, 30-90 cm tall, and > 90 cm tall. Height class counts (x) were highly skewed and not normally distributed; therefore, they were natural log transformed (ln(x+1)) prior to analysis. To examine the separate and interactive effects of invasive control and herbivory exclusion, repeated measures analysis of variance of count (transformed) was utilized. Years since initial treatment was the within subjects factor, and height class, invasive control treatment (I_0, I_1, I_3), deer exclusion (F, U), and their interactions were between subject factors with study areas as replicates. Reported *P*-values are those after applying the conservative Greenhouse-Geisser Epsilon correction for deviations from compound symmetry. A three-factor (height class, herbivory protection, invasive treatment) ANOVA was used to compare the influence of herbivory protection and invasive treatments on seedling density in 2015 after nine growing seasons. Models were examined without factors and interactions found non-significant in full model, and if the revised model had a lower AIC_c estimate, then the factors/interactions were excluded in the final analysis.

Five observations suggest obtaining forest regeneration requires a comprehensive management strategy. First, competitive interference by invasive shrubs in intact thickets continued to impede forest regeneration, especially taller seedlings, after deer were excluded. Second, density of small seedlings increased following removal of the competitive interference by invasive shrubs. Third, deer browsing depressed growth of small seedlings into taller height classes. Fourth, preferential browsing reduced species richness by favoring growth of low palatability species such as beech, especially in taller seedling classes. Lastly, the window of forest regeneration recruitment is narrow because invasive shrubs quickly recovered from a disturbance (cutting) that did not kill the root system.



Deer browsing can severely stunt the growth of tree seedlings and stump sprouts.

Therefore, restoring forest regeneration in stands with both established invasive shrubs and high deer densities will require both controlling the invasive shrubs and a multi-year program to reduce deer browsing intensity. While there are much more cost-effective methods of controlling competitive interference such as invasive shrubs, our cut/burn/burn method can provide effective control where herbicide use is restricted by regulations or by active public opposition. Equally important as controlling invasive shrubs is implementing a strategy to reduce browse intensity to the equivalent of 5-8 deer-km-2 or lower to obtain adequate tree regeneration. Without reducing browsing intensity, some tree regeneration will become established, but it will take longer and will be comprised of species with both lower economic and ecosystem services values.

Impact: Both the invasive shrub Japanese barberry and native white-tailed deer can have detrimental impacts on regeneration of Connecticut's native tree species. 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.

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, Dr. Williams with the assistance of Megan Linske and Michael Short have trapped 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.

White-footed mice are the primary host of blacklegged tick larva and nymphs.

To date, there have been 2,652 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 (5.6 larvae/mouse). Adult tick densities in dense barberry (262/acre) were higher than in both controlled barberry (118/acre) and no barberry (73/acre) areas. Ticks sampled from full barberry infestations and controlled barberry areas had similar infection prevalence with *B. burgdorferi*, 53 and 51%, 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 146 *B. burgdorferi*-infected ticks/acre in dense barberry, 69/acre where barberry was controlled, and 39/acre where barberry was absent.

Results indicate that managing Japanese barberry will have a positive effect on public health for up to 10 years after initial treatment by reducing the number of *B. burgdorferi*-infected blacklegged ticks that can develop into motile life stages that commonly feed on humans. Mouse trapping and tick sampling efforts will continue for several more years to monitor long-term effects of controlling Japanese barberry.

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

Tick-Borne Pathogen Reservoirs in Residential and Woodland Settings

Many animals can serve as reservoir or dilution hosts for *Borrelia burgdorferi*, the causal agent of Lyme disease. Dilution effect theorizes that when there is a greater diversity of hosts, there is a reduction in infection of local tick-borne disease-causing pathogens and would be found in intact woodland ecosystems compared to residential areas. This study by Drs. Scott Williams and Kirby Stafford with the assistance of Megan Linske and Michael Short focused on blacklegged tick (*Ixodes scapularis*) host diversity and abundance, and the role they play in tick-borne pathogen amplification or dilution in residential and forested lands in Connecticut. Camera traps were deployed in residential and intact forests and imagery data were analyzed to determine differences in total host encounters, species richness, and diversity at our study sites. Sherman live traps were utilized to live capture white-footed mice (*Peromyscus leucopus*), the primary reservoir host for *B. burgdorferi*. We documented the number of captured mice, numbers of juvenile ticks feeding on mice, and antibody presence to *B. burgdorferi* in mouse blood.

There were significantly more encounters with hosts and a higher diversity of hosts in residential areas as compared to woodlands. There was the same abundance of white-footed mice between the two habitat types, but more than half the number of ticks feeding on mice in residential settings. Additionally, there were significantly fewer *B. burgdorferi*-infected mice in residential areas. So while dilution theory suggests increased diversity of hosts dilutes pathogen presence in intact woodland settings, it is in fact the abundance of encounters that explains dilution of pathogens in residential settings.

Impact: While in the past dilution theory may have been used as a justification to limit habitat fragmentation, habitat fragmentation does not necessary equate to habitat loss. In an urbanized state dominated by mature forest stands like Connecticut, residential ecosystems provide a higher diversity of habitat types and therefore, more abundant wildlife than in woodlands. Encouraging habitat diversity in residential areas will ultimately lead to fewer encounters with tick-borne pathogens and potentially save millions of dollars in medical costs and improve public health.

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.

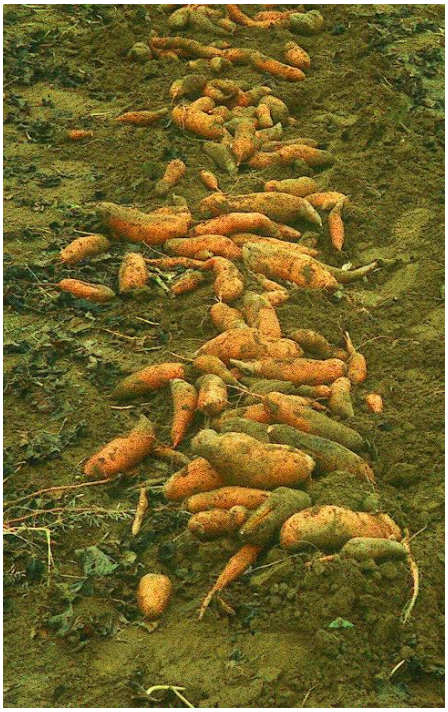
The development of a network of farmers' markets in Connecticut's major urban centers and densely populated suburbs is an important segment of direct sales of vegetables to consumers. All produce sold at farmers' markets must be "Connecticut Grown." Farm fresh produce is offered at reasonable prices 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 129 farmers' markets in 2016, attended by over 400 farmers compared to 87 markets in 2007, a 48% 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.

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 2016, Dr. Maynard evaluated the yield and quality of ten cultivars of kabocha squash at Windsor and Lockwood Farm. Included in the trials were 7 short-vined and 3 long-vined varieties as well as 3 personal-sized varieties.

Impact: Averaging both sites, Eclipse (11.9 lb/plant) produced the greatest yields followed by Sweet Mama (10.8 lb/plant) and Winter Sweet (8.4 lb/plant). Cultivar selection can dramatically increase yields

and grower profits. By growing Eclipse (11.9 lb/plant) instead of Space Station (3.6 lb/plant), the grower can produce 60,258 more pounds per acre. At a retail price of $0.69/lb, the grower can gross almost $42,000 more per acre by growing Eclipse. The long-term benefits of growing kabocha squash include an additional product and revenue for growers who attend farmers' markets or have their own roadside stands. Almost half of all vegetable growers in Connecticut grow winter squash.



Sweet Potato Trials: A 1998 Connecticut Department of Agriculture survey noted that sweet potato is one of the most popular specialty vegetables. In addition, it is very nutritious, with high values of beta carotene (vitamin A) and vitamin C. North Carolina and Louisiana are the leading US producers where they are grown in hilled soil, but we have found that they can easily be grown in Connecticut. Since they have a long growing season and thrive in warm soil, they have always been grown in the Northeast with black plastic mulch. However, black plastic mulch and hilling the soil increases both the labor and the cost per acre of producing the crop. In 2016, Dr. Maynard evaluated the effect of different cultural treatments on the yield and quality of sweet potatoes. There were 4 treatments: black plastic/flat soil, black plastic/hilled soil, no mulch/flat soil, and no mulch/hilled soil.

Impact: The greatest yields were from plots amended with black plastic mulch (4.2 lbs/plant) compared to bare soil plots (3.8 lbs/plant). Hilled plots averaged 4.2 lbs/plant compared to 3.2 lbs/plant from flat soil plots. However, the flat soil plots (both plastic and bare soil) were decimated by deer and had to resprout. Therefore, it is hard to draw any conclusions from the data. The long-term benefits of growing sweet potatoes include additional revenue for farmers and providing a product that has growing consumer demand. In addition, there may be health benefits for those who consume sweet potatoes. About 43% of vegetable growers in Connecticut grow sweet potatoes.

Okra Trials: Okra is grown for its long pointed seed pods, which are used in gumbos and soups. It is best picked when the pods are young and immature or about 2-4 inches long. It is considered a delicacy in the southern United States particularly when breaded with corn meal and deep fried. It is in the same family as cotton, hollyhocks, and hibiscus which makes it a nice ornamental plant as well. Okra plants are extremely drought resistant which makes it a popular vegetable in countries with difficult growing conditions. It grows best in hot weather with warm soils so that yields are usually increased when grown with black plastic mulch in the Northeast. In 2016, Dr. Maynard evaluated the yield and quality of ten cultivars of okra at Windsor and Lockwood Farm. In addition, the crop was grown with and without black plastic mulch to determine whether the expected increased yields utilizing the black plastic mulch is enough to offset the added expense of the plastic.

Impact: Averaging both sites and both treatments, Jambalaya (100 pods/plant), Annie Oakley II (100 pods/plant), and Emerald Green (99 pods/plant) had the greatest yields. Yields from the black plastic amended plots averaged 64% greater when compared to plots with no plastic. Cultivar selection and cultural conditions can dramatically increase yields and grower profits. By growing the cultivar Jambalaya (100 pods/plant) instead of the cultivar Red Burgundy (74 pods/plant), the grower can produce 26 more pods/plant or almost 252,000 more pods/acre. At a retail price of $2.99/12 pods (6 oz), the grower can gross almost $63,000 more per acre by growing Jambalaya. In addition, by growing the crop on black plastic instead of bare soil, the grower can produce an average of 42 more pods/plant or 407,000

more pods/acre. At a retail price of $2.99/12 pods (6 oz), the grower can gross over $101,000 more per acre by utilizing black plastic. The long-term benefits of growing okra include an additional product and revenue for growers who attend farmers' markets or have their own roadside stands. About 35% of vegetable growers in Connecticut grow okra.

Brussels Sprouts Trials: Brussels sprouts are related to other better-known vegetables in the mustard family including broccoli, cabbage, and cauliflower. Typically, it is grown as an annual and the axillary buds, which resemble miniature cabbages, are harvested either by hand with several harvests of 5-15 sprouts, or by cutting the entire stalk at once for processing. Each stalk can produce about 2 lbs per stalk. Brussels sprouts grow best in temperature ranges of 45-75^{o}F with the highest yields at 60-65^{o}F. Quality does not decrease from freezing, and, in fact, sprouts are considered to be sweetest after a frost. Sprouts that develop in hot weather often do not form compact heads and can be bitter. In 2016, Dr. Maynard evaluated the yield and quality of ten cultivars of Brussels sprouts at Windsor and Lockwood Farm. In addition, the crop was grown with and without black plastic mulch. Black plastic mulch controls weeds. However, as Brussels sprouts are cool-loving plants and black plastic raises the soil temperature, it is important to determine the effect of plasticulture on the yield and quality of marketable sprouts in Connecticut.

Impact: Last year, Jade Cross E (2.1 lbs/plant) and Dimetri (2.0 lbs/plant) averaged the greatest yields. Cultivar selection can dramatically increase yields and grower profits. By growing the cultivar Jade Cross E (2.1 lbs/plant) instead of the cultivar Churchill (1.3 lbs/plant), the grower can produce almost 8,000 more pounds per acre of Brussels sprouts. At a retail price of $5.28/lb, the grower can gross almost $41,000 more per acre by growing Jade Cross E. In addition, by growing the crop on black plastic instead of bare soil, the grower can increase yields by an average of 11%. The long-term benefits of growing Brussels sprouts include providing a product that has growing consumer demand and additional revenue for growers who attend farmers' markets or have their own roadside stands. In addition, there may be health benefits for those who consume Brussels sprouts. About 30% of vegetable growers in Connecticut grow Brussels sprouts.

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


Pawpaws are a delicious native fruit tree that can be grown in Connecticut.

Impact: Thus far, the cultivars Rebecca's Gold and Overleese have averaged the greatest yields (57 and 41 fruit/tree, respectively) with Sunflower producing the largest fruit (7.2 oz/fruit). Pawpaws are an ideal fruit for Connecticut growers who attend farmers' markets or have their own roadside stands as they are very delicate and difficult to ship long distances. The long-term benefits of growing pawpaws include an additional product and revenue for growers.

Sheet Composting of Oak and Maple Leaves

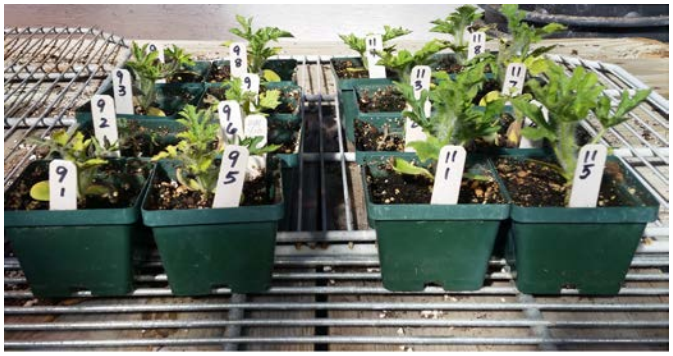
Many municipalities in Connecticut with leaf collection programs in the fall are turning to farmers to dispose of their leaves. However, not all farmers have extra land to set aside for a standard composting operation. Instead, they layer undecomposed leaves on their fields and simply plow the leaves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

To help answer this question, Dr. Maynard conducted a sheet composting experiment in which plots were amended with either all oak or all maple leaves. Undecomposed leaves were layered about 6 inches thick in the falls of 1994-2015 and incorporated into the soil by rototilling. In 2016, the greatest squash yields were from the unamended control plots (7.4 lbs/plant) followed by plots amended with maple leaves (5.4 lbs/plant) and plots amended with oak leaves (4.8 lbs/plant). For peppers, the greatest yields were from

the unamended control plots (6.3 lbs/plant) compared to 5.7 lbs/plant from plots amended with oak leaves and 5.6 lbs/plant from plots amended with maple leaves. Average yields of 12 different vegetable crops over 22 years show no significant differences between the treatments.

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.

Studies with Nanoparticles for Root Disease Management



Watermelon plants inoculated with the Fusarium wilt fungus. (Left) Untreated, (Right) NP of CuO.

Nanoparticles (NP) of metalloid and metallic oxides (< 100 nm) have great potential in agriculture as a means to deliver micronutrients such as B, Cu, Mn, and Zn. Not only are these elements essential for normal plant growth, they play pivotal roles in root health by activating important enzyme systems such as those of phenol metabolism. Since B, Cu, Mn, and Zn have poor intraplant mobility and poor availability in neutral soils, we explored the use of foliar sprays of NP to nourish susceptible root systems and protect against soilborne disease. Dr. Elmer has conducted a series of greenhouse and field trials on asparagus, chrysanthemum, eggplant, pumpkin, soybean, strawberry and watermelon. While NP performance varied across all studies, we observed that NP CuO was more consistently associated with increases in growth and yield of plants, regardless of the plant or disease status. Compared to untreated controls, when plants were treated with NP of CuO, asparagus roots had a 174% reduction in root disease, chrysanthemum had an increase in plant height, eggplant had increase yield and growth in soil infested with *Verticillium dahliae,* strawberry plants were larger, watermelons produced a mean 53% increase in fruit yield. Additional experiments were conducted in 2016 and 2017 combining NP of CuO, MnO, and ZnO. We discovered that when all three NP were combined, the performance was superior to any one alone (Figure 1). Analysis of gene expression (by RT-qPCR) in watermelon revealed strong up-regulation of polyphenol oxidase (PPO) and pathogenic related (PR1) genes when NP CuO and *F. oxysporum* f. sp. *niveum* were both present. These enzyme systems are likely responsible for the improved disease resistance.

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

Winegrapes in Connecticut

In cooperative involvement with the USDA/CSREES project, “NE-1020, Multi-state evaluation of winegrape varieties and clones” (http://www.ngwi.org/), Dr. Ferrandino is continuing the project, “Coordinated wine grape variety evaluations in the eastern USA,” which was initiated by Dr. Nail in 2008. Due to the high mortality rate over 7 years (> 75 %) of cold-sensitive vinifera varieties (Merlot, Cabernet Sauvignon, Syrah, Zweigelt, Dornfelder, and others), the number of cultivars newly planted and standing at Lockwood Farm have been reduced from 27 to 12. Cold-hardy hybrid cultivars (Frontenac, Marquette, Saint Croix, Corot Noir, Chambourcin, Vidal, and La Crescent) are also planted at the Valley Laboratory (Windsor, CT) and Griswold Research Center (Griswold, CT). The performance of these cultivars at these three locations will provide information on the effect of climate variation on growth, yield, and disease susceptibility.

←Vineyard at Lockwood Farm in Hamden, CT.

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

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

←3D-sonic anemometers measure wind information in a Pinot Gris vineyard at Lockwood Farm in Hamden, CT.

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

Since 2009, Dr. Ferrandino has maintained three remote sensing weather stations located on the CAES research farms (Hamden, CT; Windsor, CT; and Griswold, CT). Weather data from the three CAES experimental farms is available at: https://www.hobolink.com/s/d0696313715dd96f86b25f3552cc1f47. This link is available on the CAES website. Each weather station measures temperature, relative humidity, sunlight, wind speed and direction, rainfall, leaf wetness, and soil temperature every 15 minutes. The data are sent back to a central location once per hour where it is accessible via the Internet. The resultant data are used to calculate disease risk assessment reports, which are made available to

growers via Internet postings and direct Email alerts. On-site weather station data are used to calculate disease risk assessments, which are delivered to the winegrape growers on a weekly basis. 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.

Dr. Ferrandino is called upon by growers to identify problems found in their fields. Due to cold, wet weather in early spring, Phomopsis blight was a problem for growers.

←Phomopsis Blight results in purple lenticular lesions on leaves and stems. When numerous enough, these lesions can girdle and kill young stems.

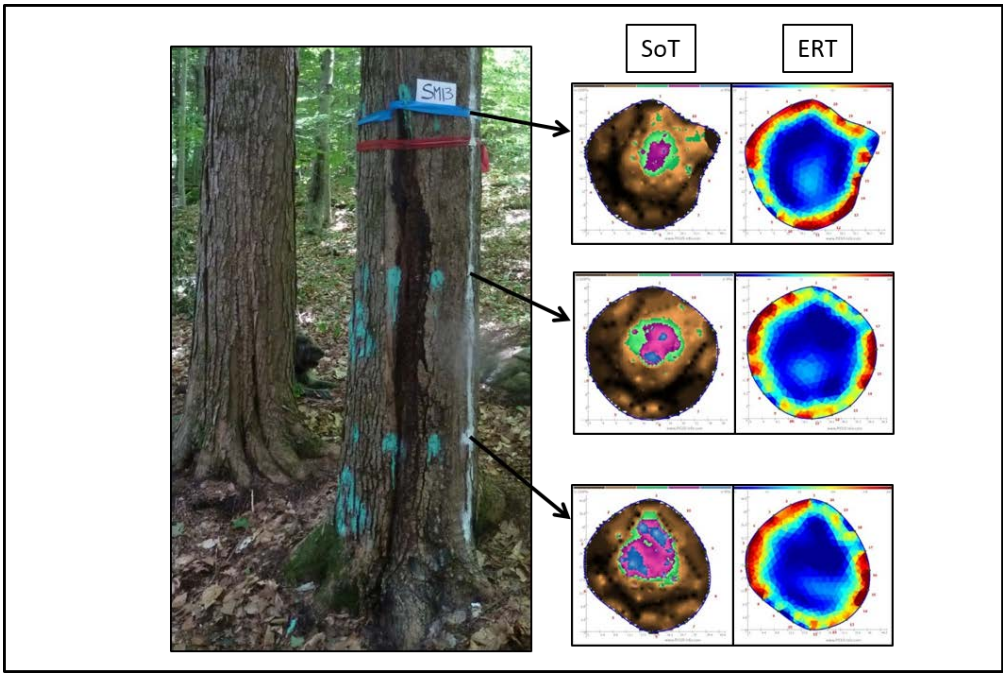
Impact: Growers are quickly informed as to the cause of a problem. In this way appropriate action can be taken.

Quantifying Uncertainty in Tomography-Based Estimates of C in Living Northern Hardwoods

Dr. Marra's National Science Foundation-funded project demonstrated that sonic and electrical resistance tomography (SoT and ERT, respectively) can be used successfully to nondestructively assess the extent and magnitude of internal decay in living trees. This project also allowed Dr. Marra to develop a methodology based on tomographic data for estimating the amount of C in the lower boles of trees; current assessments of the role that forests play in sequestering atmospheric C assume that trees are solid tapering cylinders of wood; i.e., they do not take into account the role of internal decay in reducing estimates of sequestered C. Dr. Marra's methodology incorporates data on internal decay and cavities to produce remarkably accurate estimates of C content.

As with many areas of forest ecosystem studies, these C estimates are essentially based on allometric equations, as they are derived indirectly from tomographic data as well as C density metrics associated with these tomographic data. Therefore, Dr. Marra has been working towards a method for quantifying uncertainty in the data generated by this study, and has been participating in the QUEST (Quantifying Uncertainty in Ecosystem Studies) research network. Sources of uncertainty so far identified include lower bole volume estimates (due to error in cross-sectional areas), as well as uncertainty in the model itself. To quantify the uncertainty associated with each of these sources of errors, Dr. Marra has used Monte Carlo propagation, replicating calculations that incorporate error rates associated with these sources of error. The analyses have shown that error in bole volume estimates contributes approximately 5% uncertainty in C content estimates based on tomography, while error in C density estimates contribute

less than 0.5%. Finally, there is approximate 8% uncertainty associated with the regression equation used to estimate C content based on tomography.



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

***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. Pending the successful procurement of additional research funds, Dr. Marra's methodology will be applied at larger scales in northern hardwood forests, and will also be applied to longer-term (5-, 10-, 15-year) studies that will constitute the first inquiry into rates of internal decay at these scales.

Using Tomography to Nondestructively Assess the Impact of Perennial Injections for Treatment of Dutch Elm Disease on Internal Decay

The native American Elm, with its unique umbrella-like canopy, is the iconic tree of streets and parks of the American landscape. For nearly a century, the American Elm has been decimated by Dutch elm disease (DED), caused by the invasive fungal pathogen, *Ophiostoma novo-ulmi*, which is spread by both elm bark beetles (also invasive) and by intraspecific root grafts, further propitiated by the traditional monocultural planting of this magnificent tree. The most effective treatment of DED has been through the delivery of fungicides, principally as prophylactics, via multiple injections around the perimeter of the trunk, administered through small (~1/4") holes drilled through the bark and into the conducting tissue (the xylem). Effective control via this treatment regime requires that these injections be repeated once every one to three years. Although the trunk-root interface is physiologically prone to rapid compartmentalization and healing around holes such as those drilled for these injections, the holes still represent a potential entry point for a variety of wood-decaying fungi and bacteria. However, no research to date has been done to determine if elms undergoing regular (every 1-3 years) injections have a higher

incidence and severity of internal decay relative to those that do not receive injections. Dr. Marra and his collaborator on this project, Dr. Nicholas Brazee (University of Massachusetts Amherst), have undertaken a three-year study using sonic and electrical-resistance tomography to nondestructively examine elms that have been undergoing regular fungicide injections for treatment of DED, and to compare these elms to elms that have not received injections. Elms in this latter category are typically maintained through vigilant scouting for early signs of elm bark beetles and DED, followed by aggressive pruning and other strategies for maximizing the trees' health and vigor.

Fungicide injections for treatment of Dutch elm disease involve the pumping of many gallons of fungicide solution into the conducting tissue (the xylem) through ¼" holes; the volume is determined by the tree's diameter and height. This American elm, is one of 12 on Governors Island, New York City, that Dr. Marra scanned tomographically.

While this project is still underway, to date Drs. Marra and Brazee have performed tomographic scans on 148 elms in Connecticut, Massachusetts, New York City (Governors Island), and the National Mall of Washington, D.C. Of these, 80 trees have been receiving fungicide injections, and 68 have not. The elms of the National Mall are of particular significance to this study because fungicide injections have not been used; the National Park Service has instead opted for scouting, pruning, and, in cases of severe infection, replacement. Preliminary results show only a small difference in the incidence of decay between the two groups: 33% of the injected elms, compared to 28% of the non-injected elms, harbored some degree of internal decay.

Impact: As American elms of the urban landscape continue to mature, their continued survival despite the onslaught of Dutch elm disease will be via aggressive management regimens that include routine trunk injections. The consequences of these repeated injections are not well-understood, and management decisions are so far uninformed by the potential consequences of injections vis-à-vis internal decay. This

work should facilitate those responsible for the care of these trees to make and advise more informed decisions, especially in the case of trees shown by tomography to have advanced stages of decay.

Dr. Marra measuring the geometry at the base of an American elm, in preparation for tomography. Governors Island, New York.

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

Perennial Target Canker (also known as Neonectria canker) continues to be researched by Dr. Marra. This research focuses on the ecology and genetics of the causal agent of perennial target canker, the fungal pathogen, *Neonectria ditissima*. The goal of this research is to gain a fuller understanding of the life history, evolution, population dynamics, and host-interactions of *N. ditissima*, particularly with respect to its principal hosts, black and yellow birch (*Betula lenta* and *B. alleghaniensis*). Fundamental knowledge of the natural history of *N. ditissima* is lacking, yet is an essential component to effective management strategies. Dr. Marra has developed the field techniques and laboratory tools necessary to the study of this fungus and the disease it causes, and has used these tools and methods to examine the relationship between mating system and genetic structure.

Previously, Dr. Marra developed and used a set of 13 polymorphic microsatellite markers to study mating and genetic differentiation in *N. ditissima* from two nearly adjacent sites at West Rock Ridge State Park in New Haven, CT. This study revealed a paradoxical juxtaposition of high levels of genetic diversity alongside high levels of selfing and biparental inbreeding. The results confirm an earlier hypothesis that *N. ditissima* has a "mixed mating system" (selfing and outcrossing occurring in the same population). In order to test the hypothesis that these observations of selfing are possibly the result of high levels of

biparental inbreeding, we continue the process of evaluating putatively self-fertilized sets of progeny using AFLPs. With analysis nearly complete, AFLP data confirm and corroborate conclusions of selfing.

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.

Erwinia amylovora and nucleobase transport

Erwinia amylovora is the causal agent of fire blight in apples and pears – a devastating disease often resulting to localized and extensive crop losses. Like other bacteria, *E. amylovora* has a panel of membrane localized transporters that import nitrogen rich purines and pyrimidines from the environment – effectively increasing the growth potential. The objectives of the program are: 1) to determining the function and biochemical properties of nucleobase cation symporter 2 (NCS2) transporters from *E. amylovora*; 2) determine if these transporters can move the toxic purine derivative, 6-thioguanine, that *E. amylovora* synthesizes and excretes; 3) determine if these transporters contribute to pathogen establishment on the host. We have determined the function of the uracil transporter, guanine-hypoxanthine transporter, adenine transporter and xanthine transporter through heterologous complementation in *E. coli* strains deficient for endogenous nucleobase transporters. Only the guanine-hypoxanthine transporter is capable of transporting 6-thioguanine. Currently we are constructing *E. amylovora* strains that are deficient in the four above mentioned nucleobase transporters and determining if they are involved in disease establishment in the host. The research is conducted by Dr. Neil Schultes and a colleague Dr. George Mourad at the Dept. of Biology at Indiana University-Purdue University, Ft. Wayne, IN.

Impact: Comprehending how *Erwinia amylovora* utilizes the nucleobase derivative – 6 thio-guanine – in disease establishment will contribute to devising new strategies for fire blight control.

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

Drs. Triplett and Shidore, along with collaborators at Colorado State University and Virginia Polytechnic Institute have discovered that *Xanthomonas* pathogens, including those causing bacterial spot of tomato and pepper in Connecticut, secrete a previously unknown type of protein toxin that can alter central metabolism in bacteria, fungi, and plants. Dr. Triplett demonstrated that the toxin is a new type of universal “poison” that directly alters a central metabolite in plants. This year’s work showed that pathogens actually cause this reaction inside host cells to suppress immunity, but that this likely works by changing the oxidative environment inside the cell rather than through toxicity.

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, but was never previously shown to be a weapon in pathogenesis. The characterization of this new type of bacterial toxin will help us find new strategies to fight disease, and the toxin may also have uses in biomedical and synthetic biology research.

The contribution of toxin-antitoxin systems to bacterial plant disease

Drs. Lindsay Triplett and Quan Zeng have been identifying the roles of numerous different toxin-antitoxin systems in bacterial plant disease. Several factors such as lifestyle and taxonomic group that are associated with enrichment of these toxins have been identified, which has helped us understand their potential roles in nature. This year, we have also begun deleting and re-introducing these systems into the fire blight pathogen *Erwinia amylovora* and promising biocontrol strain *Pseudomonas fluorescens* to determine whether the systems aid in survival to antibiotics or in the plant environment.

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, and which ones could be used to improve biocontrol strains for better survival.

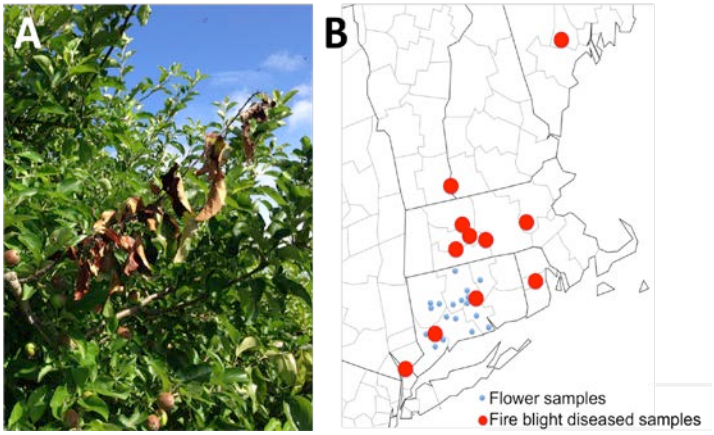
Identification of a novel *Xanthomonas* disease resistance mechanism shared by rice and tomato

Drs. Lindsay Triplett along with collaborators at Yale and Cornell University have initiated a project to map the genetic location of a new type of resistance gene in rice that is triggered by a type of protein found in diverse bacteria. The location of the gene was identified, yielding a handful of promising gene candidates. This year, we found an interaction between one of the candidate resistance genes and the pathogen protein, which suggests that the interaction may be important for resistance. We are currently working toward detecting the interaction in plants.

Impact: This is the first effective genetic resistance against a pathogen that causes up to $1 billion in annual yield loss in West African rice, and has been labeled a security threat to US rice. The resistance gene is a novel type of resistance found in both monocot and dicot plants, and it is triggered by a protein found in 60% of *Xanthomonas* and many *Ralstonia* plant pathogens. Once the mechanism of resistance is identified, it could be harnessed for resistance against a wide variety of crop diseases.

Monitor and prevent streptomycin resistance in Fire Blight pathogen populations in New England

Fire blight, caused by the bacterial pathogen *Erwinia amylovora*, is one of the most serious diseases currently limiting apple and pear production in Connecticut and in the United States. Application of antibiotic streptomycin during bloom is by far the only management option available that provides a high level of control efficacy. The intensive, long-term use of streptomycin, however, has resulted in the evolution of streptomycin resistance in *E. amylovora*. Since the first report in California in 1971, streptomycin resistance has been commonly detected in *E. amylovora* in most apple-producing regions of the United States, including Washington, Oregon, Michigan, and New York, making streptomycin ineffective in these locations. In 2014, severe fire blight outbreaks occurred throughout Connecticut and New England. Growers suspected that the streptomycin resistance may be present in the New England region. Dr. Zeng assisted by Regan Huntley and funded by the NE-IPM Center has conducted the second year survey of the streptomycin susceptibility in the fire blight pathogen populations in New England. All the isolates tested were susceptible to streptomycin. The streptomycin resistance gene *strA-strB* was detected in environmental, non-pathogenic bacterial isolates in New England orchards. These results suggest that streptomycin remains an effective management option for fire blight in the New England region, although there is a potential risk of streptomycin resistance development in *E. amylovora* population in New England orchard 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*. Genomes of some of the

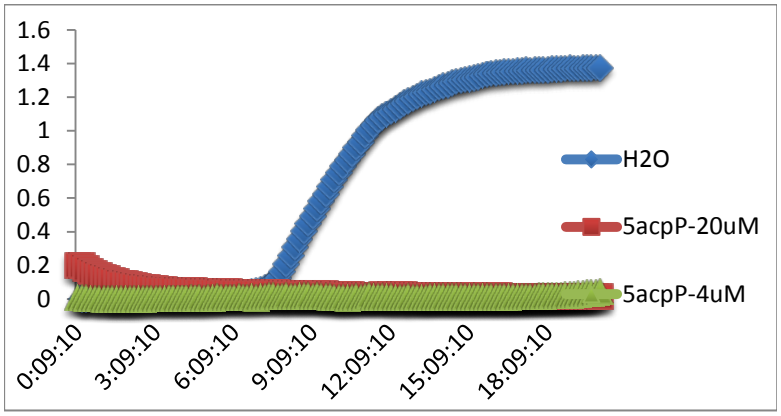


A. Typical "Shepherd's crook" symptoms of fire blight. B. Locations of sample collection in 2015.

E. amylovora strains have been sequenced. We are currently using genomics and comparative genomic approaches to understand the strain distribution and evolution of virulence factors.

Impact: Apples and pears are economically important commodities in the United States and Connecticut and are grown on 142,000 and 24,300 hectares, respectively, with cash receipt values exceeding $2.2 billion and $355 million, respectively. 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 on the use and effectiveness of streptomycin in the New England region. Research findings from this project was highlighted (http://www.northeastipm.org/about-us/publications/ipm-insights/antibiotic-resistant-fire-blight/) along with a webcast https://www.plantmanagementnetwork.org/edcenter/seminars/outreach/Apple/FireBlight/).

Develop antisense antimicrobials for Fire Blight control



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

Fire blight is a devastating plant disease, in large part due to the limited amount of control options. Current controls used in fire blight management include antibiotics, copper, and biological controls. However, the emergence of antibiotics resistance, inadequate control efficacy of biological controls, as well as the phytotoxicity caused by copper products limit the use of these options and addresses urgent need of developing alternative controls that are effective and sustainable.

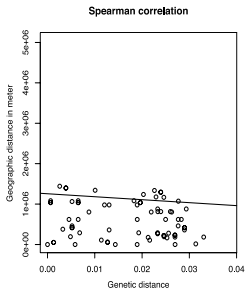
Antisense antimicrobials are short, synthetic nucleic acid oligomer mimics that contain antisense sequences to the translational initiation site of essential genes of a target pathogen. The binding of the antisense compounds to the translational initiation sites of the essential genes leads to the silencing of these genes and cell death. Compared to antibiotics, antisense antimicrobials have obvious advantage in sustainability, ability to specifically target the pathogens, and to overcome resistance. Funded by USDA-AFRI-Exploratory Research, Dr. Zeng is exploring the possibility of using antisense molecules that target the translational initiation sequence of essential genes of the fire blight pathogens to inhibit the growth of the fire blight pathogens and to control fire blight. Peptide nucleic acid (PNA) molecules that contain antisense sequences to a total of 8 essential genes were tested for the inhibition of the growth of *E.*

amylovora. Among these molecules, anti-*acpP* PNA molecule showed excellent inhibition of the pathogen growth. Detached flower assay also showed that anti-*acpP* PNA was able to significantly limit the growth of *E. amylovora* on apple stigmas at the concentration of 100 uM. Using Northern blot analysis, we proved that the anti-*acpP* PNA specifically inhibit the mRNA of *acpP* in *E. amylovora* thus proved that the antimicrobial effect is through the RNA silencing of *acpP*. The antimicrobial effect of anti-*acpP* PNA on *E. amylovora* was determined as bactericidal but not bacteriostatic.

Impact: Our research demonstrated the feasibility of using antisense molecules in controlling plant diseases. It not only provides a non-antibiotic management option for fire blight that is urgently needed for the apple and pear industry, most importantly, it also generates valuable data and conditions for the application of this novel technology in management of other important bacterial plant diseases. The research finding is summarized into a journal article and is now published on *Frontiers in Microbiology*.

Understanding disease emergence and pathogen evolution of bacterial etiolation and decline of creeping bentgrass

Creeping bentgrass is one of the most commonly used grass species on golf course putting greens in the United States. Since 2009, grass decline with symptoms of wilting, necrosis, and etiolation were consistently observed on creeping bentgrass of many golf courses in the "transition zone" of the United States. Later the causal agent of this disease was diagnosed as a bacterial pathogen *Acidovorax avenae* subsp. *avenae* (*Aaa*) and the disease is named as bacterial etiolation and decline (BED). However, how this disease emerged and spread to different parts of the U.S. was unknown.



Dr. Zeng, in collaboration with Dr. Paul Giordano, obtained the first collection of the turfgrass pathogenic *Aaa* strains from diseased creeping bent grass from 14 states of the U.S. Draft genomes of 14 turfgrass *Aaa* strains, one maize *Aaa* strain, and one orchid *Acidovorax* strain were sequenced, assembled, and annotated. Our results suggested that the 2009-2011 outbreak of BED was caused by a genetically diverse group of pathogens belonging to two divergent phylogroups. Putative virulence factors of the turfgrass pathogens were identified. To identify a genetic basis for the host specificity we searched for genes closely related among turfgrass strains but distantly related to their homologues from maize strains. We found a cluster of 11 such genes generated by three ancient recombination events within the Type III Secretion System (T3SS) pathogenicity island. Ever since the recombination, the cluster has been conserved by strong purifying selection hinting at its selective importance. Together our analyses suggest that BED is an ancient disease that may owe its host specificity to a highly conserved cluster of 11 T3SS genes.

Impact: Golf industry is an important component of the economy in the United States and Connecticut. The total size of Connecticut's golf economy was estimated at $638 million in 2008. Understanding the

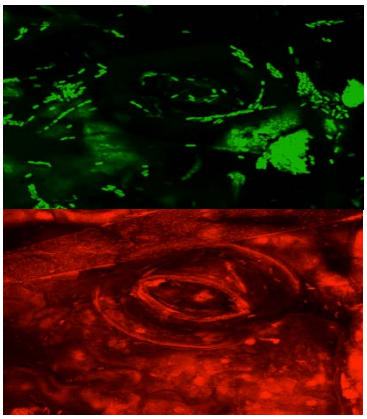
disease emergence of bacterial etiolation and decline will help restrict the spread of this important disease on golf courses and develop effective detection and management options. Understanding of the pathogen evolution and disease emergence will also provide valuable information for future disease mitigation. The research findings have been summarized into a research article and it is accepted for publication in *Molecular Plant-Microbe Interactions* (https://doi.org/10.1094/MPMI-06-17-0151-R).

Characterization of the apple flower microbiome to identify effective biological controls for Fire Blight in eastern U.S.

Dr. Zeng has been characterizing the microbial communities (microbiome) on apple flowers. Apple flowers represent the primary infection sites of fire blight. Pathogen friendly ecological conditions on apple flowers are critical for the occurrence of fire blight infection. Apple flowers are the main targets of biological control agents. Despite the importance of apple flowers, there is a lack of a comprehensive understanding of the microbial composition, diversity, abundance on apple flowers. This knowledge gap directly resulted in the lack of biocontrol agents that can provide consistent, high level of protection against fire blight. In this research, we will utilize the pyrosequencing approach to provide an in-depth characterization of flower microbiome. This information will then support the identification of potential biological control agents against fire blight. In 2016, more than 400 apple flower associated microbes were isolated and tested for their control efficacy against fire blight. Two isolates, BC250 and BC253, displayed significant antagonistic effect against the fire blight pathogen *E. amylovora*. The investigation of the biocontrol mechanism revealed that these two isolates produce an antimicrobial compound, anthranilic acid, which inhibits the growth of *E. amylovora*.

Impact: The management of fire blight is challenged by the spread of streptomycin resistance in the pathogen population. While the streptomycin is less useful in fire blight management, alternative control measures have yet been developed. In Connecticut, most growers still heavily rely on the streptomycin spray. This not only puts the growers at the risk of control failure in case of resistance, but also significantly limits the organic tree fruit production in CT, as antibiotics are no longer allowed in organic production after 2014. Thus, effective, environmental friendly options for fire blight control is urgently needed in CT.

Understand How Bacteria Pathogens Respond to Host Signals and Modulate Virulence Expression



As singles cell organisms, bacteria multiply through asexual replication. A bacterial population formed by genetic replication consists of billions of single cells with identical genetic background. When perceive an environmental signal, these single cells often respond uniformly by producing a related gene product evenly in each individual cell of the population. However, under certain adverse, fluctuating environments, bacteria sometimes express a gene in a “non-uniform” manner in a population. The type III secretion system (T3SS) is one of the most important virulence factors in Gram-negative bacteria. During the infection in plants, single cells from a clonal bacterial population developed heterogeneity in expressing T3SS: a small proportion of cells highly express the T3SS genes, whereas the majority of cells do not express these genes. This type of bacterial population behavior, in which a gene is expressed at two distinct levels in single cells of a clonal population, is defined as bi-stable expression. Because traditional research methods, such as RNA-Seq and Northern/Western blot, only detect the average expression levels of a gene in a population, the heterogeneous gene expression in single cells of a bacterial population during the interaction with plant hosts is poorly understood. Combining single-cell technologies, and genetic and transcriptomic approaches, this project will conduct

a comprehensive characterization of the T3SS bi-stability in plant pathogenic bacteria from three aspects: 1. How bacteria use bi-stable gene expression to modulate the levels of T3SS when interacting with different plant organs, and various hosts, 2. What mechanism causes the differential expression of T3SS in a clonal bacteria population, and 3. What biological significance the bi-stable expression of T3SS brings to the plant-pathogen interaction. These questions are investigated in two important plant pathogenic bacteria: the fire blight pathogen *E. amylovora* and soft rot pathogen *D. dadantii*.

***Impact**:* This study will significantly advance our knowledge on what additional strategies bacterial pathogens use to modulate the virulence gene expression during plant-pathogen interactions. In addition, this research will be performed in the context of two economically important bacteria plant diseases, thus findings from this research will also immediately benefit the U.S. agriculture by providing basic knowledge to guide the development of disease management strategies in the future.

Disease Survey

Dr. Yonghao Li, assisted by Ms. Lindsay Patrick, diagnosed a wide range of fungal, bacterial, viral, nematode, and abiotic diseases on trees, shrubs, flowers, lawn grasses, fruits, and vegetables during 2016-2017. The drought stress during the growing season in 2015 and 2016 resulted in many woody ornamentals becoming vulnerable to biotic and abiotic diseases. Dramatic fluctuations in winter temperatures contributed to severe physical injuries on trees and shrubs in 2017. Cool and wet spring weather conditions favored many fungal and bacterial diseases on evergreen and deciduous trees and shrubs in 2017.

<u>Herbaceous and Woody Ornamentals:</u>
After a severe epidemic of Volutella blight of pachysandra in 2016, severe diebacks of pachysandra caused by this disease were observed in spring 2017, which was favored by drought stress during the growing season in 2015 and 2016 and wet weather in the spring of 2017. A wide spread of Phoma stem blight of vinca was reported. Various root rot diseases were found on many annual and perennial flowers, such as Pythium root rot on scaevola, poinsettia, and chrysanthemum; Thielaviopsis root rot on lavender, petunia, and tiarella; Rhizoctonia root rot on ageratum, alyssum, and scaevola; and Phytophthora root rot on lavender. Powdery mildew was problematic on beebalm, rudbeckia, and zinnia. Botrytis blight and Alternaria leaf spot were found on *Pelargonium* spp.

Volutella blight of pachysandra.

Phoma stem blight of vinca.

Boxwood blight was continuously problematic in both landscapes and nurseries. Boxwood blight was also found on pachysandra in a landscape. Winter injury, Volutella canker, and Macrophoma leaf spot were major causal agents of severe dieback of boxwoods in landscapes. In a nursery, Thielaviopsis root

rot was found in rooted cuttings of boxwood. Foliar diseases including cedar-apple rust, scab, and frogeye leaf spot were prevalent on crabapple trees. In the spring of 2017, a severe epidemic of trellis rust was observed on ornamental pear, which caused significant defoliation of pear trees in early summer. *Gymnosporangium* rust diseases were also found on quince, serviceberry, hawthorn, and cedar. Many fungal canker diseases were found on woody ornamentals, such as Phomopsis canker on Andromeda, mountain laurel, privet, and Japanese pagoda tree; Botryosphaeria canker on cherry, maple, and willow; Seiridium canker on Hinoki cypress and Leyland cypress. Significant diebacks and browning of needles were noticed statewide, which might be attributed to drought stress and mild winter temperatures in the past few years. Canavirgella needlecast and Septorioides needle blight might also contribute to browning of needles on white pine trees. It was found that severe mortality of young white pine trees was associated with *Botryosphaeria* sp., although it needs to be further investigated. In a Christmas tree farm, Delphinella shoot blight was found on concolor fir. Rhizosphaera needlecast and Stigmina needlecast were two major foliar diseases on spruce. Phytophthora root rot was detected on Fraser fir in many Christmas tree farms. Pestalotiopsis needle blight was prevalent in arborvitae, which might be associated with drought stress and winter injury on the trees.

Mortality of white pine.

Delphinella shoot blight of concolor fir.

Vegetables:

Stemphylium gray leaf spot was found in greenhouse-grown tomato plants. Xanthomonas bacterial leaf spot, Septoria leaf spot, early blight, Verticillium wilt, and blossom-end rot were common diseases in garden- and field-grown tomatoes. Bacterial pith necrosis was found in several commercial production tomato fields. On peppers, bacterial leaf spot, anthracnose, and Phytophthora blight were problematic. Powdery mildew, anthracnose, bacterial wilt, and bacterial angular leaf spot were major disease problems on cucurbit crops. Septoria leaf and fruit spot of pumpkin was found in a farm. Basil downy mildew was found in late summer.

Stemphylium gray leaf spot of tomato.

Bacterial leaf spot of tomato.

Tree and Small Fruit:

Cedar-apple rust, scab, frogeye leaf spot, and black rot were prevalent on apple trees. On pear trees, rust, Phoma leaf spot, and Fabraea leaf spot were found. Leaf curl and brown rot continued to be major diseases on peach. Black knot and winter injury caused significant diebacks on cherry trees. Rust was frequently detected on fig trees. Black rot, powdery mildew, and anthracnose were commonly found on grapevines. Phomopsis canker, Botryosphaeria canker, and mummy berry were major diseases on blueberry. Botrytis blight was found on raspberry.

Apple scab.

Black rot of grape.

Turf:

Slime mold was prevalent in the early summer of 2017 because of wet weather conditions and higher relative humidity. Brown patch, summer patch, red thread, anthracnose, and rust were common diseases of lawn grasses. Many cases of Pythium blight, Drechslera leaf spot, and Bipolaris leaf spot were found in lawns that were frequently irrigated and over-fertilized.

Slime mold on lawn grass.

Bipolaris leaf spot of lawn grass.

Weeds:

Poison ivy remained a significant problem in residential properties. Running bamboo continued to be a topic of increasing public concern because it is difficult to control and has the potential for causing problems between neighbors. Crabgrass, annual blue grass, bittercress, creeping bentgrass, chickweed, clover, ground ivy, nutsedge, purslane, red sorrel, wild garlic, and wild violets were major weed problems in turf grasses. Oriental bittersweet, Asiatic dayflower, Japanese knotweed, Virginia creeper, horsenettle, garlic mustard, mugwort, nightshade, pigweed, spurge, stilt grass, and sumac were common weed problems in lawns, gardens, or crop fields.

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

SERVICE ACTIVITIES

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

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

Every year, official samples of vegetable, crop, and lawn seeds are collected by inspectors from the Bureau of Regulation and Inspection of the Connecticut Department of Agriculture and submitted to The Connecticut Agricultural Experiment Station, the official seed testing laboratory for Connecticut. In 2017, 279 vegetable, 5 lawn, and 6 crop seed samples were submitted to Dr. Li for testing. Pamela Sletten and Lindsay Patrick performed the germination and purity analyses that are required for compliance with Connecticut Seed Law Regulations and the Federal Seed Act for all seed samples by following strict protocols designated by the Association of Official Seed Analysts. Vegetable seeds are tested for germination. As of the date of this report, tests for 254 of the 279 vegetable seed samples were completed and 12 of the tested seed samples failed label claims for germination. Lawn seeds are tested for both germination and purity. Four of the five lawn seed samples tested met label claims for purity and all five lawn seed samples passed the germination claims. Crop seeds are also tested for both germination and purity. All six crop seed samples tested passed label claims for purity. One of the 6 crop seed samples

failed to meet the germination claim. A *Station Technical Bulletin* will be written to report the findings of this year's results.

Impact: The results of the seed testing 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 42 samples from the Connecticut Department of Consumer Protection at the request of the Department of Analytical Chemistry at the Experiment Station.

Citizen Inquiries
Plant Disease Information Office

Dr. Li, assisted by Ms. Patrick, answered 3,970 inquiries about plant health from Connecticut citizens. Although the majority of inquiries were on ornamentals, trees, and shrubs (69%), other categories, such as food crops (12%) and turf grasses (4%), were also well represented. A moderate percentage of inquiries fell into the miscellaneous category (15%), which included identification of various plants and weeds, mushroom identification for health officials, and information about pesticides and their relationships to health and environmental concerns. The majority of inquiries were from Connecticut homeowners (61%), and commercial growers and plant care professionals (34%). Five percent of inquiries were from cooperative extension, health, news, agricultural personnel, and other. A further breakdown of inquiries showed that 32% of the questions came in by phone, 14% came in by mail, 12% came as email, and 42% were brought in person. The number of physical samples handled by the PDIO (56%) continued to exceed the number of phone calls and emails (44%). 1,018 letters and email messages with attached files of fact sheets were sent from the PDIO. Many citizens opted to download fact sheets posted on the CAES website in lieu of letters, since this gave them instant access to the information of concern.

VALLEY LABORATORY

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

Activities on the Farm

There were a total of 60 experimental plots at the Windsor research farm during the past year. Four Windsor-based scientists had 34 of these plots; five New Haven-based scientists were using 13 plots. The remaining plots were maintained by the Farm Manager as rotation crops or for seed collection. Valley Laboratory scientists also conducted experiments in many plots off site, such as in growers' fields, the Lockwood and Griswold farms and in state forests. Valley Laboratory Farm Manager James Preste kept the farm and equipment ready and in excellent shape. He expertly maintained the many field plots and addressed the specific needs of each scientist. He and his summer research assistants did an outstanding job maintaining the extensive ornamental garden in cooperation with the Connecticut Nursery and Landscape Association. Mr. Preste and Dr. LaMondia coordinated the Valley Laboratory's effort to comply with EPA Worker Protection Standards for Agricultural Pesticides and organized and conducted safety and pesticide training sessions for the staff.

RESEARCH ACTIVITIES

Hemlock Woolly Adelgid Research

Biological control using imported predators of *Adelges tsugae*, the hemlock woolly adelgid (HWA), is a major long-term national strategy for reducing the impact and spread of this damaging and invasive insect, which threatens the entire range of eastern and Carolina hemlocks. *Sasajiscymnus tsugae* (Coleoptera: Coccinellidae), originating from Honshu, Japan, discovered and studied at the CAES, is one of the first biological control agents released for HWA management in the US and the only major species released in Connecticut. From 1995-2007, > 176,000 *S. tsugae* were mass-reared and released in 26 state forest and parks, municipal, water company and private forest sites throughout Connecticut. Encouraging results of hemlock recovery from HWA damage in Connecticut were recorded from 2005-2009 in > 75% of sites with *S. tsugae* releases. The overall goals of this project are to integrate established and new approaches, into (1) an overall current assessment of the health of forest hemlocks in Connecticut, 30 years after the arrival of HWA, (2) to improve the understanding of the role of climate and biological control of HWA with the introduced adelgid predator, *S. tsugae*. *S. tsugae* remains the only biological control agent for HWA available commercially due to the capability of large-scale laboratory rearing. Current assessments are evaluating the implementation of *S. tsugae* to manage HWA infestations as an important and economical option for public and private stakeholders who cannot or do not want to use chemicals for controlling HWA. These assessments quantify predation of HWA under hot, humid summer conditions.

Impacts:

- Assessments of the field efficacy of *S. tsugae* as a biological control agent documented many advantageous attributes in 2016-2017: Bivoltine *S. tsugae* are effective predators which target late sistens and resurgent summer progrediens HWA, and also uniquely feed on dormant HWA N1

settlers of the subsequent sistens generation. This results in a long season predation impact on HWA from spring to fall.

- During the hottest year of 2016, *S. tsugae* was voracious in attacking and reproducing on the HWA progrediens generation in June during extreme heat. Larvae also predate on the HWA progrediens.
- Mature *S. tsugae* adults further consumed > 1200 HWA sistens N1 each from July to late October 2016 when summer temperatures routinely exceeded 30 °C. Projected summer to fall predation of 5,000 adult *S. tsugae* = 6 million HWA!
- While unpredictable winters with high winter kill of HWA decimate prey for specialist HWA winter predators, *S. tsugae* can be implemented in late winter-early spring for biological control to reduce at least 2 generations of HWA during late spring into early fall. *S. tsugae* is able to survive the increasingly hot summers and fall, adapting to the changing climate in Connecticut. This species is commercially available and should be released after extreme winters.

Adult and first instar larval *S. tsugae* feeding on dormant first instar HWA.

- A series of extreme winters from 2014-2016 reduced HWA populations statewide to the lowest levels in decades but pockets of HWA resurgence were detected after a mild winter in 2017. It is vitally important to manage HWA before outbreaks of this pest build again. The biological control of HWA program in Connecticut was expanded in June 2017 in cooperation with Tree-Savers, LLC, Greentown, PA through a donation of 2,000 *S. tsugae* beetles to manage emerging HWA infestations at 7 new sites and augmentation at a 2016 new site with the assistance of state, municipal, and private foresters, and volunteers from the Friends of American Legion and People's State Forest.

Jayme Boniewicz, Director, and staff of Tree-Savers, PA and donated *S. tsugae* beetles.

- In June 2017, with the help of state and private foresters, land trust staff and volunteers, releases of 2,000 *S. tsugae* were implemented at 4 state forests: American Legion State Forest (Barkhamsted), Pachaug State Forest (Voluntown), Nassahegon State Forest including the Burlington Fish Hatchery (Burlington), and Algonquin State Forest (Colebrook); 2 private forest preserves at the Mine Hill Preserve, Roxbury and at Great Mountain Forest, Norfolk and Canaan, and at Webb Mountain Park in Monroe, to protect important hemlock watersheds, wildlife habitat, ecosystems and recreational areas for the benefit of all Connecticut's citizens. These new sites will also be used for field research to follow *S. tsugae* establishment, impact on emerging HWA populations and predator winter survival in Connecticut in a changing climate.

Clockwise upper left to right: Ralph Scarpino, Kathy Hart, Paul Hart and Nicki Hall (Friends of American Legion and People's State Forests) releasing *S. tsugae* at American Legion State Forest, Barkhamsted.

DEEP State foresters Emery Gluck and Dan Evans releasing *S. tsugae* along the Green Falls River, Pachaug State Forest, Voluntown.

John Weeks, Jr. and DEEP State Forester David Irvin releasing *S. tsugae* at the Burlington Fish Hatchery and Nassahegon State Forest in Burlington.

Ed Racz, Jamie Curren, Ann Astarita at the *S. tsugae* release at the Mine Hill Preserve, Roxbury.

Dave Soleck, Monroe Park Ranger releasing *S. tsugae* at Webb Mountain Park.

Zach Jaminet, Brandon Coleman and Talia Stewart, 2017 Great Mountain Forest (GMF) forestry interns and Russell Russ, GMF Forester, releasing *S. tsugae* along Wangum Brook, GMF, Canaan.

Drought and Elongate Hemlock Scale Impacts on Connecticut's Hemlocks

- Surveys in 2016-2017 showed that eastern hemlocks in some marginal release sites exhibited decline on northwest and northeast ridges, due to heavy EHS infestations, in either single or joint infestations with HWA. But as HWA levels have been significantly depressed due to 3 winters, the decline is mostly due to EHS buildup and subsequent needle loss.
- Recent severe winters have not greatly reduced elongate hemlock scale (EHS) *Fiorinia externa* infestations. The scale has continued to encroach on high elevation hemlock stands in northwestern CT. However, the most severe and prolonged drought since 1964-66, together with heavy EHS infestations at some sites resulted in rapid tree decline and thin hemlock crowns, especially in marginal sites on stressed ridge tops in the northern half of the state. Many perennial and feeder streams were dried up in the fall of 2016 and winter of 2017. Extensive needle drop of scale-infested foliage in 2017 has also resulted in a drop in EHS levels in some sites.
- Hemlock crown health ratings were completed in the fall of 2016 into spring 2017 at 15 of Connecticut's *S. tsugae* release sites 10-20 years post release, and at 6 former baseline sites at high elevation, which had previously had negligible adelgid and/or EHS infestations. HWA infestations throughout Connecticut in 2016-2017 continue to be at the lowest levels in 16 years, due to the heavy winter kill, except for protected pockets and some urban areas, coastal and eastern forests, which had more snow cover. Of the 15 release sites evaluated, 46% were still in fair to good condition in spite of the statewide drought. Hemlock decline exacerbated by severe

drought impacts was recorded in 33% of the sites, hemlock borer outbreaks at 20% of the sites, all ridgetops and detected in 33% of the sites monitored.

- The drought in Connecticut was officially ended in April 2017, heavy rains and cool temperatures have favored dramatic hemlock refoliation and recovery statewide, which is being monitored.

Dry stream beds and thinning hemlocks due to extreme 2016 drought in northern Litchfield and Hartford Counties, CT.

Needle drop with heavy EHS infestations in East Hartland.

- Concurrently, incidences of hemlock mortality due to the secondary native pest, the hemlock borer, *Melanophila fulvoguttata*, were recorded during site data collection. Hemlock borer tree mortality near trails statewide is being mapped with the help of volunteers from the public. Hazard trees in recreation areas are being communicated to forest and park managers for removal for public safety.

Hemlock mortality due to hemlock borer infestations in northern Connecticut.

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 eastern U.S. in the 1930s and is classified as a serious invasive weed in Connecticut. Infestations are found in 14 eastern states from North Carolina to Ohio and the first record of MAM in Connecticut was in Greenwich in 1997, later confirmed in 2000. To date in Connecticut, 45 towns have confirmed reports of MAM, though some have only limited reports of a few plants, which have since been removed. This rapidly growing prickly and prolific vine is annual in its northern range but quickly forms dense thickets which overwhelm and displace native vegetation and reduces plant diversity. An introduced weevil, *Rhinoncomimus latipes* (Coleoptera: Curculionidae), imported from central China, has been successfully reared and released for biological control of this invasive species in the Mid-Atlantic and southern New England states. Releases of *R. latipes* began in 2009 in Connecticut, and over 52,000 weevils have been released in 21 towns as of June 2017, with a new release in the town of Glastonbury and augmentation in the town of Sprague. This project has documented the continued successful establishment and wide spread of this phytophagous species in southern New England.

This project is a collaboration between the CAES and Donna Ellis, Senior Extension Educator at the University of Connecticut and is funded by USDA APHIS PPQ, in cooperation with the New Jersey Department of Agriculture Phillip Alampi Beneficial Insect Laboratory. Many volunteers and cooperators from the private sector work together with our team, other state, town and federal officials in a team effort to implement MAM biological control to limit the spread of MAM. Dr. Cheah and Donna Ellis have participated in the releases and monitoring of all the release sites since 2009. Emmett Varricchio, summer research assistant at the Valley Laboratory, has been hired for a third year to conduct GIS mapping, release weevils and scout MAM and weevil dispersal and abundance, distribution and spread in the state.

Kris Vagos, US Fish and Wildlife, Stewart B. McKinney Wildlife Refuge introducing weevils into tent rearing cage on Calf Island, Greenwich in July 2016.

Emmett Varricchio, CAES Windsor, releasing weevils on Cockenoe Island, Westport in July 2016.

Emmett Varricchio and Donna Ellis (UConn) releasing *Rhinoncomimus latipes* on mile-a-minute weed in Glastonbury in June 2017.

Impacts:

- 45 Connecticut towns (26.6%) with confirmed reports of MAM to date in June 2017, with the latest report from a homeowner in Cromwell (www.mam.uconn.edu).
- MAM germination was delayed again in 2017 (late April) as in 2016 and 2014, due to cool spring temperatures. Monitoring in 2016 showed the weevils' continued presence at all sites, very late maturation of fruit, reduction of MAM at some sites. Extended severe drought and early competition from aggressive natives are also possibly limiting MAM germination, growth and seed set. Intensive scouting and GIS mapping in adjacent areas around release sites have shown little or no spread of MAM.
- Weevils have overwintered successfully again in Connecticut following successive severe winters in 2014, 2015, and 2016 and an extreme drought in 2016. Weevils have survived severe flooding, drought, storms, variable winters, site interference from mowing, tree felling, vegetation clearance and herbicide treatments. This marks the 8th year of successful weevil overwintering.
- Incredible off shore dispersal (3-4 miles over Long Island Sound) of weevils and MAM to islands was recorded again in 2016. Three bird sanctuaries on islands received weevils in 2016, to mitigate MAM spread, partnering with US Fish and Wildlife, Towns of Westport, Greenwich, and the CT Department of Energy and Environmental Protection. Establishment and spread of the

weevils has also occurred in the majority of release sites in a variety of different habitats on the mainland.

- Establishment of *R. latipes* for mile-a-minute weed appears to have limited the spread of mile-a-minute vine in some towns, together with other cultural and chemical means of control. Biological control of MAM is reducing the need for chemical control, especially in watershed areas, in utility rights-of-way, agricultural lands, bird refuges, etc.

Augmentative Biological Control of Elongate Hemlock Scale

Elongate hemlock scale, *Fiorinia externa* (EHS), an exotic scale present in Connecticut since the 1960s, has recently rapidly expanded its range and population densities to seriously damaging levels on forest and landscape hemlocks over much of Connecticut in the past 5 years. Forest stands in northern and western Connecticut with heavy elongate hemlock scale infestations have shown thinning crowns and declining health, leading to pre-emptive hemlock salvage in forest management. Recently, the native species, *Abgrallaspis ithacae*, or the hemlock scale, is increasingly found in southwestern and central parts of Connecticut on forest hemlocks while it has also been seriously damaging Christmas tree plantations for at least the past 3 years. As EHS and hemlock scale also infests other conifers, especially firs, which are the most popular species for Christmas trees, the industry is impacted and mostly resorts to chemical control for management of scale outbreaks. There is no effective natural enemy of EHS in North America. However, the twice-stabbed lady beetle, *Chilocorus stigma*, is a native and widespread omnivorous scale predator. There have been no attempts to mass-rear *C. stigma* and it is not available commercially. The goal of the project is to develop optimal laboratory methods to mass-rear suitable scale cultures and *C. stigma* for potential augmentative and safe biological control releases in EHS-affected stands.

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.

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

Infested and clean butternut squash storage at the Griswold Farm.

Avian Dispersal of Hemlock Woolly Adelgid

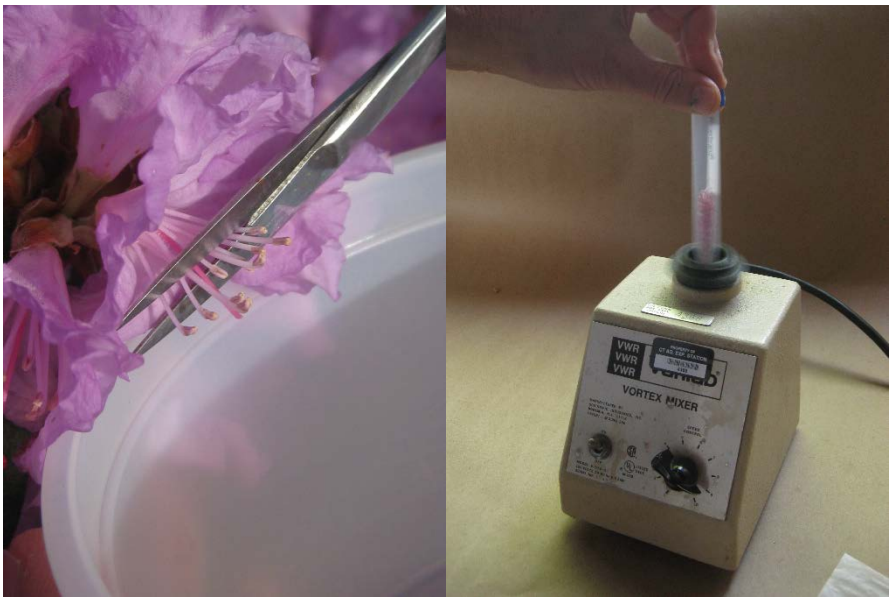
Dr. Cheah has participated in an undergraduate research project by Nicholas Russo, from the University of Connecticut, in collaboration with Dr. Morgan Tingley, and Dr. Chris Elphick, Department of Ecology and Evolutionary Biology. The Valley Laboratory hemlock plot is where Nick investigated the potential dispersal of HWA crawlers onto stationary preserved bird mounts and the relationship between crawler dispersal and the phenology of HWA hatch. Nick Russo is currently in the third year of his project where he is continuing mist netting to investigate crawler dispersal on live birds at the Valley Laboratory hemlock plot and 3 other forest plots. Nick is also investigating simulated possible transfer of HWA crawlers from mounted passerine specimens onto uninfested hemlock foliage at the Valley Laboratory.

Nick Russo and Dr. Chris Elphick mist net sampling of birds at the Valley Laboratory.

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

Insect Management

Efforts to better quantify the potential for neonicotinoid insecticides (NNIs) for causing harm to pollinators require an understanding of the concentration of these insecticides in floral rewards (nectar and pollen), the sensitivity of pollinators to the insecticides (known as intrinsic toxicity), the quantity of the pollen or nectar collected by the pollinators, and the duration of time that the pollinator may be exposed. The focus on NNIs is due to their systemic nature, which allow them to be transported within plants to nectar or pollen. The U. S. EPA has established that 25 parts per billion (ppb) in nectar and possibly 100 ppb in pollen may be thresholds for sublethal effects on honey bee health. In previous work that is now in press, Drs. Cowles and Eitzer investigated the relationships between factors associated with the application of these insecticides (active ingredient, dosage, application method, and interval before bloom) in influencing the resulting residues found in nectar (milkweed) and pollen (sunflower). These plant species were chosen based on their abundant production of nectar or pollen, because one-gram quantities of nectar or pollen (the quantity required for sensitive residue analyses) could be collected. At normal nursery application rates, the concentrations found in pollen decline rapidly following a foliar spray. By two weeks after spraying, the residues would not be of concern to honey bees. In contrast to foliar sprays, soil drenches at medium and high rates result in residues in pollen that would be of concern to pollinator health. These general findings are now being shared by the Horticultural Research Institute, which funded the work, so that nursery growers can be better informed regarding their use of neonicotinoid insecticides (http://growwise.org/wp-content/uploads/2017/01/HRI-Pollinator-BMPs-January2017.pdf). This work is being replicated and expanded through work on a Specialty Crop Research Initiative project with a large multistate team, which also includes CAES scientists Kimberly Stoner and Brian Eitzer. Work initiated two years ago by the Station demonstrated that *Rhododendron* spp. are an excellent model plants for assessing residues in both nectar and pollen. In the new, larger study, groups in CT and three other states are replicating the application of systemic insecticides, of which NNIs are only a part, to determine the residue levels in nectar and pollen in the rhododendron cultivar 'PJM'. Dr. Cowles participated in choosing the other plant materials in the study to be representative of annual and perennial ornamental horticulture plants, based upon their ability to produce large quantities of either nectar or pollen for residue analyses. At normal nursery application rates, the concentrations found in pollen decline rapidly following a foliar spray. By two weeks after spraying, the residues would not be of concern to honey bees. These data will be of great value to establish best management practices for nursery growers, and to assure the public that these insecticides can be used in ways that are not likely to harm pollinators.



Pollen is harvested from 'PJM' rhododendrons by snipping the filaments to collect the ripe anthers. Pollen is then released from the anthers by vibrating them in a centrifuge tube with a vortex mixer, simulating buzz pollination by bumble bees.

Honey Bee Health

Honey bee colonies have experienced poor overwintering survival in Connecticut for the past several years, with losses each year of about 50% of hives. The chief suspect for poor honey bee health is varroa mite infestation. These mites not only weaken bees through direct parasitization of bee pupae, but also by transmitting viral diseases within and between hives. A "vicious cycle" exists, in which colonies that have died during the winter are restocked by beekeepers during the spring by purchasing packages of bees. If their queen bees have poor genetic traits and the colonies are also poorly managed for varroa mite infestations, then the colony would be likely to die the next winter and have to be replaced again. Other parts of the country have developed honey bee genetic improvement programs, which usually involve selection for the strongest hygienic traits, in which worker bees remove parasitized bee pupae from the hive, thereby preventing reproduction of varroa mites. An additional potential source of good survival genes for honey bees is from feral honey bee colonies, because, if they have survived for multiple years, they have done so without involvement of chemical treatments to manage mite populations. A collaboration between Dr. Cowles and the CT State Bee Inspector, Mark Creighton, is being supported by the CT Department of Agriculture Specialty Crops Block Grant program. This project, initiated in 2017, addresses the needs of Connecticut beekeepers by starting a queen rearing and breeding program. The goal of this project is to obtain bees from exceptional commercial sources (based upon hygienic and overwintering traits), and also from feral bee populations, to use in controlled crosses via with instrumental insemination. The large numbers of queens desired from this program cannot all be produced through the laborious process of instrumental insemination, and so queens will also be produced through open mating, with the hope that sufficient drones will be generated by the colonies at the Station to improve the odds that virgin queens will mate with drones carrying beneficial survival and hygienic traits. These hybrid bees will then be given to state beekeepers for them to assess their qualities, including overwintering, propensity to generate swarms, gentleness, and honey yield. To obtain bees from feral populations, swarm traps are being placed in remote forested locations, with the expectation that swarms finding and colonizing these traps will be from local populations surviving in bee trees. To determine whether feral populations are present in these remote areas, bee-lining techniques will be used in

September to identify the locations of bee trees. If feral populations in forests cannot be found, then bees with similar beneficial traits will be obtained from exceptionally healthy colonies found and rescued from structures (houses and barns). An added benefit from this project involves outreach to beekeepers, so that they gain a better understanding of the joint necessity for improving the hygienic traits carried by their queen bees and of the need to maintain varroa mites at low populations. Side benefits expected from these actions will be (1) state beekeepers will start to purchase or replace existing queens with hygienic bees, which will improve overall health and survival of the state's honey bee population, (2) the Connecticut Queen Breeders Association (founded in 2015) will have a "jump start" in terms of breeding material for which they will become responsible, (3) the increasing proportion of bees with hygienic traits in the state may reach a threshold that increases the likelihood that open matings of bees will result in hygienic traits in the hive, and (4) better health for honey bees will improve the health of our native species of bees, because it will reduce the sharing of viruses from honey bees with other species on flowers that both species visit.

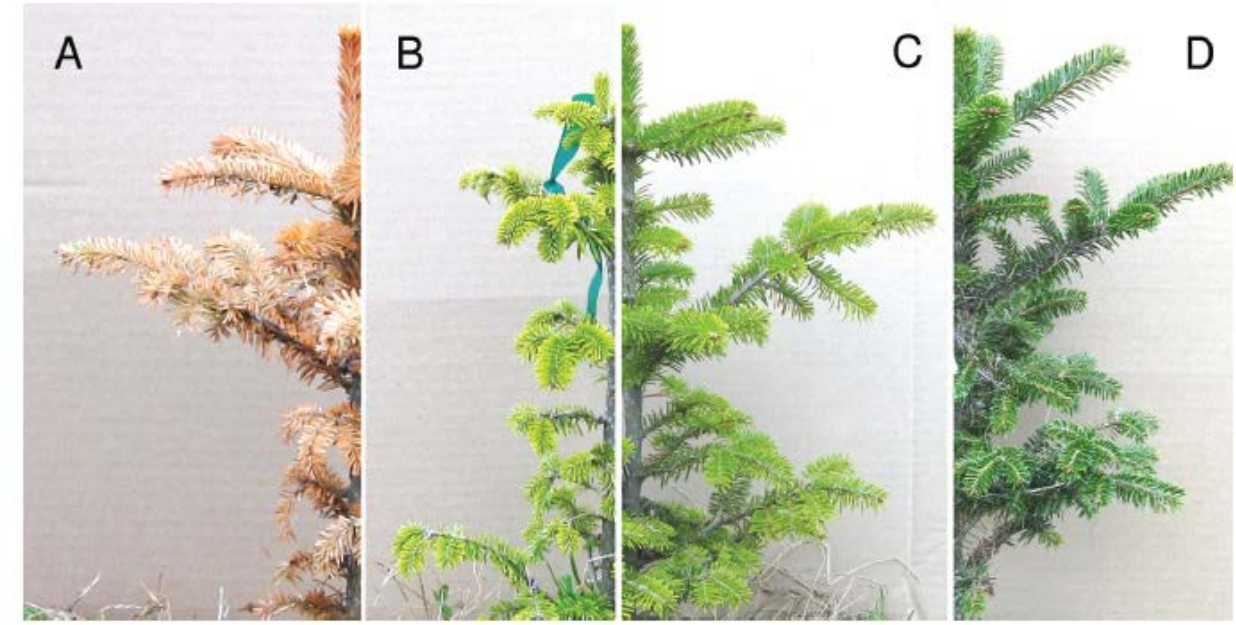
Dr. Cowles, research assistant Ethan Paine, State Bee Inspector Mark Creighton, and research assistant Ellie Clark check on the acceptance of a queen bee within a colony. (Photo, Patrick Skahill, WNPR)

Disease Management

In 2015, Dr. Cowles established a planting of firs in Brooklyn, CT, at a site with high naturally occurring incidence of phytophthora root rot. This experiment is investigating soil acidification as a method to prevent infection by root rot organisms. The underlying hypothesis in this experiment is that *Phytophthora* spp. are less tolerant of acid soils than are the fir tree hosts. Two species were planted, Fraser fir, which is highly susceptible to *Phytophthora*, and Canaan fir, which is somewhat tolerant. Evaluation of tree health in the same year as planting demonstrated a highly significant treatment effects from application of sulfur, which benefitted both species of fir, and a phosphite root dip, which benefitted only the Fraser firs. In the 2016 evaluation of this experiment (the year following planting), the trees in the low pH (acidified soil) plots had twice the terminal growth as the trees in plots not amended with elemental sulfur. Several hypotheses are now being considered to more fully explain the benefits from having amended the soil with sulfur. From laboratory bioassays of four *Phytophthora* spp. isolated from

CT Christmas trees, we have determined that growth of mycelium is directly affected by pH conditions in a dosage-dependent manner (dosage of hydrogen ions). Other possible influences expected from sulfur application appear to not influence mycelium growth, including the presence of elemental sulfur and higher concentrations of calcium ions.

The observation that tree growth one year after planting was associated with better tree color in the year of planting, and that all trees were somewhat yellow in the year of planting, suggests that improvement of plant nutritional status during the year of planting could have tremendous dividends for initial establishment and future growth of the trees. In spring of 2017, a follow-up experiment was started, in which the influence of sulfur incorporation at the time of planting, and root dips or drenches of products that could enhance root growth are being tested in a factorial experiment to determine which tools may benefit tree growth. The full effects of these treatments are not expected to be known until the summer of 2018.



The root health of Christmas tree transplants can be visualized by the color and growth of the aboveground part of the tree. Trees with even moderate yellowing (C) grow half as much as those with darker green foliage (D).

Impacts:

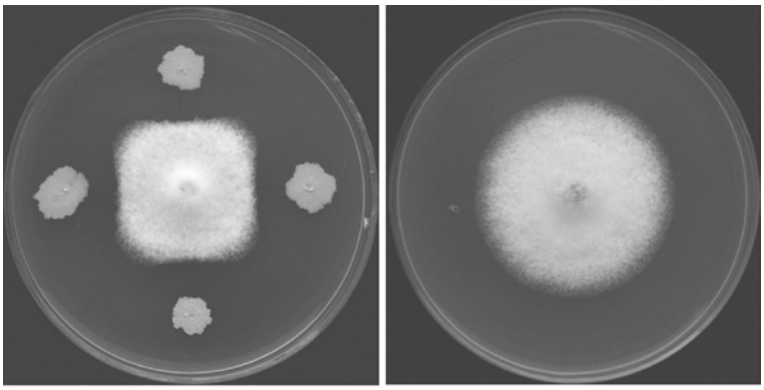
- The Horticultural Research Institute has incorporated results from our residue studies to inform nursery growers of the hazards to bees from drench applications of long-residual neonicotinoids (http://growwise.org/wp-content/uploads/2017/01/HRI-Pollinator-BMPs-January2017.pdf).
- The public at the state and national level has become more aware of the need for honey bee queen genetic improvement efforts (see http://wnpr.org/post/building-bee-resilience-one-queen-time).

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.

Biocontrol of plant diseases: the study was carried out on two hosts, poplar and *Euonymus japonicas* and two papers were published. *Burkholderia pyrrocinia* strain JK-SH007 isolated from poplar stems showed a highly significant effect on promoting growth of poplar and as a potential biocontrol agent against poplar canker. The ideal reference gene of *B. pyrrocinia* strain JK-SH007 was filtered and determined for the transcript normalization. The expression of pyrG was relatively stable *in B. pyrrocinia* JK-SH007. A bacterium HYEB5- 6 isolated from healthy *Euonymus japonicus* showed significant antifungal activities against various phytopathogenic fungi, including *C. gloeosporioides* s.s. HYCG2-3. The bacterial metabolites of HYEB5- 6 inhibited conidial germination, the growth of the germ tube and appressorium formation of HYCG2-3, possibly through protease and glucanase of HYEB5-6. HYEB5-6 is a potential biological control agent against *C. gloeosporioides*. The HYEB5-6 isolate was identified as *Bacillus velezensis*.

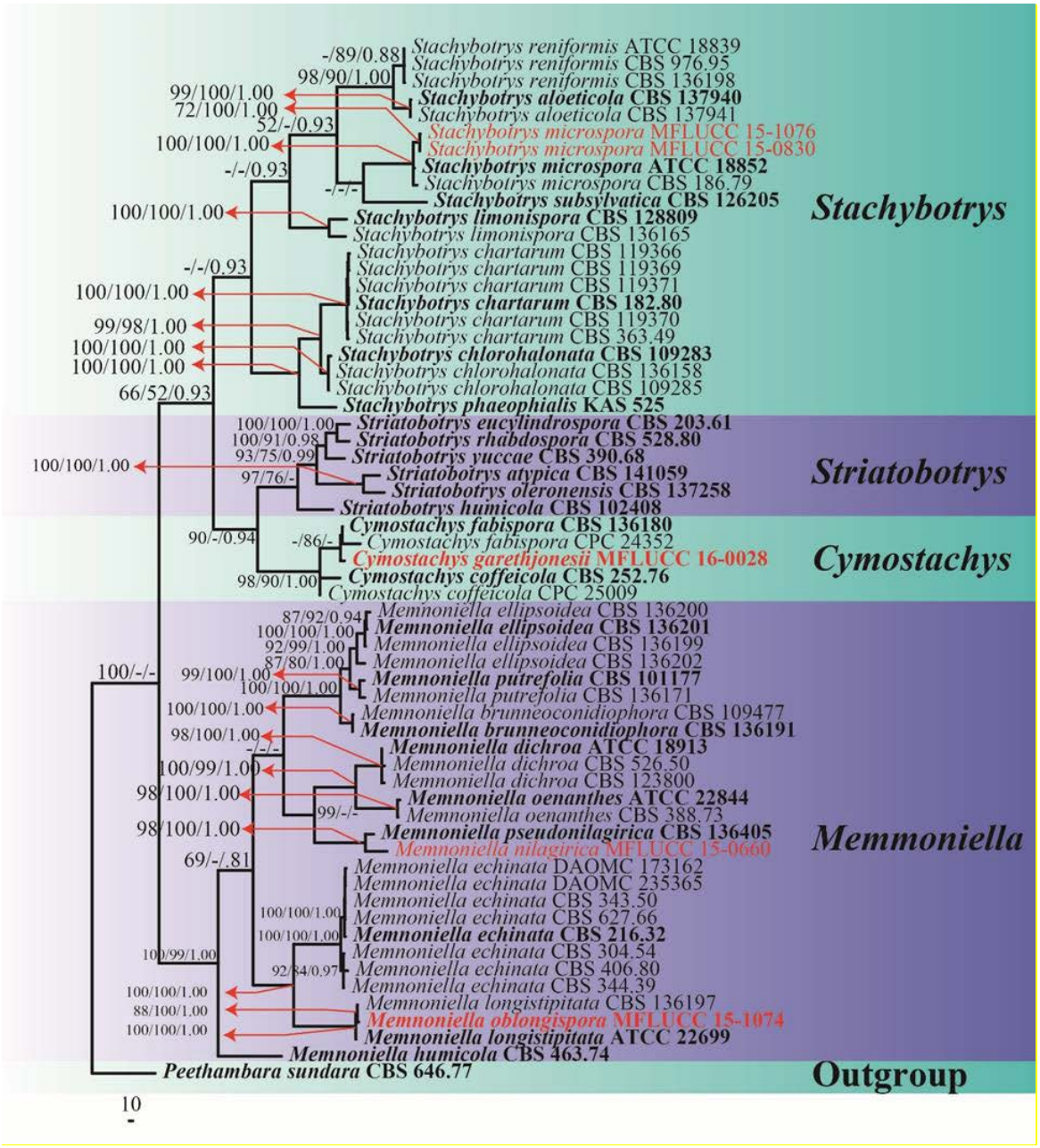
Impact: For the benefits of environmental and human health, it is important to explore alternatives for disease management. Biocontrol is always a good alternative to explore. Two bacteria studied at cellular and molecular levels clearly showed potential for managing polar canker and anthracnose of *Euonymus japonicas*. The studies are important steps to elucidate the biocontrol mechanisms of these biocontrol agents.



Inhibition of *Colletotrichum gloeosporioides* s.s. by HYEB5-6 on dual culture plates. The control was solely inoculated with *C. gloeosporioides*.

Toxic Indoor Mold - *Stachybotrys* and Hyphomycete Biosystematics

Ongoing collaborative study on Stachybotrys has led to the discovery of two new species of Stachybotrys-like fungi from karst areas in Thailand, *Cymostachys garethjonesii* sp. nov., *Memnoniella oblongispora* sp. nov., and one new combination, *M. nilagirica* comb. nov.
Impact: The study further clarified the species concept of this group. Since some fungi in this group are mycotoxigenic, allergenic or facultative pathogens to humans and are also rather common in water-damaged buildings, it is imperative to clearly define the members of this group. This study will assist indoor mold, medical, ecological, and public health professionals to better identify these fungi.



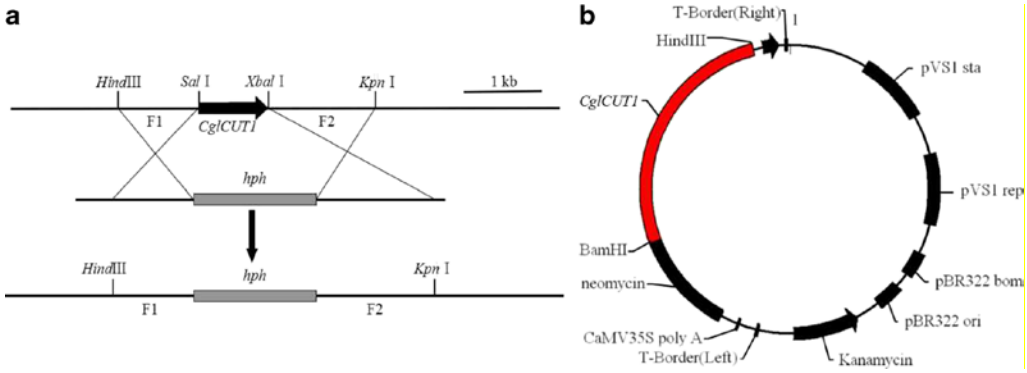
Phylogenetic tree generated from maximum parsimony (MP) analysis based on combined cmdA, ITS, rpb2, tef1 and tub2 sequence data for selected genera within the family Stachybotryaceae. Bootstrap support values for maximum parsimony (MP) and maximum likelihood (ML) greater than 50% and Bayesian posterior probabilities greater than 0.8 are indicated above or below the nodes as MPBS/MLBS/PP. The ex-type strains are in bold and the new isolates are in red. The tree is rooted with *Peethambara sundara* (CBS 646.77).

Study on anthracnose of *Camellia oleifera*

Colletotrichum gloeosporioides is the causal agent of *Camellia oleifera* anthracnose. The fungus secretes degrading enzymes to destroy the cuticle of aerial plant parts and help infect the host successfully. The characterization of CglCUT1 predicted protein suggests that the cloned DNA encoded a cutinase in *C.*

gloeosporioides affecting *C. oleifera*. The whole CglCUT1 gene was knocked-out and the knockout transformants exhibited significant decreases in cutinase activity and virulence compared with the wild-type strain. This study suggests that the CglCUT1 gene has a positive effect on fungal virulence of the hemibiotrophic *C. gloeosporioides* on *C. oleifera*.

***Impact*:** The study is a significant step for better understanding of infection mechanism using gene knock-out method and the crucial role played by CglCUT1 gene. The results can help explore new approaches of the management of this disease on *C. oleifera*.



Targeted disruption strategy and the map of the complementation vector p3300neoComCglCUT1. a: Targeted disruption of CglCUT1 gene using homologous recombination method. A map shows the gene disruption vector construction and a gene replacement event. The vector p3300neoCglCUT1 contained a 0.9 kb HindIII/SalI fragment, a 1.2 kb XbaI/KpnI fragment, and a hygromycin resistance cassette (hph). b: The map shows the complementation vector construction p3300neoComCglCUT1 that contains a 3.8 kb HindIII/BamHI fragment including the CglCUT1 (in red color), and G418 resistance gene (neomycin).

Weed Science
Invasive Plant Management Trials

In Connecticut, hundreds of non-native plants occur in various managed and natural ecosystems. One of these non-native invasive plants is mugwort (*Artemisia vulgaris* L.), which was introduced in North America more than 400 years ago as a medicinal herb. Dense monotypic stands of mugwort are commonly found along roadsides, floodplains and riparian areas, pasture and rangeland, rights-of-way, and in various agronomic, turf and landscape settings. Mugwort is also considered to be one of the 10 most troublesome weeds in the US nursery industry where it strongly interferes with the growth of ornamental plants. Mugwort's rapid spread is attributed to its extensive underground rhizome system and resistance to chemical and cultural control tactics. Current mugwort management relies mainly on herbicides; a few nonchemical options are available for mugwort control. Dr. Aulakh has established two field research projects at Lockwood Farm in Hamden to evaluate mugwort response to herbicides and mowing regimes under enhanced levels of soil nitrogen. The first experiment included a factorial combination of three levels of nitrogen (0, 25, and 50 kg N/a) and three different rates of herbicides: glyphosate, aminopyralid, and clopyralid. A second experiment consisted of three different levels of nitrogen (0, 25, and 50 kg N/A) and three mowing schedules (10-, 15-, and 30-day intervals). First year results revealed a significant reduction in mugwort infestation with lower (0.5 x) than recommended (1 x) herbicide rates. A year following herbicide treatments (October 2016), glyphosate at 1.1 kg ae/ha (acid equivalent per hectare) and aminopyralid at 0.06 kg ae/ha resulted in 90 and 80%, respectively, visual control of mugwort. Higher rates of glyphosate at $\geq$ 2.2 kg ae/ha and aminopyralid at $\geq$ 0.12 kg ae/ha.

Increased N fertilization did not affect mugwort control in response to any herbicide treatment. However, addition of nitrogen favorably affected perennial grasses. Mugwort did not seem to respond to the increased mowing frequency (10 versus 15 or 30 days mowing interval) under any of the nitrogen fertilization levels. Research will continue in following years to evaluate the role of low herbicide rates for complete elimination of mugwort rhizome biomass. Results from laboratory trials on mugwort seed germination have indicated huge variation in mugwort biotypes for regeneration via seed. All biotypes produced viable seed with germination ranging from 35 to 75%.

Impact: This research indicates that mugwort can reproduce and spread via both seed and rhizomes contrary to the conventional belief of its reproduction uniquely via rhizomes.

Mugwort management research at Lockwood Farm in Hamden, CT.

Ornamental Nursery Trials

Herbicides are a critical input to raise weed-free, high quality ornamental plants. In 2016, eight ornamental plant species (dogwood, Virginia sweetspire, red oak, White oak, vincas, pachysandra, and leucothoe) were screened for their tolerance to new experimental weed control products. Ten additional IR-4 funded ornamental plant safety trials are being conducted in multiple ornamental species in the current year (2017). These studies will help to develop safe use practices for these new products and compare their weed control efficacy with the conventional pre-emergence herbicides.

Impact: The herbicides Biathlon and Freehand at 200 and 300 lb/a, respectively, did not injure the tested ornamental species. As a result of these trials, safer alternative herbicides have been discovered for preemergence weed control in leucothoe, vincas, red oaks and white oaks.

Christmas Tree Weed Management Trials: Christmas tree tolerance to herbicides depends on many variables that encompass tree species, age, herbicide chemistry, application rate and timing (dormant or actively growing), and method of application (directed or over-the-top). In 2016, numerous new products such as indaziflam, flumioxazin, mesotrione, hexazinone + sulfometuron and their combinations have been evaluated for weed control efficacy and tolerance of Christmas trees at multiple locations in Connecticut (Shelton, Brooklyn, and Hamden). Experiments are being repeated in 2017 for consistency of results. Additional dose-response trials are being conducted at the Valley Laboratory in Windsor, and Broken Arrow Nurseries in Hamden. Dr. Aulakh is also conducting weed diversity surveys to assess the impact of various weed management systems currently being followed by Christmas tree growers in Connecticut. Surveys conducted in 2016 have indicated significant differences in weed species under different management situations. Weed management trials have discovered many safe and effective herbicides for pre-emergence weed control in Fraser fir, balsam fir, Colorado blue spruce, Canaan fir, and Douglas-fir. Weed surveys in 2016 have shown that a weed species shift toward predominance of perennial weeds (horsenettle, horsetail, black swallowwort, Asiatic dayflower, mugwort, smooth bedstraw, and hedge bindweed) in response to the current chemical weed management is occurring in many Christmas tree farms.

Christmas tree weed management research trials at Hamden and Shelton, CT.

Impact: Lack of selective post-emergence herbicides for perennial weed control and sole reliance on herbicides was the likely cause of the observed weed species shift.

Organic Production Systems: Weed management is one of the greatest challenges in organic production systems because chemical herbicides are not allowed in order to meet the organic production standards. A multi-year field study is underway at the Valley Laboratory to investigate the role of cover crops, crop rotations, and weed management systems (organic vs. chemical) for managing weeds in sweet corn and winter squash. Cover crops being investigated include cereal rye, spring oats, Sudan sorghum, and crimson clover. Rotational components include winter squash and sweet corn crops. The organic weed control methods include hoeing, application of vinegar or Weed Zap, an organic herbicide (clove oil 45% and cinnamon oil 45%). First year results indicated significant reduction in weed density (common purslane, field pansy, redroot pigweed, crabgrass, and horseweed) with a combination of cereal rye and crimson clover. Following cereal rye, overall weed control in chemically managed sweet corn/summer squash ranged between 95 to 99%. In organically managed sweet corn and winter squash, following a cereal rye plus crimson clover mixture, weed control was in the range of 85 to 95%. These results indicate that cereal rye plus crimson clover mix can be a viable weed management option for organic sweet corn and winter squash.

Sweet corn-winter squash rotation following cover crops at the Valley Lab in Windsor.

Strawberry and Rosemary Trials: Few herbicides with a broad spectrum weed control efficacy are available for weed control in high value crops such as strawberry and rosemary. Two field research trials are underway at the Valley Laboratory to assess safety and weed control efficacy in strawberry and rosemary to A 16003, an experimental herbicide being developed by Syngenta. These research efforts seek to provide safer and more effective chemical weed management options for strawberry and rosemary growers in Connecticut.

Strawberry and rosemary herbicide tolerance trials at the Valley Lab in Windsor.

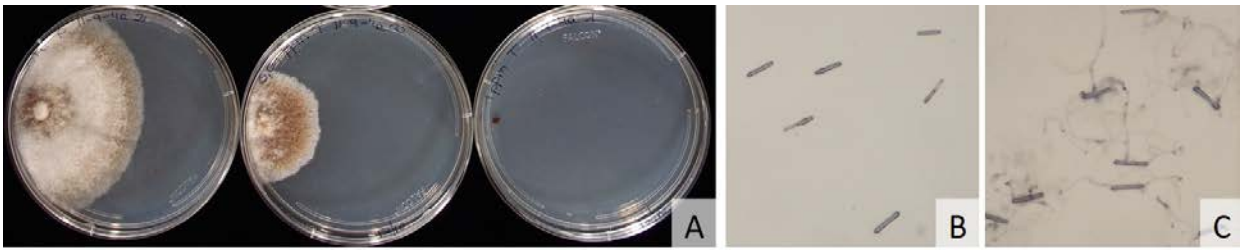
Plant Disease Research

Boxwood Blight

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

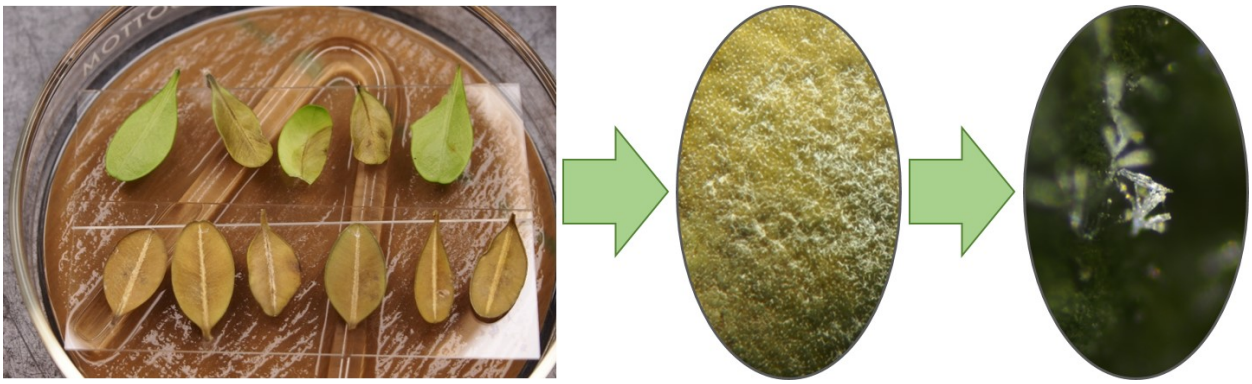
Assessing the potential for development of fungicide resistance in *C. pseudonaviculata*

One aim of the boxwood blight research is to assess the potential for development of fungicide resistance (insensitivity) in the pathogen *C. pseudonaviculata (C.ps.)*. The development of resistance is common and observed for many pathogens and crops. Therefore, Drs. James LaMondia and Katja Maurer conducted tests to evaluate the fungicide sensitivity of three different pathogenic isolates (two different wild types I and II from Connecticut landscapes and an isolate of wild type I selected for its ability to grow on up to 250 µg a.i./ml pyraclostrobin). Previous experiments included the evaluation of mycelial growth and conidial germination on different strobilurin fungicides (pyraclostrobin, azoxystrobin, trifloxystrobin, and kresoxim-methyl) and demethylation inhibitor (DMI) fungicides (propiconazole, tebuconazole, triflumizole, myclobutanil, and tetraconazole) amended in vitro assays. All tested DMI fungicides strongly inhibited radial growth, but did not prevent conidial germination. The strobilurin fungicides inhibited the conidial germination of the wild type I and its selected isolate, but not of the other wild type II. Only pyraclostrobin inhibited mycelial growth and conidial germination of both wild types within the label use rates. However, the germination tube length was reduced by all tested strobilurin fungicides.



A: In vitro assay to determine the radial growth of *C.ps*. isolates on fungicide amended media with different concentrations. B: Non-germinated conidia of *C.ps*. wild type I on pyraclostrobin amended media. C: Germination of wild type I spores on unamended media.

Further experiments to analyze differences in pathogenicity of these isolates in vivo are being conducted. Previous studies showed the effectiveness of pyraclostrobin and propiconazole against boxwood blight. Therefore, detached leaf assays with these two fungicides were performed. Leaves of the varieties Green Velvet, Green Mound and Green Mountain were sterilized and dipped for 5 seconds in fungicide solution with the concentration of 0.3 µg a.i./ml, 1 µg a.i./ml, and 3 µg a.i./ml. Leaves were infected with one drop of conidial suspension (around 400-500 conidia/drop) each of wild type and the selected isolates. Symptoms and sporulation were analyzed weekly. The infection and sporulation rate of the wild type I was very high. The selected isolates showed less infection and sporulation on propiconazole treated leaves at the concentration of 3 µg a.i./ml. No differences between the boxwood varieties were observed. Only a few untreated (control) as well as fungicide treated leaves showed symptoms by the wild type II, which is why we assumed that the isolate lost pathogenicity during culturing. More repetitions at higher concentrations have to be conducted. However, this study with these three isolates demonstrates that reduced fungicide sensitivity in *C.ps.* can be selected for in vitro and that reduced strobilurin sensitivity can also occur naturally in pathogenic isolates in the landscape.



Detached leaf assay: Leaves were infected with 400-500 conidia. Symptoms included brown leaf spots resulting in defoliation. Sporulation can be observed under the microscope (two right pictures).

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

- Because of the high application of fungicides to control boxwood blight, the likelihood of the development of resistance is great.
- The knowledge of fungicide insensitivity is important to develop an effective spray program and to avoid fungicide resistance development.
- For effective control of mycelial growth as well as conidial germination, and to reduce the risk of resistance development, growers are using fungicides with multiple active ingredients from different mode-of-action groups in mixture and rotating usage.

***Pachysandra* species and cultivar susceptibility to the boxwood blight pathogen**

At CAES-Windsor, we have conducted research in response to questions regarding potential differences in susceptibility in *Pachysandra* species and cultivars to the boxwood blight pathogen *Calonectria pseudonaviculata*. We used whole plants and detached leaf assays to evaluate differences in disease severity that occurred on five cultivars of *P. terminalis*, one cultivar of *P. axillaris*, and one selection of *P. procumbens*. The tested *Pachysandra* species and cultivars were susceptible to the pathogen although there were differences in the numbers of lesions that developed between the plants tested; those differences were more apparent with whole plants than with the detached leaf assays. Best Management Practices to manage disease and prevent additional spread of the pathogen in nurseries, garden centers and landscapes will need to take into account that all of the *Pachysandra* species and cultivars that we evaluated may serve as inoculum reservoirs for the boxwood blight pathogen.

Boxwood Blight Fungicide Efficacy

Orkestra Intrinsic™ fungicide is a new broad-spectrum active ingredient under development by BASF. Dr. LaMondia conducted trials on three- to four-year-old 'Green Velvet' and 'Tide Hill' boxwood plants in no. 1 containers for efficacy against the fungus that causes boxwood blight. The fungicide applications were applied as a foliar spray to runoff using a Solo backpack sprayer at 30-35 psi with an adjustable hollow cone nozzle on 15 Jun, 6 Jul, and 26 Jul 2016 in the outdoor container nursery production area. Plants were moved to a plastic-covered hoop-house and inoculated with 4.0×10^5 conidia per plant on 16 Jun, 3.0×10^5 on 8 Jul, and 2.5×10^6 conidia per plant on 29 Jul using a hand-held mist sprayer. Plants were moved back to the nursery area after 4 d. Maximum daily temperature for Experiment 1 ranged from 69 to 99 F, with a mean of 87.7 and minimum temperatures ranged from 51 to 72 F, averaging 61.9 F. There were 23 days with precipitation totaling 3.9 in. Plants were irrigated with overhead sprinklers twice per day, morning and afternoon, delivering an additional approximately 0.7 in. of water daily. Disease

was assessed by counting numbers of dropped leaves and typical boxwood blight lesions on newly produced leaves, older mature leaves and stems on 10 Aug. The experiment was repeated (Experiment 2) as described above with the fungicide applications made on 6 Jul, 26 Jul, and 17 Aug 2016. Plants were inoculated with 9.0×10^5 conidia on 8 Jul, and 2.5×10^6 conidia per plant on 29 Jul, respectively. Maximum daily temperature for Experiment 2 ranged from 69 to 99 F, with a mean of 88.5 and minimum temperatures ranged from 52 to 73 F, averaging 64.5 F. There were 24 days with precipitation totaling 5.8 in. Plants were irrigated with overhead sprinklers twice per day, morning and afternoon, delivering an additional approximately 0.7 in. of water daily. Disease was assessed on 24 Aug. For both experiments, all treatments reduced infection significantly compared to the untreated controls, and the fungicides and the different rates of fungicide were not significantly different from each other. Disease control averaged over all fungicides resulted in excellent control, generally greater than 95%. Tide Hill boxwoods in Experiment 2 had less disease than the Green Velvet plants in Experiment 1. Tide Hill had previously been shown to be less susceptible to boxwood blight than Green Velvet. No symptoms of phytotoxicity were observed on the fungicide-treated plants.

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

Boxwood blight viability after exposure to fungicides

The boxwood blight pathogen, *Calonectria pseudonaviculata (C.ps.)*, can be affected by low rates of fungicides in tests in artificial media, however, management of disease on infected plants can be difficult. We investigated the sensitivity of microsclerotia (MS) survival structures to efficacious fungicides. Melanized MS were removed from media, washed for 30 s in sterile water and soaked in 5 ml of 0, 3.16, 10.0, 31.6, 100, or 316 ppm of kresoxim-methyl, thiophanate-methyl or propiconazole fungicides for 24, 48, 72, or 96 h. After exposure, MS were washed three times with sterile water, blotted and placed on growth media. Viability (germination) and colony diameter were measured after one week, and growth from exposed MS was normalized by the 0 ppm control. Thiophanate-methyl did not affect MS viability or colony diameter after any concentration or time combination. Kresoxim-methyl reduced growth by 50% only after MS exposure to 316 ppm for $\geq$ 72 h. Propiconazole affected both survival and subsequent colony diameter. Few MS survived exposure to 100 ppm for $\geq$ 48 h or 316 ppm for $\geq$ 24 h. A multiple regression model predicted 50% colony diameter reduction after 30 h in 10 ppm, 14 h in 31.6 ppm, or any exposure to $\geq$ 100 ppm propiconazole. The melanized MS of *Cps* exhibit increased survival after exposure to fungicides toxic to hyphae. However, propiconazole can effectively reduce viability and subsequent colony growth at concentrations within use rates.

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 is the most economical, environmentally responsible, and often most effective way to control diseases. The development of plant resistance to Tobacco Mosaic Virus (TMV) in the 1950s, to ozone damage (weather fleck) in the 1960s, black shank in the 1970s, and Fusarium wilt in the 1980s and early 1990s effectively controlled serious diseases which each threatened to seriously impact or even wipe out cigar wrapper tobacco production in the Connecticut River Valley. There are currently a number of pathogens that threaten the crop. Dr. LaMondia conducts an ongoing breeding program to develop resistance to: *Fusarium oxysporum* (causing Fusarium wilt); *Globodera tabacum* (the tobacco cyst nematode); tobacco mosaic virus, and *Peronospora tabacina* (blue mold) for both shade and broadleaf types. Recently, a male-sterile F1 hybrid ‘B2’ highly resistant to Fusarium wilt, TMV and the TCN and with moderate resistance to blue mold and black root

rot was released and licensed. Black shank, caused by *Phytophthora nicotianae*, has re-emerged as a serious pathogen in Connecticut and we are working to develop a hybrid line with significant resistance to the pathogen. Our first candidate line, B3, was evaluated under field conditions in 2014 and 2015 and, while resistant, was found to be lacking in sufficient wrapper leaf quality. Additional crosses are now being made. Black root rot, caused by the fungus *Thielaviopsis basicola*, has been damaging and increasing in impact in recent years with cool wet springs. We obtained three sources of dark wrapper tobacco with high levels of black root rot resistance from cooperating scientists in Kentucky. A back-cross program is being used to transfer resistance to CT broadleaf, and resistant plants are being selected for broadleaf characteristics. Inbreds have been developed and have been used to develop hybrid lines with resistance to multiple pathogens. Two of these lines are being evaluated under commercial conditions and one has been licensed with a company for commercial seed production. Breeding for resistance to Potato Virus Y (PVY) has been a high priority, however, the burley tobacco cultivar (TN-86) that is the commercial source of resistance to Potato Virus Y (PVY) has been evaluated and found not to be resistant to the new PVY strains that occur in potato, tobacco, and other solanaceous crops. No source of resistance to the new strains is currently known, so this objective has been put on hold.

Impacts:

- C9 tobacco carries resistance to Fusarium wilt and TMV. It has been widely grown since its release (> 80% of acreage) and has prevented more than $5 million in losses each year since 1992.
- The development of a male-sterile hybrid broadleaf cigar wrapper tobacco with resistance to most of the major pathogens, including Fusarium wilt, TMV, the TCN and blue mold, will allow sustainable production with reduced disease and much reduced pesticide inputs. Growing B2 eliminates the need for nematode management at over $500 per acre.
- B2 has been released as a new cultivar and licensed to a local company. Proceeds will support further research on plant resistance. Adding resistance to black root rot will further reduce plant losses to disease.

Tobacco Cyst Nematode Management

Trap crops are being developed for nonchemical control of cyst nematodes. A solanaceous weed, sticky nightshade (*Solanum sisymbriifolium*) is being evaluated to control potato cyst nematodes *Globodera pallida*. Because of the difficulties in working with this regulated pathogen in the United States, Dr. LaMondia is cooperating with scientists from Idaho to conduct experiments with the closely related tobacco cyst nematode *G. tabacum* as a model system. The influence of broadleaf cigar wrapper tobacco (*Nicotiana tabacum*), eastern black nightshade (*Solanum ptychanthum*), and sticky nightshade (*Solanum sisymbriifolium*) on egg hatch and subsequent development of the tobacco cyst nematode, *Globodera tabacum*, was investigated in field microplots over two years. Sixty-five microplots 1-m-diam., naturally infested with various densities of TCN, were transplanted with nematode-susceptible shade tobacco (cv. '8212' in 2015, and 'O-40' in 2016), nematode-resistant broadleaf tobacco cv. 'B2', or Litchi tomato. In 2016, treatments were expanded to include eastern black nightshade and a cultivated fallow. TCN densities were determined before planting and again after harvest by sampling each microplot with 10 cores 1.5-cm-d to 15-cm depth. Soil was dried and extracted using a modified Fenwick can. Cysts were crushed and the number of viable encysted J2 per cm^3 soil determined. Nematode reproduction as determined by the ratio of the final (Pf) to initial (Pi) populations varied between treatments. In 2015, Pf/Pi ratios were 2.89, 0.38 and 0.14 for susceptible tobacco, resistant tobacco and Litchi tomato, respectively. All three plants were significantly different from each other. In 2016, Pf/Pi ratios were highest for eastern black nightshade (6.64) and susceptible tobacco (2.84), which were different from fallow (0.56), resistant B2 tobacco (0.32) and Litchi tomato (0.20). These results are consistent with previous research that Litchi tomato, *S. sisymbriifolium*, stimulates tobacco cyst nematode hatch better than resistant or susceptible tobacco but unlike eastern black nightshade, does not allow significant nematode 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.

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.

Reduced Pesticide Residues in Tobacco

Connecticut shade and broadleaf tobacco types are used to produce some of the highest quality cigar wrappers in the world. Blue mold, caused by *Peronospora tabacina*, is a leaf spot disease that can destroy the crop, valued at up to $50,000,000 per year. Fungicides can help protect the leaves, but growers and cigar makers want to keep residues low. Dr. LaMondia conducted experiments to maximize disease control with reduced levels of fungicide in cured leaves in 2016. The strategy tested investigated the effects of using azoxystrobin, dimethomorph, mandipropamid, or fluopicolide fungicides early in the season and avoiding or minimizing sprays prior to harvest as opposed to the standard application of the same total amount of fungicide spread out over the season. Leaves were harvested, cured and fungicide residues determined by Dr. Brian Eitzer of the Department of Analytical Chemistry. Our results indicated that fungicide concentrations were stable in the plant and may have more systemic activity than thought.

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

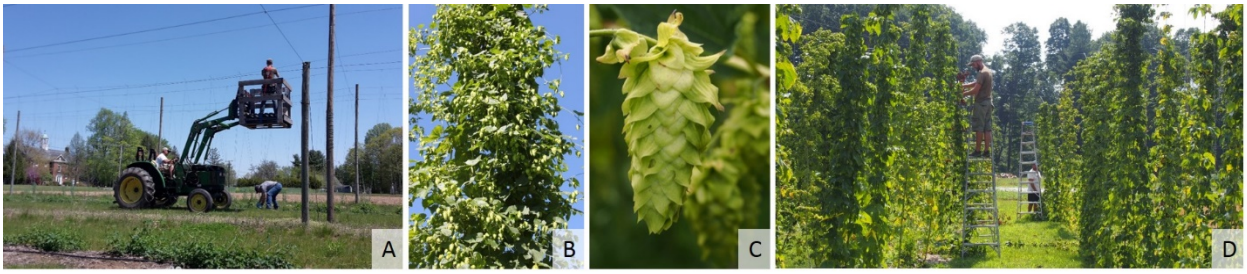
Hops Research

Hop (*Humulus lupulus*) cultivation in the Northeastern United States dates back to the first settlers, but disappeared for a century because of disease pressure and the enactment of Prohibition. Subsequently, it was established in the Pacific Northwest, with the biggest production area worldwide (50,857 acres; IHGC - 2016 Statistical Report).

Yellow Lupulin glands of female hop cones contain resins, acids, and essential oils, which are responsible for aroma, flavor, and bitterness in beer.

New York State has the largest production area in the Northeast (400 acres, Steve Miller) followed by Vermont (25 acres; IHGC - 2016 Statistical Report) and Maine (24 acres). Commercial hop production has just started in CT (15 acres). The increasing popularity of the microbrew culture, local brewpubs, home brewing, and the growing demand for regional products have created a niche market for high quality hops in the Northeast.

The objective of this project, which is supervised by Dr. James LaMondia and Dr. Katja Maurer, is to investigate the feasibility of hop production in CT. Therefore, we examined growing characteristics and susceptibility to diseases and pests for five varieties using high and low trellis systems in two locations—the Valley Laboratory in Windsor and Lockwood Farm in Hamden—over the last 4 years. The most common diseases and pests are downy mildew, which is the most damaging disease in the northeastern U.S., two-spotted spider mites, and potato leafhoppers. Diseases and pests can be control by intensive scouting and rigorous sanitation measures. Spraying pesticides, using biological control measures (e.g., predators), removing weeds, and stripping the lower leaves helps to reduce the spread of diseases and pests. We have established a region-specific integrated pest management program, which includes intensive scouting and timely control measures.



(A) In the spring, the crew prepares the hop yard, trains bines on twine and prunes. (B) Hop bines can climb more than 20 feet. During the season the hops are fertilized, irrigated, scouted for diseases and pests and treated. (C) Female mature cones are harvested from mid-August to the beginning of September. (D) The crew cuts bines to bring them to the shed and hand picks the cones, which are weighed to determine yield, dried and shipped to a laboratory for quality analysis.

The varieties Cascade and Summit are well suited for CT, and the high trellis set up is more reliable except for the semi-dwarf variety Summit. Perle, a German breeding line, had the smallest growth and lowest yield. AlphAroma, moderately resistant in other areas, was highly susceptible to downy mildew. Hop plants at Lockwood Farm produced more cones than plants at the Valley Laboratory. In 2016, the yields of all varieties at Lockwood Farm were in the range or higher than it is described. The varieties Cascade and Newport had the highest yields at both locations. Analysis of alpha acids, beta acids and hop storage index (HSI) showed that we were able to produce high quality hops.

In conclusion, the trial has proven the general feasibility of successful hop production in CT, but not all varieties do well. More varieties will be tested in the coming years. Therefore, 23 more varieties were planted at Lockwood Farm in 2016, in total 46 varieties over the last 4 years, and 10 more varieties were planted in Windsor. Preliminary results lead to the conclusion that the varieties Zeus (CTZ) and Super Alpha are highly susceptible to downy mildew. Brewer's Gold, Chinook, Comet, and Southern Brewer seem to be promising candidates, but more research has to be done.

Impacts: Assessment of different cultivars in terms of their growth, yield, and disease/pest development will lead to a better understanding of successful hop cultivation in Connecticut.

- The general feasibility of successful high quality hop production in CT has been proven.
- Hops varieties differ in yields, growth characteristics, quality, and susceptibility to downy mildew. Not every variety does well in CT.
- Downy mildew, spider mites, and potato leafhoppers, which are the most dreaded disease and pests, can be controlled with a rigorous pest management.
- Drs. Maurer and LaMondia created an Integrated Pest Management Guideline for CT.

VALLEY LABORATORY SERVICE ACTIVITIES

Requests for Information

A total of 5,245 inquiries were answered at the Valley Laboratory during the past year. The majority of these queries were answered by Ms. Rose Hiskes (64%) in the inquiry office (60% of these from the public sector, 32% commercial) or by Dr. LaMondia (20% of inquiries; 90% of which were commercial). About 48% 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 (52%). The majority of

inquiries answered by Ms. Hiskes concerned insects (33%), diseases (18%), pesticides (14%) or horticulture (11%). Most concerned landscape and nursery (53%), vegetable (7%) and structural entomology (9%). Dr. LaMondia responded to disease (52%), horticulture (25%), insect (5%), fertility (4%), pesticide (4%), weed (1%) and animal (1%) inquiries. These inquiries primarily concerned tobacco (41%), hops (20%), nursery and landscape (15%), vegetables (8%), fruit (5%), golf turf (6%) and Christmas trees (2%). All scientists and many of the staff at the Valley Laboratory assist growers and homeowners.

Valley Laboratory scientists made 106 presentations to grower, professional and citizen groups (over 7,000 people), were interviewed 23 times and made 233 visits to commercial nurseries, greenhouses, farms, forests and landscapes to diagnose complex problems or conduct research projects. Dr. LaMondia maintained the Connecticut River Valley Blue Mold Web Site to keep growers current with the disease in North America, and management options. His laboratory conducted 148 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 5,708 soil tests were expertly performed by Ms. Diane Riddle during the past year. About 66% were performed for commercial growers and 33% for homeowners. Of the commercial samples submitted, 70% were for landscapers; 7% for tobacco growers; 7% for vegetable growers, 5% for municipalities, 2% for golf course superintendents; 2% for nursery growers; 1% for small fruit, 1% for Christmas tree growers, and 4% for research.

Figure 1. Gypsy moth caterpillars dead from a fungus and a virus. ©CAES Rose Hiskes

Valley Lab Information Office Insect, Disease and Plant Health Survey

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

Insects

During the spring and summer months, insect pests, such as gypsy moth caterpillars, Norway shoot gall midge, borers and chinch bugs affected trees, shrubs and flowers in landscapes and lawns. As of late June 2017, the heavy infestation of gypsy moth caterpillars began dying from the fungus *Entomophaga maimaiga* and nucleopolyhedrosis virus (Figure 1). Rains in May and June were sufficient to build up the fungus population

and keep infection cycles going in the caterpillars. Though some large oak trees in Eastern Connecticut did die this year, next year we should have a much lower population of gypsy moth. Two gypsy moth caterpillar parasites were observed in the state over the last year. In late August, an egg parasite was observed in egg masses. In late June a wasp, probably a braconid, was observed parasitizing gypsy moth caterpillars in Tolland. White cocoons, like those frequently seen on tomato hornworms, were observed attached to caterpillars.

The Norway spruce shoot gall midge, *Piceacecis abietiperda*, continues to attack Norway spruce with resulting branch tip dieback. This cecidomyid fly deposits eggs in bud scales or on twigs where larvae burrow into the stem tissue causing swelling and bending of twigs. Galls are produced individually, not communally, as is done by the spruce gall adelgids. When galls are found at the base of the current season's growth, this insect can be confused with the eastern spruce gall adelgid. Repeated death of growing tips can seriously injure and disfigure trees, eventually causing death. Research is needed on possible management methods for this pest.

Ambrosia beetles killed Styrax trees for a number of Connecticut citizens over the last several years. *Styrax japonica* is listed as a host for *Xylosandrus germanica* and *Xylosandrus crassiusculus*, the granulate ambrosia beetle. These beetles will attack stressed and healthy trees. The fungi they bring with them can clog the plant's vascular system and cause wilting and plant death.

The very hot, dry summer caused problems in home lawns that could not be irrigated. Chinch bugs attacked many lawns in sunny areas causing large dead patches. Endophytic perennial rye and fescue grasses containing fungi that produce entomopathogenic alkaloids can help manage chinch bug infestations.

Many homeowners want to grow their own tree fruit. This year for the first time a pear sample was received where the leaf edges were curling up and maggots were found inside (Figure 2). However, only a few of the leaves at the canopy edges were affected. This cecidomyid fly overwinters in the ground as a pupa. As leaves emerge on pear it emerges as an adult, mates and begins laying eggs on unfolding foliage. Maggot feeding on leaves causes the margins to curl upward parallel to the midrib, becoming reddish and swollen in the process. Pear midge is not a serious pest in Connecticut (Mary Concklin, personal communication).

Figure 2. Leaf curling pear midge damage. ©CAES, Rose Hiskes

Structural and human insect pests continue to create problems for Connecticut citizens. Because of excessive temperatures outside in the summer of 2016, many click and ground beetles, along with root weevils found their way into homes to find cooler more humid environments. Blacklegged ticks were very problematic in the spring having survived our mild winter weather. The percentage of tick inquiries from this office went up from 1% last year to 1.5% in the 2016-2017 year.

Connecticut has a new pollinator law that took effect in 2017. Homeowners will no longer be able to buy some neonicotinoid insecticides that may harm pollinators. There are many homeowner products that contain imidacloprid and dinotefuran. One neonicotinoid, acetamiprid, is around 3,000 times less toxic to honey bees than imidacloprid. One homeowner product with acetamiprid and flowers, vegetables and fruits on the label did come out this season. Homeowners can protect pollinators from insecticide poisoning by applying insecticides only to plants that are not

frequented by bees. If a systemic insecticide is necessary on a plant bees frequent, apply it after bloom, using a short residual product. Also, applying the least toxic neonicotinoid, acetamiprid; or using alternative products such as horticultural oils, bacterial products like Thuricide, or spinosad can provide insect control while protecting pollinators (Use of Neonicotinoids in the Home Landscape, Dr. Richard Cowles).

Diseases

Homeowners bring in many samples with lichens on plant stems. Lichens are a combination of algae and fungus that use plant surfaces as a place to grow. They are not plant pathogenic. When the host plant begins to decline due to other factors, such as disease or insect attack, increased sunlight reaching the lichen causes it to grow more, increasing in size and taking over more area. This causes the homeowner to believe that lichen is causing the plant to decline.

Vegetables such as tomato and squash have disease problems. Given the many cultivars of tomato and how widely they are grown, each year many foliar and vascular diseases are brought into the office. *Septoria* and bacterial wilt have been seen already in the summer of 2017. Squash leaves were brought in with suspected powdery mildew. The zucchini plant had silvery areas on the leaves that were not powdery mildew and just normal leaf coloring.

Figure 3. Sirococcus tip blight damage to a hemlock hedge.
Photo by Richard Vocke

Evergreens such as white pine and spruce continue to suffer needle loss but at a lower rate. *Septorioides*, a new fungus, discovered in New Hampshire by Forest Service personnel, continues to be found in white pines in Connecticut. Second year needles are cast six months early, causing trees to produce fewer carbohydrate reserves. White, blue, and Norway spruces have had *Rhizosphaera* needlecast. *Sirococcus* tip blight was found on a hemlock from Wethersfield (Figure 3). No management practices have been tested for effectiveness as this disease is mainly known from forest settings. Umbrella pines, including the one in the landscape at the Valley Lab, continue to suffer branch dieback. As Maskell scale can attack *Sciadopytis*, this was thought to be the cause for a number of years. Closer inspection has shown scales are not the cause. Many attempts at getting samples and incubating them have not resolved this issue. Research is needed to solve this landscape problem.

Our state flower, the mountain laurel, has significant fungal leaf spot issues. Many samples come in with Cercospora leaf blight. Can a disease resistant mountain laurel be bred in our state? In talking with a Connecticut nursery that specializes in mountain laurels, they suggest that varieties with thick, waxier leaves show less leaf spot in their growing fields. Cultivars such as ‘Nathan Hale’ and ‘Yankee Doodle’ may get less leaf spot, especially if grown in open, sunny areas.

Hops are a new crop being grown commercially in the state. Downy mildew is the most common and important disease and was diagnosed from a number of samples. Leafhoppers also caused a hopper burn symptom on leaves and stunted plants.

While dry weather reduced foliar diseases on golf course turf, we received increased numbers of plant parasitic nematode diagnostic samples from greens with damaged turf. Stunt, lance and cyst nematodes were observed to be above damaging levels in many instances.

Weeds and Herbicides

An exotic grass from Eurasia, bulbous bluegrass, is a perennial weed in some Connecticut lawns. It grows through the winter months and dies back during the summer months. The seed head consists of small bulbs that fall to the ground and germinate in the fall.

Homeowners with older lawns bring in samples with what appears to be dead patches. On closer inspection, yellow stalks are seen with a bit of green at the top. Colonial bent grass was a weed in older grass seed mixes. As with other bent grasses, it does not do well when mowed high. Mesotrione is now available to homeowners and landscapers for management of bent grass.

A new herbicide product with four active ingredients is also now available to homeowners. It contains dicamba, which can be volatile and move offsite through air or soil movement. This active ingredient has injured soybeans in the Midwest and caused yield loss.

Plant Health - Weather

The NOAA Drought Monitor shows Connecticut is no longer in a drought. Plentiful rains in April and May made for extended periods of bloom in crabapples, azaleas, rhododendrons and mountain laurels. It also made for higher incidence of leaf spot in those plants that show symptoms early such as crabapples and other tree fruits. As mentioned in the insect section above, sufficient rains in May and June allowed for fungal control of gypsy moth caterpillars.

The winter of 2016-2017 had no drastic temperature swings and little snowfall so there was little winter injury in the spring. The end of February was very warm and it seemed spring would again be early. However, March was significantly colder and so most planting of annual flowers and vegetables was delayed relative to last year.

Impact: 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, 16 different groups used the room on 50 occasions. Our most frequent users were the Connecticut Rhododendron Society, Connecticut Invasive Plants Working Group, Connecticut Farmland Trust, Connecticut Council for Soil & Water Conservation, Land Trust Alliance, CT Native Plant Pollinator & Wildlife Working Group, CT Department of Agriculture, CT Farm Bureau, CT Hops Growers Association, Nursery Landscape Research Group, CT Agricultural Information Council, Invasive Plant Council, CT Vineyard & Winery, West Hartford Farmers' Market, and the CT Tree Protective Association. Ms. Jane Canepa-Morrison scheduled the meetings and James Preste and Isaac Buabeng arranged the furniture and ensured that the room was available after hours.

Annual Tobacco Research Meeting

One hundred and twenty people attended the Connecticut Agricultural Experiment Station's annual Tobacco Research Meeting held at the East Windsor Scout Hall on February 21, 2017. Dr. Jim LaMondia welcomed growers and spoke about recent developments at the Experiment Station. The meeting addressed a wide variety of issues of concern to growers. Jim LaMondia spoke about management of tobacco pathogens including Fusarium wilt, poty viruses, black shank, target spot, cyst nematodes and blue mold and presented strategies to reduce pesticide residues in broadleaf and shade tobacco wrapper leaves while managing fungicide resistance. He provided an overview of the breeding program with the objective of incorporating plant resistance to pathogens through traditional breeding techniques. Thomas Rathier spoke about the effects of cultural practices, the environment and weather events on soils, soil microbes and tobacco growth. Christina Berger of the CT DEEP gave growers an update on EPA Worker Protection training changes and licensing. Andrew Urbanowicz, Dave Arnold and Paul Polek presented an update on the Connecticut-Massachusetts Tobacco Growers Association. Colleen Kisselburgh discussed tobacco insurance program changes and Martha Dorsey of the Farm Services Administration provided updates on FSA services to growers. Jane Canepa-Morrison, Jim Preste, and Nathaniel Child assisted with much of the behind the scenes work for the meeting. The meeting qualified for pesticide applicator recertification credit in Connecticut and Massachusetts and 67 persons received credit.

SCIENTIFIC JOURNAL ARTICLES PUBLISHED BY STAFF DURING 2016-2017

Anderson, J. F., **F. J. Ferrandino**, **M. P. Vasil**, R. H. Bedoukian, M. Maher, and K. McKenzie. 2017. Relatively small quantities of CO_2, ammonium bicarbonate, and a blend of (E)-2-hexenal plus (E)-2-octenal attract bed bugs (Hemiptera: Cimicidae). *J. Med. Entomol.* 54:362-367.

Armstrong, P. M., **T. G. Andreadis**, **J. J. Shepard**, and **M. C. Thomas**. 2017. Northern range expansion of the Asian tiger mosquito (*Aedes albopictus*): Analysis of mosquito data from Connecticut USA. *PLoS Negl. Trop. Dis.* 11(5): e0005623.

Brackney, D. E. and **P. M. Armstrong**. 2016. Transmission and evolution of tick-borne viruses. *Curr. Opin. Virol.* 21:67-74.

Brackney, D. E. 2017. Implications of autophagy on arbovirus infection of mosquitoes. *Curr. Opin. Insect Sci*. 22:1-6.

Cahill, M. E., Y. Yao, D. Nock, **P. M. Armstrong**, **T. G. Andreadis**, M. A. Diuk-Wasser, and R. R. Montgomery. 2017. West Nile virus seroprevalence, Connecticut, USA, 2000-2014. *Emerg. Infect. Dis.* 23(4):708-710.

Cai, F., X. Shen, M. Zhang, W. Chen, Q. Gao, **J. C. White**, S. Tao, and X. Wang. 2017. Impact of TiO_2 nanoparticles on lead uptake and bioaccumulation in rice (*Orza sativa* L.). *NanoImpact* 5:101-108.

Cheah, C.A.S.-J. 2016. Potential biological control of armored scales in Christmas tree plantations. *The Real Tree Line* 56(3), Summer 2016, pp. 10, 18.

Cheah, C.A.S.-J. 2017. Climate change impacts in the Northeast on HWA and its coccinellid predator from Japan, *Sasajiscymnus tsugae*. Abstract for an oral presentation at the 2017 NorthEast Natural History Conference, April 22-23, 2017, Cromwell, CT. Available online at: https://www.eaglehill.us/NENHC_2017/program/NENHC2017-oral-abstracts.pdf

Cheah, C.A.S.-J. 2017. Predicting winter mortality of hemlock woolly adelgid in Connecticut by climatic divisions. *Northeast. Nat.* Vol. 24, Special Issue 7, 2017 B90-118.

Cheah, C.A.S.-J. 2017. Update on ongoing hemlock research at Steep Rock. *The Steep Rock Vista* Winter 2016-2017, p. 4.

Covey, K. R., C. P. Bueno de Mesquita, B. Oberle, D. S. Maynard, C. Bettigole, T. W. Crowther, M. C. Duguid, **B. Steven**, A. E. Zanne, M. Lapin, M. S. Ashton, C. D. Oliver, X. Lee, M. A. Bradford. 2016. Greenhouse trace gases in deadwood. *Biogeochemistry* 130:215-226.

Cowles, R. S. 2017. When do we need to consider alternatives to neonics? 2017 Proceedings of the 62nd NJ Agricultural Convention and Trade Show, pp. 109-112.

Cowles, R. S. and **B. D. Eitzer**. 2017. Residues of neonicotinoid insecticides in pollen and nectar from model plants. *J. Environ. Hort.* 35(1):24-34.

Deng, Y., **B. D. Eitzer**, **J. C. White**, and B. Xing. 2016. Impact of multiwall carbon nanotubes on the accumulation and distribution of carbamazepine in collard greens (*Brassica oleracea*). *ES: Nano* 4:149-159.

Deng, R., D. Lin, L. Zhu, **S. Majumdar**, **J. C. White**, J. L. Gardea-Torresdey, and B. Xing. 2017. Nanoparticle interactions with co-existing contaminants: Joint toxicity, bioaccumulation and risk. *Nanotoxicology* http://dx.doi.org/10.1080/17435390.2017.1343404

Duzy, L. M., A. J. Price, K. S. Balkcom, and **J. S. Aulakh**. 2016. Assessing the economic impact of inversion tillage, cover crops, and herbicide regimes in Palmer amaranth (*Amaranthus palmeri*) infested cotton. *Int. J. Agron.* https://www.hindawi.com/journals/ija/2016/1524389/

Eevers, N., **J. C. White**, N. Weyens, and J. Vangronsveld. 2017. Bio- and phytoremediation of pesticide contaminated environments: A review. *Adv. Botan. Sci*. http://dx.doi.org/10.1016/bs.abr.2017.01.001

Elmer, W. H. 2016. Influence of biochar, earthworms and leaf mold mulch on root health, mycorrhizal colonization and yield of asparagus. *Plant Dis.* 100:2507-2512.

Elmer, W. H. 2017. Improving plant disease resistance: can nanoparticles deliver? *Scientia* http://www.scientia.global/dr-wade-h-elmer-improving-plant-disease-resistance-can-nanoparticles-deliver/

Elmer, W. H. and **J. C. White**. 2016. The use of metallic oxide nanoparticles to enhance growth of tomatoes and eggplants in disease infested soil or soilless medium. *Environ. Sci.: Nano* 3:1072-1079.

Elmer, W. H., **P. Thiel**, and **B. Steven**. 2017. Response of sediment bacterial communities to Sudden Vegetation Dieback in a coastal wetland. *Phytobiome* (http://apsjournals.apsnet.org/doi/full/10.1094/PBIOMES-09-16-0006-R)

Fauver, J. R., N. D. Grubaugh, B. J. Krajacich, J. Weger-Lucarelli, S. M. Lakin, L. S. Fakoli, F. K. Bolay, J. W. Diclaro, K. R. Dabiré, B. D. Foy, **D. E. Brackney**, G. D. Ebel, and M. D. Stenglein. 2016. West African *Anopheles gambiae* mosquitoes harbor a taxonomically diverse virome including new insect-specific flaviviruses, mononegaviruses, and totiviruses. *Virology* 498:288-299.

Fauver, J. R., A. Gendernalik, J. Weger-Lucarelli, N. D. Grubaugh, **D. E. Brackney**, B. D. Foy, and G. D. Ebel. 2017. The use of xenosurveillance to detect human bacteria, parasites and viruses in mosquito bloodmeals. *Am. J. Trop. Med. Hyg*. May. doi.org/10.4269/ajtmh.17-0063

Gent, M. P. N. 2016. Effect of temperature on composition of hydroponic lettuce. *Acta Hortic.* 1123:95-100.

Gent, M. P. N. and I. Seginer. 2016. Dynamic carbohydrate supply and demand model of vegetative growth. *Acta Hortic.* 1154:73-81.

Graney, L., **W. H. Elmer**, and A. L. Loyd. 2017. First report of Fusarium wilt of yellowwood (*Cladrastis kentukea*) caused by *Fusarium oxysporum* in the United States. *Plant Dis.* 101:258.

Grubaugh, N. D., C. Rückert, **P. M. Armstrong**, **A. Bransfield**, **J. F. Anderson**, G. D. Ebel, and **D. E. Brackney**. 2016. Transmission bottlenecks and RNAi collectively influence Powassan virus evolution. *Virus Evol.* 2(2):vew033.

Grubaugh, N. D., J. R. Fauver, C. Rückert, J. Weger-Lucarelli, S. Garcia-Luna, R. A. Murrieta, A. Gendernalik, D. R. Smith, **D. E. Brackney**, and G. D. Ebel. 2017. Mosquitoes transmit unique West Nile virus populations during each feeding episode. *Cell Rep*. 19(4):709-718.

Guo, H., B. Xing, **J. C. White**, A. Mukherjee, and L. He. 2016. Ultra-sensitive determination of silver nanoparticles by Surface-enhanced Raman Spectroscopy after hydrophobization-mediated extraction. *Analyst* 141:5261-5264.

Hsieh, H.-S. and **J. J. Pignatello**. 2017. Activated carbon mediated alkaline hydrolysis of alkyl bromides. *Appl. Catal. B: Environ.* 211:68-78.

Huang, L., Q.-C. Y. H. Li, G.-Q. Li, J.-Y. Yang, **D. W. Li**, and J.-R. Ye. 2017 *Bacillus velezensis* strain HYEB5-6 as a potential biocontrol agent against anthracnose on *Euonymus japonicus*. *Biocontrol Sci. Techn.* https://doi.org/10.1080/09583157.2017.1319910

Kelly, A., R. H. Proctor, F. Belzile, S. N. Chulze, R. M. Clear, C. Cowger, **W. H. Elmer**, T. Lee, F. Obanor, C. Waalwijk, and T. J. Ward. 2016. The geographic distribution and complex evolutionary history of the NX-2 trichothecene chemotype from *Fusarium graminearum. Fungal Genet. Biol.* 95:39-48.

Krupke, C. H., J. D. Holland, E. Y. Long, and **B. D. Eitzer**. 2017. Planting of neonicotinoid-treated maize poses risks for honey bees and other non-target organisms over a wide area without consistent crop yield benefit. *J Appl. Ecol.* doi:10.1111/1365-2664.12924.

LaMondia, J. A. 2016. Boxwood blight: identification and management. *Public Gardens: Journal of the American Public Gardens Association* 31(4):24-25.

LaMondia, J. A. 2016. Evaluation of fungicides for management of boxwood blight, 2014. *Plant Dis. Manag. Rep.* 10:O7010. http://www.plantmanagementnetwork.org/pub/trial/pdmr/reports/2016/OT010.pdf

LaMondia, J. A. 2016. Evaluation of fungicides for management of tobacco blue mold in shade-grown cigar wrapper tobacco, 2015. *Plant Dis. Manag. Rep.* 10:V105 http://www.plantmanagementnetwork.org/pub/trial/pdmr/reports/2016/V105.pdf

LaMondia, J. A. 2016. Evidence for suppression of *Meloidogyne hapla* by *Pasteuria* in Connecticut. *J. Nematol.* 48:341.

LaMondia, J. A. 2016. Susceptibility of *Buxus* accessions to the boxwood blight pathogen *Calonectria pseudonaviculata*. *Phytopathology* S4:89.

LaMondia, J. A. 2017. Connecticut River Valley blue mold web page. CAES. http://www.ctvalleytobacco.org

LaMondia, J. A. 2017. *Pachysandra* species and cultivar susceptibility to the boxwood blight pathogen, *Calonectria pseudonaviculata. Plant Health Progress* 18:41-43.

LaMondia, J. A. and **K. Maurer**. 2016. Evaluation of fungicides for management of boxwood blight, 2015. *Plant Dis. Manag. Rep.* 10:OT11 http://www.plantmanagementnetwork.org/pub/trial/pdmr/reports/2016/OT011.pdf

LaMondia, J. A. and **K. Maurer**. 2017. Evaluation of fungicides for management of boxwood blight, 2016. *Plant Dis. Manag. Rep.* 11:OT16 http://www.plantmanagementnetwork.org/pub/trial/pdmr/reports/2017/OT016.pdf

Langlois, P. A., J. Snelling, J. P. Hamilton, C. Bragard, R. Koebnik, V. Verdier, **L. R. Triplett**, J. Blom, N. A. Tisserat, and J. E. Leach. 2017. Characterization of the *Xanthomonas translucens* complex using draft genomes, comparative genomics, phylogenetic analysis, and diagnostic LAMP assays. *Phytopathology* 107:519-527.

Leach, J. E., **L. R. Triplett**, C. T. Argueso, and P. Trivedi. 2017. Communication in the phytobiome. *Cell* 169:587-596.

Li, J., H. Sang, H. Guo, G. Jung, A. Mukherjee, **J. C. White**, and B. Xing. 2017. Antifungal mechanisms of ZnO and Ag nanoparticles to *Sclerotinia homeocarpa*. *Nanotechnology* 28:15.

Li, T., G.-Q. Pan, **C. R. Vossbrinck**, J.-S. Xu, C.-F. Li, J. Chen, M.-X. Long, M. Yang, X.-F. Xu, C. Xu, B. A. Debrunner-Vossbrinck, and Z.-Y. Zhou. 2017. *Database: J. Biolog. Databases and Curation.* doi: 10.1093/database/bax001

Lin, C.-G., E. C. McKenzie, D. J. Bhat, S.-F. Ran, Y. Chen, K. D. Hyde, **D. W. Li**, and Y. Wang. 2016. *Stachybotrys*-like taxa from karst areas and a checklist of stachybotrys-like fungi of Thailand. *Mycosphere* 7(9):1273-1291. Doi 10.5943/mycosphere/7/9/3.

Lui, H., C. Ma, G. Chen, **J. C. White**, O. Parkash Dhankher, and B. Xing. 2017. Titanium dioxide nanoparticles alleviate tetracycline toxicity to *Arabidopsis thaliana*. *ACS Sustain. Chem. Eng.* *5*(4):3204-3213.

Ma, C., H. Liu, H. Guo, **C. Musante**, S. H. Coskun, B. C. Nelson, **J. C. White**, O. P. Dhankher, and B. Xing. 2016. Defense mechanisms and nutrient displacement in *Arabidopsis thaliana* upon exposure to CeO_2 and In_2O_3 nanoparticles. *ES: Nano.* 3:1369-1379.

Ma, C., H. Liu, G. Chen, Q. Zhao, **B. Eitzer**, Z. Wang, W. Cai, L. A. Newman, **J. C. White**, O. Dhankher, and B. Xing. 2017. Effects of titanium oxide nanoparticles on tetracycline accumulation and toxicity in *Oryza sativa* (L.). *Environ. Sci.: Nano*. 10.1039/C7EN00280G.

Maier, C. T. 2017. *Xiphydria prolongata* (Hymenoptera: Xiphydriidae): first North American hosts and state records for Connecticut and New York. *Great Lakes Entomol.* 49:199-201.

Marmiroli, N. and **J. C. White**. 2016. Editorial: Nanotoxicology and environmental risk assessment of engineered nanomaterials (ENMs) in plants. *Front. Plant Sci.* 7:1370.

Monteiro, T. S. A., J. A. Brito, S. J. S. Vau, W. Yuan, **J. A. LaMondia**, and D. W. Dickson. 2016. First report of endotokia matricida in *Meloidogyne hapla*: a case study. *J. Nematol.* 48:354.

Mukherjee, A., J. Hawthorne, **J. C. White**, and J. W. Kelsey. 2017. Nanoparticle Ag co-exposure reduces the accumulation of weathered persistent pesticides by earthworms. *Environ. Tox. Chem.* doi:10.1002/etc.3698.

Noori, A., **J. C. White**, and L. A. Newman. 2016. Mycorrhizal fungi influence silver uptake and membrane protein gene expression following Ag-NPs exposure. *J. Nano. Res*. 19:66.

Pagano, L., F. Pasquali, **S. Majumdar**, **R. De La Torre-Roche**, **N. Zuverza-Mena**, M. Villani, A. Zappettini, **R. Marra**, S. Isch, M. Marmiroli, E. Maestri, O. Parkash Dhankher, **J. C. White**, and N. Marmiroli. 2017. Exposure of *Cucurbita pepo* to binary combinations of engineered nanomaterials: Physiological and molecular response. *ES: Nano* 10.1039/C7EN00219J.

Pasquali, F., C. Agrimonti, L. Pagano, A. Zappettini, M. Villani, M. Marmiroli, **J. C. White**, and N. Marmiroli. 2017. Nucleo-mitochondrial interaction in yeast in response to cadmium sulfide quantum dots. *J. Hazard. Mat*. 324:744-752.

Patel, R. R., G. W. Sundin, C.-H. Yang, J. Wang, **R. B. Huntley**, Y. Yuan, and **Q. Zeng**. 2017. Exploration of using antisense peptide nucleic acid (PNA)-cell penetrating peptide (CPP) as a novel bactericide against fire blight pathogen *Erwinia amylovora*. *Frontiers in Microbiol.* 8:687.

Pignatello, J. J., W. A. Mitch, and W. Q. Xu. 2017. Activity and reactivity of pyrogenic carbonaceous matter toward organic compounds. *Environ. Sci. Technol.*, ASAP; DOI:10.1021/acs.est.7b01088.

Read, A. C., F. C. Rinaldi, M. Hutin, Y.-Q. He, **L. R. Triplett**, and A. J. Bogdanove. 2016. Suppression of *Xo1*-mediated disease resistance in rice by a truncated, non-DNA-binding TAL effector of *Xanthomonas oryzae. Front. Plant Sci.*, doi: 10.3389/fpls.2016.01516.

Rodrigues, S., N. Dokoozlian, C. O. Hendren, B. Karn, M. Mauter, O. Sadik, M. Safarpour, J. Unrine, J. Viers, **J. C. White**, M. R. Wiesner, and G. V. Lowry. 2017. Nanotechnology for sustainable food production: High value opportunities and scientific challenges. *ES: Nano* DOI: 10.1039/C6EN00573J.

Russo, N. J., **C. A. S-J. Cheah**, and M. W. Tingley. 2016. Experimental evidence for branch-to-bird transfer as a mechanism for avian dispersal of the hemlock woolly adelgid (Hemiptera: Adelgidae). *Environ. Entomol.* First published online on August 1, 2016. DOI: http://dx.doi.org/10.1093/ee/nvw083

Russo, N. J., **C. A. S-J. Cheah**, C. S. Elphick, and M. W. Tingley. 2017. Avian spring migration as a dispersal mechanism for an invasive insect pest. Abstract for an oral presentation at the 2017 NorthEast Natural History Conference, April 22-23, 2017, Cromwell, CT. Available online at: https://www.eaglehill.us/NENHC_2017/program/NENHC2017-oral-abstracts.pdf

Rutledge, C. E. and E. R. Hoebeke. 2017. *Agrilus smaragdifrons* Ganglbauer new to North America: Detection of an East Asian *Agrilus* through monitoring *Cerceris fumipennis* colonies and *Agrilus planipennis* traps. USDA FS Factsheet (unreviewed).

Scott, J. D., K. L. Clark, J. E. Foley, **J. F. Anderson**, L. A. Durden, J. M. Manord and M. L. Smith. 2017. Detection of *Borrelia* Genomospecies 2 in *Ixodes spinipalpis* ticks collected from a rabbit in Canada. *J. Parasitol.* 103:38-46.

Servin, A. D., L. Pagano, H. Castillo-Michel, **R. De La Torre-Roche**, J. Hawthorne, J. A. Hernandez-Viezcas, R. Loredo, **S. Majumdar**, J. Gardea-Torresdey, O. Parkash-Dhankher, and **J. C. White**. 2017. Weathering in soil increases nanoparticle CuO bioaccumulation within a terrestrial food chain. *Nanotoxicology* 11:98-111.

Sheele, J. M., **G. E. Ridge**, T. S. McCormick, K. Coppolino, A. B. Young, S. L. Gaines, and T. Bonfield. 2017. Antibody and cytokine levels in humans fed on by the common bed bug *Cimex lectularius* L. *Parasite Immunol.* DOI: 10.1111/pim.12411 39(3):1-5.

Shepard, J. J., **T. G. Andreadis**, **M. C. Thomas**, and **G. Molaei**. 2016. Host associations of mosquitoes at Eastern equine encephalitis virus foci in Connecticut, USA. *Parasites and Vectors* 9:474 DOI 10.1186/s13071-016-1765-1.

Shidore, T. and **L. R. Triplett**. 2017. Toxin-antitoxin systems: implications for plant disease. *Ann. Rev. Phytopath.* 55 https://doi.org/10.1146/annurev-phyto-080516-035559

Shidore, T., C. D. Broeckling, J. S. Kirkwood, J. J. Long, J. Miao, B. Zhao, J. E. Leach, and **L. R. Triplett**. 2017. The effector AvrRxo1 phosphorylates NAD *in planta*. *PLOS Pathogens* 13: e1006442.

Slack, S. M., **Q. Zeng**, C. A. Outwater, and G. W. Sundin. 2017. Microbiological examination of *Erwinia amylovora* exopolysaccharide ooze. *Phytopathology* 107:403-411.

Soghigian, J., **G. E. Ridge**, **K. C. Stafford III**, and **G. Molaei**. 2017. The first evidence of nanism in *Ixodes* (*Ixodes*) *scapularis* (Acari: Ixodidae), found parasitizing a human host. *J. Med. Ent.* 2017, 1-5 doi: 10.1093/jme/tjx111

Stafford III, K. C. and **S. C. Williams**. 2017. Deer-targeted methods: A review of the use of topical acaricides for the control of ticks on white-tailed deer. *J. Integ. Pest Mgmt.* 8(1): https://doi.org/10.1093/jipm/pmx014

Steven, B., C. Hesse, **J. Soghigian**, L. Gallegos-Graves, and J. Dunbar. 2017. Simulated rRNA/DNA ratios show potential to misclassify active populations as dormant. *Appl. Environ. Microbiol.* 83:e00696-17

Stoner, K. A. 2016. Current pesticide risk assessment protocols do not adequately address differences between honey bees (*Apis mellifera*) and bumble bees (*Bombus* spp.). *Front. Environ. Sci.* doi: 10.3389/fenvs.2016.00079.

Stoner, K. A. 2017. (excerpted by Jack Kittredge, editor). Excerpts from a citizen's guide to creating pollinator habitat in Connecticut. *The Natural Farmer*, Summer, 2017. B-22-25.

Stoner, K. A. 2017. Threats to bees – Honey bees, bumble bees and others. *The Natural Farmer*, Summer, 2017. B-3-4.

Triplett, L. R., S. P. Cohen, C. Heffelfinger, C. L. Schmidt, C. Tekete, V. Verdier, A. J. Bogdanove, and J. E. Leach. 2016. A resistance locus in the American heirloom rice variety Carolina Gold Select is triggered by diverse TAL effectors and is effective against African strains of *Xanthomonas oryzae* pv. *oryzicola*. *Plant Journal* 87:472-483.

Triplett, L. R., **T. Shidore**, J. Long, J. Miao, S. Wu, Q. Han, C. Zhou, H. Ishihara, J. Li, B. Zhao, and J. E. Leach. 2016. AvrRxo1 is a bifunctional type III secreted effector and toxin-antitoxin system component with homologs in diverse environmental contexts. *PLOS ONE* 11: e0158856

Uchimiya, M., **J. J. Pignatello**, **J. C. White**, S. Hu, and P. J. Ferreira. 2017. Surface interactions between gold nanoparticles and biochar. *Sci. Rep.-UK*, 7:5027; doi: 10.1038/s41598-017-03916-1.

Wang, Y., J. Chen, **D. W. Li**, L. Zheng, and J. Huang. 2017. *CglCUT1* gene required for cutinase activity and pathogenicity of *Colletotrichum gloeosporioides* causing anthracnose of *Camellia oleifera*. *Eur. J. Plant Pathol.* 147(1):103-114. DOI:10.1007/s10658-016-0983-x

Ward, J. S. 2017. Twenty-five-year response of non-crop trees to partial release during precommercial crop tree management. *Forest Ecol. Manag.* 387:12-18.

Ward, J. S., **S. C. Williams**, and **M. A. Linske**. 2016. Independent effects of invasive shrubs and deer herbivory on plant community dynamics. *Forests* 8(2):1-18.

Ward, J. S., T. E. Worthley, T. J. Degnan, and **J. P. Barsky**. 2017. STORMWISE: Integrating arboriculture and silviculture to create storm resilient roadside forests. P. 119-132 In *Proceedings 20th Central Hardwood Conference*. USDA Forest Service General Technical Report NRS-P-167. 313 p.

Wu, B., J. R. Ye, L. Huang, L. M. He, and **D. W. Li**. 2016. Validation of reference genes for RT-qPCR analysis in *Burkholderia pyrrocinia* JK-SH0072017. *J. Microbiol. Meth.* 132(1):95-98. http://dx.doi.org/10.1016/j.mimet.2016.10.004

Xu, J., Q. He, Z. Ma, T. Li, X. Zhang, B. A Debrunner-Vossbrinck, and **C. R. Vossbrinck**. 2016. The genome of *Nosema* sp. isolate YNPr: A comparative analysis of genome evolution within the Nosema/Vairimorpha clade. *PloS One* 11(9), e0162336.

Yang, J., **J. J. Pignatello**, B. Pan, and B. Xing. 2017. Degradation of *p*-nitrophenol by lignin and cellulose chars: H_2O_2-mediated reaction and direct reaction with the char. *Environ. Sci. Technol.*, ASAP; DOI: 10.1021/acs.est.7b01087.

Yue, L., **C. Ma**, X. Zhan, **J. C. White**, and B. Xing. 2017. Molecular mechanisms of maize seedling response to La_2O_3 NPs exposure: water uptake, aquaporin gene expression and signal transduction. *ES: Nano* DOI: 10.1039/c6en00487c.

Zeng, Q. 2017. Fire blight and streptomycin resistance (2017) Northeast IPM Center Outreach Webcast, *Plant Management Network* https://www.plantmanagementnetwork.org/edcenter/seminars/outreach/Apple/FireBlight/

Zhang, Y., **J. J. Pignatello**, and S. Tao. 2016. Bioaccessibility of nitro- and oxy-PAHs in fuel soot assessed by an in vitro digestive model with absorbent sink. *Environ. Pollut.* 218:901-908.

Zhao, B., T. Yang, X. Cao, **R. De La Torre-Roche**, **J. C. White**, H. Xiao, B. Xing, and L. He. 2017. A green, facile, and rapid method for microextraction and Raman detection of titanium dioxide nanoparticles from milk powder. *RSC Advances* 7:21380-21388.

Zhao, Q., **C. Ma**, **J. C. White**, O. Parkash Dhankher, X. Zhang, S. Zhang, and B. Xing. 2017. Quantitative evaluation of multi-wall carbon nanotube uptake by terrestrial plants. *Carbon* 114:661-670.

BULLETINS AND FACT SHEETS PUBLISHED BY STAFF DURING 2016-2017

Aulakh, J. S. and **R. H. Hiskes**. 2016. Crabgrass (*Digitaria* spp.) control in home lawns. *CAES Fact Sheet* http://www.ct.gov/caes/lib/caes/documents/publications/fact_sheets/valley_laboratory/crabgrass_control_factsheet.pdf

Bugbee, G. J. and **J. M. Fanzutti.** 2016. Monitoring report 2014 invasive aquatic plants, Candlewood Lake, Lake Lillinonah, Lake Zoar. *CAES Bulletin 1045.* http://www.ct.gov/caes/lib/caes/documents/publications/bulletins/b1045.pdf

Bugbee, G. J. and **J. M. Fanzutti.** 2016. Monitoring report 2015 invasive aquatic plants, Candlewood Lake, Lake Lillinonah, Lake Zoar and Squantz Pond. *CAES Bulletin 1046.* http://www.ct.gov/caes/lib/caes/documents/publications/bulletins/b1046.pdf

Cheah C.A. S-J. 2016. HWA winter mortality in Connecticut & implications for management and control. *CAES Fact Sheet.* http://www.ct.gov/caes/lib/caes/documents/publications/fact_sheets/plant_pathology_and_ecology/hemlock_woolly_adelgid_winter_mortality__7.12.16.pdf

Krol, W. J., **B. D. Eitzer**, **T. Arsenault**, **J. C. White**, J. Fontana, E. Sloan, L. A. Lin, and S. Robinson. 2017. A targeted study of pesticide residues in fresh and dried herbs sold in Connecticut in 2011. *CAES Technical Bulletin 15.* http://www.ct.gov/caes/lib/caes/documents/publications/technical_bulletins/tb15.pdf

Li, D. W. 2017. Indoor molds and their management (Revised). *CAES Fact Sheet.* http://www.ct.gov/caes/lib/caes/documents/publications/fact_sheets/valley_laboratory/indoor_molds_and_their_management_lid.pdf

Li, Y., **P. Sletten**, and **L. Patrick**. 2016. Seed germination and purity analysis 2016. *CAES Technical Bulletin 14.* http://www.ct.gov/caes/lib/caes/documents/publications/technical_bulletins/tb14.pdf

Stafford III, K. C. 2017. Prevention of ticks and tick-associated disease in companion animals. *CAES Fact Sheet.* http://www.ct.gov/caes/lib/caes/documents/publications/fact_sheets/entomology/prevention_tbd_companion_animals_2017_expd_ver.pdf