

# THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

*Record of the Year*

2017 - 2018



# CAES

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The Connecticut Agricultural Experiment Station

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*Putting Science to Work for Society since 1875*

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



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## BOARD OF CONTROL

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

The members of the Board of Control as of June 30, 2018 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 2, 2017, October 18, 2017, January 19, 2018, and April 11, 2018.

## 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, 2018.

### 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  
Michael J. Cavadini  
Lisa L. Kaczinski  
Jennifer L. Stevens

### ANALYTICAL CHEMISTRY

Dr. Jason C. White, Vice Director, Department Head  
Michael A. Ammirata  
Terri Arsenault  
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  
Dr. Megan A. Linske  
Dr. 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  
Alexander J. Diaz  
Dr. Gillian Eastwood  
Dr. Andrea Gloria-Soria  
Michael J. Misencik  
Dr. Goudarz Molaei  
Tanya A. Petruff  
Dr. Brij L. Sawhney, Emeritus  
John J. Shepard  
Dr. Blaire T. Steven  
Dr. Charles R. Vossbrinck  
Dr. Yi Yang

## FORESTRY AND HORTICULTURE

Dr. Jeffrey S. Ward, Department Head  
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, Maintenance Supervisor  
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. Zhouqi Cui  
Dr. Sharon M. Douglas, Emeritus  
Dr. Francis J. Ferrandino  
Regan B. Huntley  
Dr. Yonghao Li  
Dr. Robert E. Marra  
Dr. Neil A. McHale, Emeritus  
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. Elisha B. Allan-Perkins  
Dr. Jatinder S. Aulakh  
Jane Canepa-Morrison  
Dr. Carole A. Cheah  
Dr. Richard S. Cowles  
Jeffrey M. Fengler  
Rose T. Hiskes  
Dr. DeWei Li  
James J. Preste, Research Farm Manager  
Thomas M. Rathier, Emeritus  
Diane Riddle  
Michelle R. Salvas



## RETIREMENTS

### Ms. Kathryn Soleski



Ms. Kathryn Soleski began her State career in 1989 and joined the Business Office staff of The Connecticut Agricultural Experiment Station in 1990 as clerk-typist. She always made suggestions to improve processes and service and moved up through the ranks to her current position of Purchasing Assistant. As a hard-working, loyal and dedicated Station staff member, Kathy provided outstanding purchasing and administrative support to the agency's research staff in a courteous and professional manner. She was quick to learn and adapt to agency modernization and the agency's transformation to the completely automated State-wide accounting system CORE-CT. Ms. Soleski was polite and courteous with co-workers and state residents who called upon the Station for assistance or information. Her dedication to her responsibilities and loyalty to the Experiment Station along with her cheerful personality are qualities that will leave a void and certainly be missed. A true public servant and ambassador for the Experiment Station and the State of Connecticut, for twenty-eight years, we honor Ms. Kathryn Soleski and her many important contributions on the occasion of her

retirement.

### Michael C. Thomas



Michael Thomas joined the staff of The Connecticut Agricultural Experiment Station in April 1999 as a Research Assistant II in the Department of Entomology where he assisted Dr. Chris Maier in studies on forest and apple orchard insect pests. A year later he was promoted to Research Technician I, and transferred to the Department of Soil & Water, (now the Department of Environmental Sciences and Center for Vector Biology & Zoonotic Diseases) where he assisted Dr. Theodore Andreadis and later Dr. Philip Armstrong in the statewide Mosquito/Arbovirus Surveillance Program and assisted in studies on the ecology of mosquitoes and epidemiology of mosquito-borne diseases. In 2004, he was promoted to Research Technician II. An outstanding ornithologist and field naturalist with taxonomic expertise in local insect fauna, most notably dragonflies and robber flies, Michael quickly mastered the identification of mosquitoes, and over the years became an expert on mosquito ecology and natural history throughout

the region. This culminated in publication of the *Identification Guide to the Mosquitoes of Connecticut*, which he co-authored with Dr. Andreadis and Mr. John Shepard. For eighteen years, Michael made immeasurable contributions to the Station's mosquito research and surveillance programs, identifying and processing mosquitoes for virus isolation, maintaining mosquito and animal colonies, conducting bioassays with potential biological control agents and establishing the Station's reference collection of local mosquito species. In the field, Michael routinely traversed the State uncovering breeding sites for native and invasive species, setting specialized traps and collecting mosquitoes in variety habitats across the entire spectrum, from inner urban cities and junk yards to remote woodland swamps. In addition to maintaining equipment, each summer he would supervise the training of seasonal research assistants in mosquito trapping in the field. Ever resourceful, Michael would enthusiastically take on new tasks, never hesitate to work beyond normal hours and make adjustments to meet the demands of a project. He would

always make excellent suggestions to improve the efficiency and lend his expertise in designing and implementing research projects in the field. An outstanding nature photographer with exceptional skill in graphic arts, Michael would regularly prepare maps, figures and photographs for scientific publications and ably served as the Station's official photographer at all events, including Plant Science Day. Always polite, courteous and cooperative, with visitors, Station staff, and collaborators, Michael is the embodiment of a true professional in every sense of the word. Whereas, for eighteen years, Michael Thomas has ably served The Connecticut Agricultural Experiment Station and citizens of Connecticut. His research truly exemplifies the motto of the Experiment Station: "Putting Science to Work for Society". We honor Michael and his contributions on his retirement.

### Michael P. Vasil

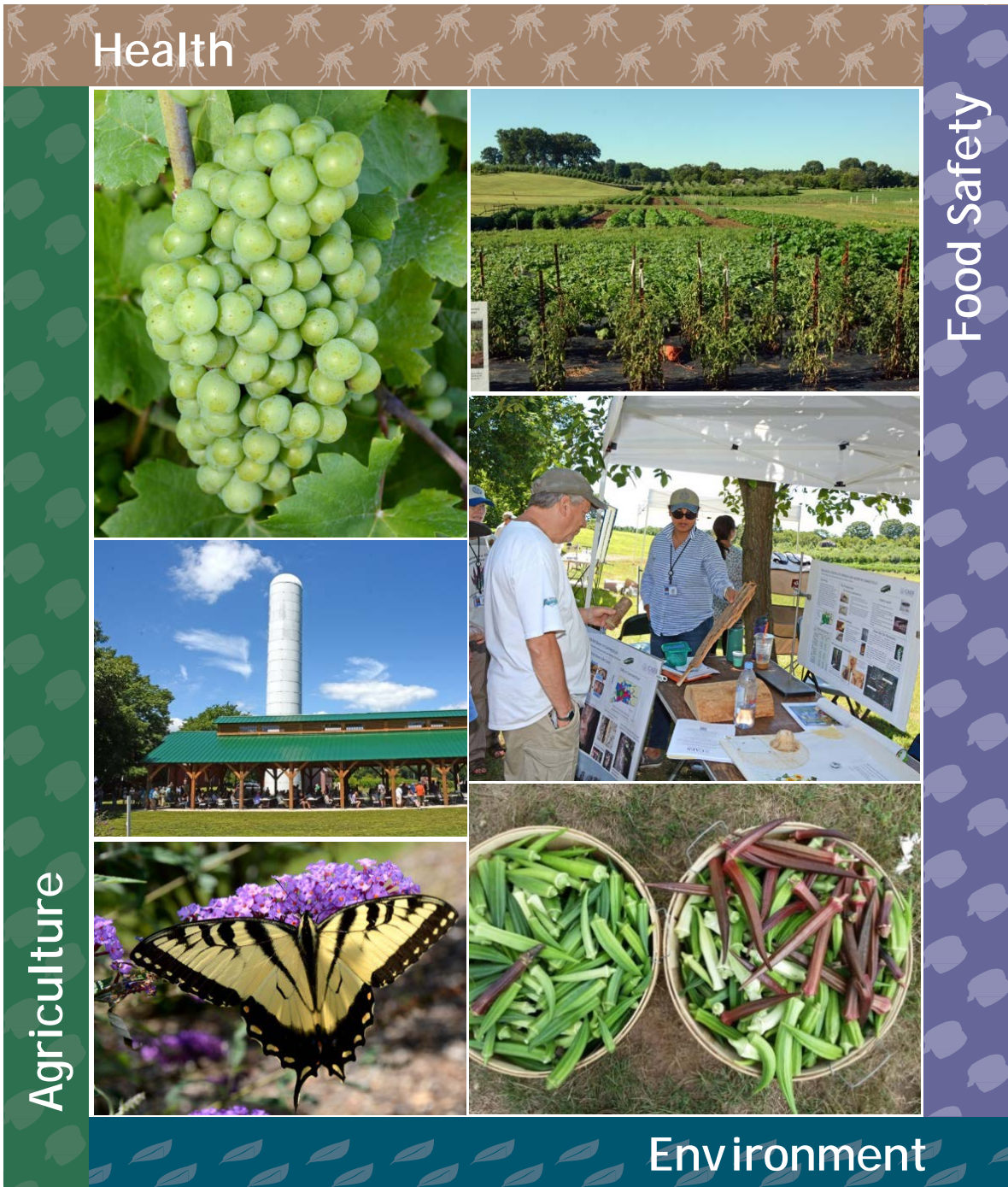


Michael Vasil joined the staff of The Connecticut Agricultural Experiment Station as a Summer Worker in the Department of Entomology in 1992 studying the predation of gypsy moths for Dr. Ronald Weseloh. He was later hired in November as an Agricultural Research Assistant II to assist Dr. John F. Anderson with his studies on the epidemiology of Lyme disease and ticks. Initially, he learned to identify ticks sent in by the public and to test ticks for *Borrelia burgdorferi* by culture and the polymerase chain reaction. Two years later, he was promoted to Agricultural Research Assistant III, and in 1996, he was promoted to Agricultural Technician I. In 1999, he was promoted to Agricultural Research Technician II. Years later he was transferred

to the Department of Environmental Sciences and Center for Vector Biology & Zoonotic Diseases. An exceptional outdoorsman, who grew up enjoying the woods, pastures, woodland and coastal swamps, and waters of Connecticut and who graduated with a biology degree from Southern Connecticut State University, Michael learned to collect mosquitoes and ticks, and to trap mammals and birds for Dr. Anderson's studies on the natural history of biting arthropods and the epidemiology of human and animal viruses and pathogens. For twenty-five years, Michael made important contributions to the Station's tick and mosquito research and testing programs. He maintained laboratory animals and established mosquito, tick, and bed bug colonies. Michael trapped arthropod vectors, birds and mammals from Stonington to Greenwich. Birds were collected in the field in mist nets early in morning, identified, ticks removed, and blood samples taken before being released back into the wild. Michael would set up his card table in the field with microscope, forceps, syringes, collecting tubes with labels, ice chest, anesthesia, notebook, and chair, and upon retrieving captured rodents, specimens would be examined for ticks, bled, ear-tagged, and returned to the field. Various types of mosquito traps, some containing laboratory animals, were placed in the field at various heights from subterranean into the canopy of trees. During his Station career, Michael worked in many "hot spots" in Connecticut for Lyme disease, human babesiosis, eastern equine encephalomyelitis, and West Nile virus disease, and in the BSL-2 and BSL-3 containment laboratories. He conducted animal experiments with the causative agents of many of these human diseases as well as Powassan encephalitis virus. In relatively recent years, Michael conducted dozens of experiments testing attractants and repellents of bed bugs. He maintained and in some cases, built equipment for field and laboratory studies. Michael enthusiastically took on new tasks, never hesitated to work beyond normal hours, including weekends, and often made adjustments to complete assignments. He often made excellent suggestions to improve the efficiency of projects and provided his expertise in designing and implementing research projects. In the past two years, Michael assisted Dr. Theodore Andreadis and Dr. Philip Armstrong in raising and identifying native and exotic container-breeding mosquitoes associated with the transmission of viruses. Always polite, courteous, cooperative, and professional with citizens, Station staff, and collaborators, and particularly in relatively recent years with Bedoukian Research in

Danbury, CT, Michael is the embodiment of a true professional in every sense of the word. Whereas, for twenty-five years, Michael P. Vasil has ably served The Connecticut Agricultural Experiment Station and citizens of Connecticut through his research in the outdoors and laboratory, and whereas his daily efforts truly exemplify the motto of the Experiment Station: “Putting Science to Work for Society,” we honor Michael and his numerous contributions on his retirement.

The Connecticut Agricultural Experiment Station  
107<sup>th</sup> Plant Science Day  
Lockwood Farm, Hamden, CT  
Wednesday, August 2, 2017



PLANT SCIENCE DAY  
2017

The weather on Plant Science Day 2017 was in the 90s and humid. A total of 1,157 guests visited Lockwood Farm, making it one of the more heavily attended Open Houses at the Farm in recent years. Of special note was the attendance by US Congresswoman, Rosa DeLauro, representing Connecticut's third district, who addressed attendees in the Pavilion during the morning session.

Director Theodore G. Andreadis welcomed attendees in the 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:**

<b>Dr. Kirby C. Stafford III</b>	<b>Gypsy Moth Outbreaks in Connecticut: Past, Present, and Future</b>
<b>Dr. Richard S. Cowles</b>	<b>Bees and the Neonicotinoid Controversy</b>
<b>Dr. Francis J. Ferrandino</b>	<b>Growing Grapes in Connecticut's Ever-Changing Climate</b>

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

**DEMONSTRATION TENT:**

<b>Ms. Lindsay A. Patrick</b>	<b>Pruning Basics</b>
<b>Dr. Gale E. Ridge</b>	<b>Household Pest Control</b>

Attendees took advantage of several tours around the farm:

**BUS TOURS – Dr. Neil 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.

- **Invasive Shrubs and Deer Browse.** Investigators: Dr. Jeffrey S. Ward and Dr. Scott C. Williams. Assisted by Ms. Megan A. Linske, Mr. Michael R. Short, and Mr. Joseph P. Barsky.
- **Mosquito Blood-Feeding Behavior and the Risk of Human Infection.** Investigators: Dr. Goudarz Molaei, Dr. John S. Soghigian, and Dr. Theodore G. Andreadis. Assisted by Mr. Michael C. Thomas and Mr. John J. Shepard.
- **Detecting Pesticides in Plant Pollen.** Investigators: Dr. Kimberly A. Stoner, Dr. Brian D. Eitzer, Dr. Richard S. Cowles, Mr. Mark H. Creighton, and Dr. Alejandro Chiriboga (University of Connecticut). Assisted by Ms. Andrea Nurse (University of Maine), Ms. Tracy A. Zarrillo, and Ms. Morgan F. Lowry.

- **Analysis of Aflatoxins in Animal Feed.** Investigators: Dr. Brian D. Eitzer and Dr. Nubia Zuverza-Mena.
- **Hops, a New Specialty Crop in Connecticut.** Investigators: Dr. James A. LaMondia and Dr. Katja Maurer.
- **Using Tomography to Assess Internal Decay in American Elms.** Investigators: Dr. Robert E. Marra and Dr. Nicholas J. Brazee (University of Massachusetts). Assisted by Ms. Genevieve Higgins and Ms. Kelly Allen (University of Massachusetts, Amherst).

#### **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, Dr. Gale E. Ridge, Ms. Rose Hiskes, Ms. Lindsay Patrick, and Ms. Diane Riddle.

#### **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. Hunter Naizby. Visitors were able to visit the following 92 field plots:

CHINESE CHESTNUT TREES	Dr. Sandra Anagnostakis
SHEET COMPOSTING WITH MAPLE AND OAK LEAVES	Dr. Abigail Maynard and Dr. David Hill
NUT ORCHARD	Dr. Sandra Anagnostakis, assisted by Ms. Pamela Sletten
FIG TRIALS IN SELF-WATERING PLANTERS	Dr. Charles R. Vossbrinck
COMMERCIAL CHESTNUT CULTIVARS	Dr. Sandra Anagnostakis, assisted by Ms. Pamela Sletten
REMOTE ACCESS WEATHER STATION	Dr. Francis J. Ferrandino, assisted by Ms. Joan Bravo
TECHNICAL DEMONSTRATION TENT	
COMMERCIAL CHESTNUT SEEDLINGS	Dr. Sandra Anagnostakis, assisted by Ms. Pamela Sletten
CONTROL OF BLIGHT ON AMERICAN CHESTNUTS	Dr. Sandra Anagnostakis, assisted by Ms. Pamela Sletten
NEW HYBRID CHESTNUT ORCHARD	Dr. Sandra Anagnostakis, assisted by Ms. Pamela Sletten
USE OF NANOPARTICLES OF METAL OXIDES TO SUPPRESS SOIL-BORNE	Dr. Wade Elmer, Dr. Roberto De La Torre-Roche, Dr. Nubia Zuverza-Mena,

DISEASES OF EGGPLANT AND WATERMELON	Dr. Chuanxin Ma, and Dr. Jason White, assisted by Mr. Peter Thiel, Mr. Cristian Perez, and Mr. Benson Chan
COMPARISON OF GRAFT UNION HEIGHT ON CHARDONNAY GRAPEVINES	Dr. Francis J. Ferrandino, assisted by Ms. Joan Bravo and Ms. Catherine Walters
ENVIRONMENTALLY-FRIENDLY CONTROL OF POWDERY MILDEW ON LANDSCAPE PLANTS	Dr. Francis J. Ferrandino, assisted by Ms. Joan L. Bravo
NANOPARTICLE CONTROL OF POWDERY MILDEW ON CHARDONNAY WINE GRAPES	Dr. Wade Elmer and Dr. Francis J. Ferrandino, assisted by Ms. Joan L. Bravo
USE OF NANOPARTICLES OF METAL OXIDES TO SUPPRESS FUSARIUM WILT OF CHRYSANTHEMUMS	Dr. Wade Elmer, assisted by Mr. Peter Thiel, Ms. Taylor Abendroth, Mr. Benson Chan, Mr. Joe Clark, Mr. Jesse Farrell, Ms. Julie Fitzgerald, Ms. Mia Forgione, Ms. Courtney Haigle, Ms. Alexa Ornstein, Ms. Claire Walsh, and Ms. Jada Ward
TABLE GRAPE DEMONSTRATION PLOT	Dr. Francis J. Ferrandino, assisted by Ms. Joan L. Bravo
SEEDLINGS OF OLD SURVIVING AMERICAN CHESTNUTS	Dr. Sandra Anagnostakis, assisted by Ms. Pamela Sletten
WILD CHESTNUTS FROM TURKEY	Dr. Sandra L. Anagnostakis, assisted by Ms. Pamela Sletten
A RENDEZVOUS WITH NON-NATIVE INVASIVE PLANTS IN CONNECTICUT: THEIR IDENTIFICATION AND CONTROL	Dr. Jatinder S. Aulakh
QUESTIONS AND ANSWERS TENT	Mr. Robert Durgy, Ms. Rose Hiskes, Dr. Yonghao Li, Ms. Lindsay Patrick, Ms. Diane Riddle, and Dr. Gale E. Ridge
COMPOSTING LEAVES USING THE STATIC PILE METHOD	Dr. Abigail Maynard and Dr. David Hill
HAMDEN POLICE DEPARTMENT	
VERIZON WIRELESS	
THE FARMER'S COW	Ms. Kathy Smith
KIDS' KORNER	Ms. Kathryn Soleski, Ms. Lisa Kaczinski Corsaro, and Ms. Tracy Zarrillo
SELF-GUIDED ACTIVITY FOR ALL CHILDREN,	Ms. Terri Arsenault

INCLUDING GIRL SCOUTS	
EXPERIMENT STATION ASSOCIATES	Ms. Barbara Yaeger
FIDDLEHEAD TRIALS	Dr. Abigail Maynard and Dr. David Hill
POTENTIAL ROLES FOR CARBON MATERIALS IN THE BREAKDOWN OF POLLUTANTS	Dr. Joseph J. Pignatello
HANDS-ON CHEMISTRY	Dr. Christina Robb, Ms. Kitty P. Riveros, Dr. Walter Krol, Ms. Terri Arsenault, Mr. Michael Cavadini, and Dr. Jason C. White
NANOMATERIALS IN AGRICULTURE: INTERACTIONS WITH CO-EXISTING CONTAMINANTS	Dr. Roberto De La Torre-Roche, Dr. Nubia Zuverza-Mena, Dr. Chuanxin Ma, and Dr. Jason C. White
INTEGRATING FOREST AND ROADSIDE MANAGEMENT OBJECTIVES TO CREATE STORM RESILIENT FORESTS	Dr. Jeffrey S. Ward and Mr. Thomas E. Worthley (UConn), assisted by Mr. Joseph P. Barsky
SOIL pH AFFECTS HEALTH OF CHRISTMAS TREES	Dr. Richard S. Cowles, Dr. James LaMondia, assisted by Mr. Nathaniel Child and Mr. Ethan Paine
THE PUBLIC HEALTH AND ENTOMOLOGY TENT:	
THE “DEER” TICK <i>IXODES SCAPULARIS</i>	Dr. Kirby C. Stafford III, assisted by Ms. Heidi Stuber and Ms. Megan Linske
STATEWIDE MOSQUITO MONITORING PROGRAM FOR MOSQUITO-BORNE VIRAL DISEASES	Dr. Philip M. Armstrong, Dr. Theodore Andreadis, and John Shepard, assisted by Ms. Angela Bransfield, Mr. Michael Misencik, Ms. Stephanie Canales, Mr. Daniel Cole, Mr. Duncan Cozens, Mr. Christopher Driscoll, Mr. Max Engel, Mr. David Guzhnay, Ms. Noelle Khalil, Mr. Michael Olson, Ms. Sofia Moscovitz, Ms. Demi Rodriguez, and Ms. Danielle Sohai
TICK TESTING PROGRAM FOR LYME AND ALLIED DISEASES	Dr. Goudarz Molaei, assisted by Mr. Alex Diaz, Ms. Mallery Breban, Ms. Pauline Dutka, and Ms. Kristina D’Agostino
A WORLD OF VIRUSES	Dr. Doug Brackney, assisted by Ms. Maria Correa
DIVERSITY AND DILUTION: THE IMPACT OF MEDIUM-SIZED MAMMAL DIVERSITY ON <i>BORRELIA BURGDORFERI</i> PREVALENCE IN FRAGMENTED AND UNFRAGMENTED	Dr. Scott C. Williams, assisted by Mr. Michael R. Short and Ms. Megan Linske



HABITATS IN CONNECTICUT, USA	
INVASIVE INSECTS IN THE NORTHEAST	Dr. Chris T. Maier, assisted by Ms. Tracy Zarrillo and Ms. Morgan Lowry
A NEW SPECIES <i>BACTRODESMIASTRUM DOMESTICUM</i> AND A NOTEWORTHY MOLD FROM INDOOR ENVIRONMENTS	Dr. De-Wei Li, assisted by Chin S. Yang and Ariunaa Jalsrai
ORGANIC CONTROL OF FIREBLIGHT ON APPLES	Dr. Quan Zeng and Dr. Zhouqi Cui
THE PAVILION AT LOCKWOOD FARM	
NATIVE WOODY SHRUBS	Dr. Jeffrey S. Ward, assisted by Mr. Joseph P. Barsky
OAK SUCCESS FOLLOWING REGENERATION HARVESTING IN CONNECTICUT	Dr. Jeffrey S. Ward, assisted by Mr. Joseph P. Barsky
BIRD AND BUTTERFLY GARDEN	Ms. Jane Canepa-Morrison and Mr. Jeffrey Fengler
VARIATION IN ATTRACTION TO POLLINATORS AMONG CULTIVATED VARIETIES OF ORNAMENTAL PLANTS	Dr. Kimberly Stoner, assisted by Ms. Morgan Lowry, Ms. Tracy Zarrillo, Ms. Damaris Chenoweth, Mr. Sawyer Badey, and Mr. James Durrell
ENVIRONMENTALLY-FRIENDLY CONTROL OF POWDERY MILDEW ON VEGETABLE PLANTS	Dr. Francis J. Ferrandino, assisted by Ms. Joan L. Bravo
SUPPRESSION OF POWDERY MILDEW OF PUMPKIN WITH NANOPARTICLES OF METAL OXIDES	Dr. Wade Elmer and Dr. Jason White, assisted by Mr. Peter Thiel and Mr. Benson Chan
INVASIVE AQUATIC PLANT PROGRAM	Mr. Gregory Bugbee, assisted by Ms. Amanda Massa, Ms. Summer Stebbins, and Ms. Abigail Wiegand
CHESTNUT SPECIES AND HYBRIDS	Dr. Sandra Anagnostakis, assisted by Ms. Pamela Sletten
HEALTHY PLANTS—HEALTHY BUSINESS: SUPPORT OF THE GREEN INDUSTRY BY INSPECTION	Dr. Victoria Lynn Smith, assisted by Ms. Tia Blevins, Mr. Zachary Brown, Mr. Mark Creighton, Ms. Joann Klein, and Mr. Jeff Fengler
THE COOPERATIVE AGRICULTURAL PEST SURVEY (CAPS) PROGRAM AND FARM BILL SURVEYS	Ms. Katherine Dugas, assisted by Mr. Zachary Brown

BOXWOOD BLIGHT – MEANS OF SPREAD AND IMPLICATIONS FOR MANAGEMENT	Dr. James A. LaMondia, assisted by Ms. Michele Salvas and Mr. Nathaniel Child
BIOLOGICAL CONTROL OF HEMLOCK WOOLLY ADELGID AND MILE-A-MINUTE WEED IN CONNECTICUT	Dr. Carole Cheah, assisted by Mr. Emmett Varricchio
10 YEARS OF WASP WATCHING: WHAT HAVE WE LEARNED ABOUT CONNECTICUT’S JEWEL BEETLES	Dr. Claire Rutledge, assisted by Ms. Mioara Scott
OKRA TRIALS	Dr. Abigail Maynard and Dr. David Hill
BRUSSELS SPROUTS TRIALS	Dr. Abigail Maynard and Dr. David Hill
SWEET POTATO TRIALS	Dr. Abigail Maynard and Dr. David Hill
BUTTERNUT SQUASH TRIALS	Dr. Abigail Maynard and Dr. David Hill
CURIOSITY GARDEN	Dr. Abigail Maynard and Dr. David Hill
HOPS – ADDITIONAL VARIETIES FOR CONNECTICUT	Dr. Katja Maurer and Dr. James A. LaMondia, assisted by Mr. Nathaniel Child and Ms. Michelle Salvas
HYBRID AND VINIFERA WINEGRAPE CULTIVAR TRIAL	Ms. Joan Bravo and Dr. Francis J. Ferrandino
PINOT GRIS CULTURAL TRIALS	Ms. Joan L. Bravo and Dr. Francis J. Ferrandino
THE ROCK	
ROCKY HILL AMERICAN CHESTNUT TREES	Dr. Sandra Anagnostakis, assisted by Ms. Pamela Sletten
HYBRID ELM TREES	Dr. Sandra Anagnostakis, assisted by Ms. Pamela Sletten
JAPANESE PLUM VARIETY TRIALS	Dr. Abigail Maynard and Dr. David Hill
PAWPAW TRIALS	Dr. Abigail Maynard and Dr. David Hill
BEACH PLUM TRIALS	Dr. Abigail Maynard and Dr. David Hill
ASIAN CHESTNUT GALL WASP ON CHESTNUT	Dr. Sandra Anagnostakis, assisted by Ms. Pamela Sletten
CONNECTICUT BOTANICAL SOCIETY	Truda Steinnagel
CONNECTICUT COLLEGE ARBORETUM	Christine Donovan and Glenn Dreyer

CONNECTICUT DEPARTMENT OF AGRICULTURE	Rebecca Eddy
CONNECTICUT DEPARTMENT OF AGRICULTURE AND THE ANIMAL FEED REGULATORY PROGRAM STANDARDS (AFRPS)	Wayne Nelson, Kate Ciarletta, and Mary Joaquin
CONNECTICUT DEPARTMENT OF ENERGY & ENVIRONMENTAL PROTECTION: WILDLIFE DIVISION (CT DEEP WILDLIFE DIVISION)	Katerina Hutchins
CONNECTICUT DEPARTMENT OF LABOR OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (CONN-OSHA)	Catherine Zinsser
CONNECTICUT ENVIRONMENTAL COUNCIL (CTEC)	Erica Fearn
CONNECTICUT FARM BUREAU ASSOCIATION (CFBA)	Joan Nichols
CONNECTICUT FARMLAND TRUST	Brianna Dunlap
CONNECTICUT FOREST AND PARKS ASSOCIATION (CFPA)	Liz Fossett
CONNECTICUT HORTICULTURAL SOCIETY	Cheryl Marino
CONNECTICUT INVASIVE PLANT WORKING GROUP (CIPWG)	Donna Ellis
CONNECTICUT PROFESSIONAL TIMBER PRODUCERS ASSOCIATION (TIMPRO CT)	Brennan Sheahan
CONNECTICUT TREE PROTECTIVE ASSOCIATION (CTPA)	Cathy Dvorsky
FEDERATED GARDEN CLUBS OF CONNECTICUT, INC.	Polly Brooks
LYMAN HALL HIGH SCHOOL AGRICULTURAL SCIENCE AND TECHNOLOGY PROGRAM	Emily Picard
SLEEPING GIANT PARK ASSOCIATION	Julie Hulten
SOUTH CENTRAL CONNECTICUT REGIONAL WATER AUTHORITY	Kate Powell, Ron Walters, and Jeff Yale
TREE-SAVERS, LLC	Jayne Boniewicz and Fred Lishman

UNIVERSITY OF CONNECTICUT EXTENSION MASTER GARDENER PROGRAM (UConn EXTENSION MASTER GARDENERS PROGRAM)	Jude Hsiang
UNITED STATES DEPARTMENT OF AGRICULTURE, ANIMAL AND PLANT HEALTH INSPECTION SERVICE, PLANT PROTECTION AND QUARANTINE (USDA APHIS-PPQ)	Eric Chamberlain
UNITED STATES DEPARTMENT OF AGRICULTURE, FARM SERVICE AGENCY (USDA FSA)	Debbie Castle and Teresa Peavey
UNITED STATES DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICE (USDA NRCS)	Lisa Krall
UNITED STATES DEPARTMENT OF LABOR, OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (US OSHA)	Leona May
UNITED STATES DEPARTMENT OF AGRICULTURE NATIONAL AGRICULTURE STATISTICS SERVICE, NEW ENGLAND (USDA NASS)	Gary Keough

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. 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 a.m., Director Theodore G. Andreadis introduced Dr. Rob Klee, Commissioner of the Connecticut Department of Energy & Environmental Protection, as the Samuel W. Johnson Memorial Lecturer. He gave a talk entitled “Building a Sustainable Future in an Age of Uncertainty.”

Following Mr. Klee’s talk, Dr. Andreadis presented the Century Farm Award to Kasheta Farms of South Windsor, Connecticut.

## CENTURY FARM AWARD

### **Kasheta Farms South Windsor, CT**

The Century Farm Award is given to a farm that has been in family operation for more than 100 years. The recipient is selected by the Connecticut Agricultural Information Council.

#### *Proclamation from Governor Dannel P. Malloy:*

Kasheta Farms had its beginnings in 1905, when Peter and Mary Kasheta purchased a long, narrow parcel of land that extended from the Connecticut River to the Town Center in South Windsor. The primary crop grown at that time was broadleaf tobacco, but it was also a complete family farm selling milk, cheese, butter, eggs, and fresh grown fruits and vegetables.

Operation of the farm was subsequently taken over by Walter Kasheta along with his son, Edward W. Kasheta, Sr. In 1955, the tobacco industry in the Connecticut River Valley was dealt a severe blow due to the invention of a process to produce sheet tobacco for use as binders and wrappers for cigars. The federal government provided assistance to farmers through funding of the Connecticut-Massachusetts Tobacco Co-Op and purchased all the unsold tobacco produced in the Valley so farmers could survive. Kasheta Farms consequently started growing 150 acres of potatoes until that market fell into decline in the 1960s. Kasheta Farms further diversified by growing market vegetables, including tomatoes, sweet corn, peppers, and squash all while still producing tobacco.



Ed Kasheta, Jr. then added grain corn marketed as a high moisture corn crop and sold it for chicken feed to K & L Feed Co. in North Franklin, CT until that mill closed. Along the way, pumpkins, gourds, and giant pumpkins were added to the list of products that were sold to local farm stands and retailers.

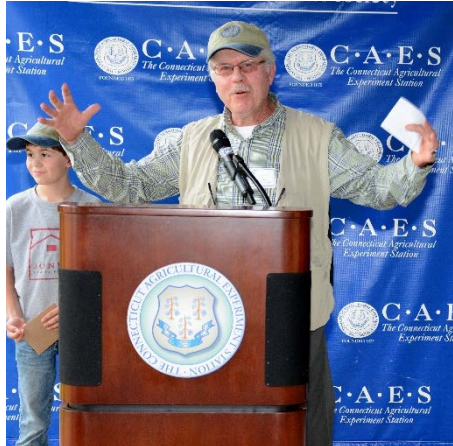
Through the years, Ed Sr.'s other sons joined the family business. Donald T. Kasheta has been growing and delivering sod turf and currently oversees a commercial landscape maintenance service. David A. Kasheta runs the power equipment store sales, service, and parts. All three brothers and Dad work together to keep the farm running smoothly.

Kasheta Farms, Inc. is currently producing approximately 400 acres of grain corn, 100 acres of sod, 20 acres of broadleaf tobacco, and 20 acres of pumpkins and gourds.

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 Kasheta Farms, who is most deserving of this honor.

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

Plant Science Day 2017 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

### **Governor Malloy Attends Board of Control Meeting**

On April 11, Governor Dannel P. Malloy presided over a statutory meeting of the Experiment Station's Board of Control, the first governor to do so in nearly 80 years. The meeting was held in the Slate Board Room and in attendance were Board Members: Dr. Theodore Andreadis (Director CAES), Mr. Terry Jones (Vice President, Governor appointee), Mr. Paul Larson (Secretary, appointee of the University of Connecticut), Dr. Erol Fikrig (appointee of Yale University), Ms. Joan Nichols (Governor appointee), Mr. Steven Reviczky (Commissioner of Agriculture), Dr. Dana Royer (appointee of Wesleyan University), and Ms. Patti Maroney (Governor representative). Also present by invitation were Dr. Jason White, Mr. Michael Last, Dr. Lindsay Triplett and Dr. Teja Shidore.

The Governor and members of the Board of Control toured the Jenkins-Waggoner Laboratory with stops at the laboratories of Dr. Lindsay Triplett and Dr. Kim Stoner for research updates in plant pathology and pollinator research. Dr. Wade Elmer and Dr. Stoner also provided overviews of the Plant Disease and Insect Information Offices.

Following the tour, the Governor opened the Board meeting and Vice President Terry Jones read the following official statement:

*Governor Malloy, on behalf of the Connecticut Agricultural Experiment Station (the first such station in the United States), I would like to state for the record this board has profound appreciation for your steadfast support of CAES throughout your two terms of office.*

*During that time, a few highlights include completion of our Griswold Field Laboratory and the renovation and expansion of the Jenkins-Waggoner building in New Haven. We also are very excited for your commitment to moving forward on renovating and expanding our Valley Lab in Windsor.*

*Most recently, your support to refill two, critically important scientist positions – fruit virologist and food chemist – is a strategic boost to our long-range sustainability.*

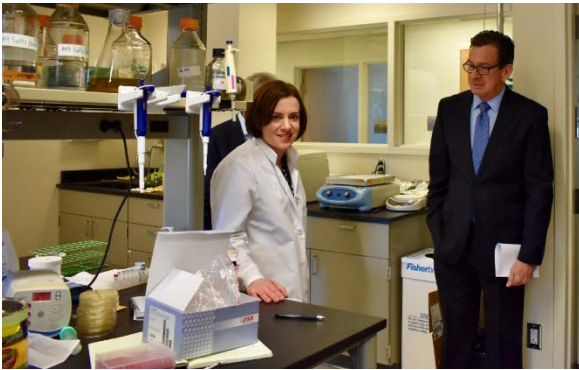
*Thank you for believing in and helping us fulfill our mission: “Putting science to work for society, protecting agriculture/public health and the environment.”*

*Lastly, we appreciate your presence at this board meeting. We believe it is an historic event worth noting since, to the best of our knowledge, it has been 70-80 years since a governor has presided here.*

Dr. Andreadis also thanked the Governor for attending the meeting and his support of The Connecticut Agricultural Experiment Station during his tenure as Governor.

Governor Malloy thanked the Board of Control members and the staff of The Connecticut Agricultural Experiment Station for the good work they perform on behalf of the citizens of Connecticut.





## Pollinator Conference

Dr. Kimberly Stoner organized a conference entitled “Creating or Improving Pollinator Habitat on Your Farm” held in Jones Auditorium on February 27, 2018, and was supported by a Specialty Crop Block Grant from the Connecticut Department of Agriculture and the U.S. Department of Agriculture (75 attendees). The speakers were:

- Emily May, Xerces Society for Invertebrate Conservation, “What Do Bees Need? Overview of Bees and Their Habitat Needs”
- Cynthia Rabinowitz, Executive Director of the Northwest CT Conservation District, “A Permaculture Approach to Incorporating Pollinator Habitat into the Goals of the Farm”
- Nancy Ferlow, Natural Resources Conservation Service, “Natural Resources Conservation Service (NRCS) Programs to Promote Pollinator Habitat”
- Steve Munno, Massaro Farm, “Pollinator Habitat at Massaro Farm”
- Michael Nadeau, Wholistic Land Care Consultant, “Site Analysis and Planning Pollinator Habitat That Will Thrive on the Site”
- Dr. Kimberly Stoner, CAES, “Protecting Pollinators from Pesticides”
- Dr. Richard Cowles, CAES, “Diversionary Plantings and Fixed Land Honey Production”

## 2018 Connecticut State AgriScience Fair

On Thursday, May 3, 2018, 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. The event this year drew 42 exhibits prepared by 54 students. 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 24-27, 2018.

Tours of the Experiment Station were offered to the participants, advisors, and chaperones attending the AgriScience Fair. Dr. Megan Linske, Dr. Gale Ridge, and Mr. John Shepard offered presentations about ongoing research programs to the group. Several individuals volunteered to serve as judges for the event, including: Mr. Gregory J. Bugbee, Mrs. Vickie Bomba-Lewandoski, Ms. Kate Fararr, Ms. Amanda Gagne, Dr. Robert Marra, Mr. Ron Michaels, Ms. Rebecca Rose, Dr. Blaire Steven, Dr. Charles Vossbrinck, and Dr. Nubia Zuverza. The participating ASTE high schools included: Bloomfield, Bridgeport, Middletown, Northwestern, E.O. Smith, Sound School, Southington, Trumbull, 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

### 2017 Connecticut-FFA Forestry Career Development Event

On November 17, 2017, the Department of Forestry and Horticulture hosted the Connecticut-FFA Forestry Career Development Event (CDE) at the Lockwood Farm Pavilion. This marks the sixth year that CAES has hosted this event. This year's Forestry CDE evaluated students' knowledge of forest management practices, forest mensuration, knowledge of forest and tree disorders, forestry related equipment, timber stand improvement, and tree identification.

Thirty-six students from 9 State FFA Chapters participated in this year's event, with the 4-student team from E.O. Smith High School Agricultural Education Program taking first place. Students from E.O. Smith FFA will represent The State of Connecticut in regional and national competition at the 2018 Eastern States Exposition and the 2018 National FFA Convention in Indianapolis, IN.

We would like to thank Gerry Milne and Jill Humphreys from DEEP-Forestry for their assistance.

## EVENTS HELD AT THE VALLEY LABORATORY

### Hops Research Meeting Held at the Valley Laboratory

Twenty-five people attended the Connecticut Agricultural Experiment Station Hops Summer Meeting and Field Day held on Wednesday, July 12, 2017, at the Valley Laboratory. CHGA President Alex DeFrancesco welcomed growers and spoke about current issues for the Hop Growers Association. Dr. Katja Maurer spoke about “Hop Culture and Research Results,” Jason Hoagland spoke about “Economic Aspects of Hop Yard Establishment,” Dr. Jim LaMondia spoke about “Integrated Pest Management of Hops,” and Spencer Thrall spoke about “Barley Production and Malting.” Fred Behringer presented information on “Hop Quality Testing.” Talks were followed by question-and-answer tours of hop and barley field plots and demonstrations of the HopsHarvester combine and barley combine by Jim Preste. The meeting qualified for 3.25 pesticide applicator re-certification credits.

### Connecticut River Working Group Meetings

Back-to-back meetings of the Connecticut River Watershed Water Chestnut Working Group and the Connecticut River Hydrilla Working Group, both organized by the U.S. Fish & Wildlife Service, Silvio O. Conte National Fish & Wildlife Refuge, were hosted by Gregory Bugbee on February 23, 2018, at the Gordon S. Taylor Conference Room at the Valley Laboratory. Attendees were from throughout the Northeastern States and included experts from the NFWS. Distribution and management techniques were discussed and coordination of efforts was planned.

### Invasive Plant Control Workshop Held at the Valley Laboratory

Eighty-nine people attended the Connecticut Agricultural Experiment Station’s Invasive Plant Control Workshop “From Theory to Practice” on June 12, 2018. Dr. Jim LaMondia welcomed participants and spoke about research and services at the Experiment Station Valley Laboratory. The Theory (Indoor sessions) included “Invasive impacts, control techniques, and project management” presented by Dr. Jeff Ward; “Chemical control of mugwort (*Artemisia vulgaris*) garlic mustard (*Alliaria petiolata*) and Japanese knotweed (*Fallopia japonica*)” presented by Dr. Jatinder Aulakh; “Biological control of mile-a-minute (*Persicaria perfoliata*)” by Dr. Carole Cheah; and “Controlling Japanese barberry (*Berberis thunbergii*) to reduce risk of Lyme disease” by Dr. Scott Williams. The Practice (outdoor sessions) included “Foliar application, cut stem, and stem injection methods for Japanese knotweed control” by Dr. Aulakh; “Mechanical control techniques” by Dr. Williams; “Biological controls” presented by Dr. Cheah; and “Directed heating with propane torches” by Dr. Ward. The workshop qualified for 6 CEUs for CT Rights-of-Way (6) and Ornamentals & Turf (3A); and 2.0 CEUs for CT Foresters, Supervising Forest Products Harvesters, and Forest Products Harvesters. Farm Manager Jim Preste and Jane Canepa-Morrison assisted with much of the behind-the-scenes work for the meeting.

## THE STATION IN THE COMMUNITY

### UConn-CAES Spring Bedding Plant Meetings

These meetings were co-organized and co-sponsored by Dr. Yonghao Li from CAES and Dr. Rosa Raudales, Ms. Joan Allen, and Ms. Leanne Pundt from UConn and were held on February 13, 2018 at the UConn campus in Torrington (35 attendees) and on February 22, 2018, at the UConn Cooperative Extension Office in Vernon (33 attendees).

### 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 27, 2018. Dr. Jim LaMondia welcomed growers and spoke about recent developments at the Experiment Station. The meeting addressed a wide variety of topics of interest to growers. Joe Bonelli (UConn Cooperative Extension) and Colleen Kisselburgh (Arthur Carroll Insurance) discussed risk management in tobacco and the tobacco insurance program. Jim LaMondia spoke about management of tobacco pathogens including Fusarium wilt, 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 carbon and nitrogen in tobacco soils. Candace Bartholomew, Cooperative Extension, spoke about pesticide safety for growers. Martha Dorsey of the Farm Services Administration provided updates on FSA services to growers. Andrew Urbanowicz, Dave Arnold, and Paul Polek presented an update on the Connecticut-Massachusetts Tobacco Growers Association. Jane Canepa-Morrison, Jim Preste, and Michelle Salvias assisted with much of the behind-the-scenes work for the meeting. The meeting qualified for pesticide applicator re-certification credit in Connecticut and Massachusetts and 65 people received credit.

### New Haven Public Schools Science Fair at Yale University

From May 14-16, 2018, at the Yale University Commons, a team from the Experiment Station served as special awards judges for the New Haven Public Schools Science Fair, choosing winners for the CAES award. Drs. Robert Marra and Abigail Maynard served as judges. The *Connecticut Agricultural Experiment Station Award* (\$150) for "The best project related to food, plants, insects, or the environment" was awarded to Matilda Pethrick, a 7th grade student at Betsy Ross Arts Magnet School, for her project "From Biomass to Biogas." Dr. Marra presented the CAES award and certificate to the student at the Awards Ceremony on the evening of May 16, which was held in Yale University's Sheffield-Sterling-Strathcona Hall.

### Station Scientist Continues Second Year of Undergraduate Internship Program at CAES and Southern Connecticut State University



The second year of CAES and Southern CT State University's (SCSU) joint USDA-funded internship program, the Summer Undergraduate Fellows in Plant Health and Protection, started on June 11, 2018. Ten students from 9 universities nationwide worked on summer research projects with CAES and SCSU scientists and living in apartments at SCSU. Pictured: 2018 Plant Health Fellows. L to R: Tia Brown (working with Dr. Lindsay Triplett), Lance Moore

(Dr. Jeff Ward), Ceara Wetterman (Dr. Blaire Steven), Zach Seltzer (Dr. Quan Zeng), Jillian Tate (Dr. Claire Rutledge), Gillian Page (Dr. Elizabeth Roberts, SCSU), Victoria Romero (Dr. James Kearns, SCSU), Collette McMahon (Dr. Nubia Zuverza-Mena), Kelvin Mintah (Dr. Wade Elmer), and Melvin Mercado-Ayala (Dr. Robert Marra).

## DONATIONS MADE TO THE COMMUNITY

### Lockwood Farm

A total of 29,522 pounds of fresh produce, including apples, cabbage, eggplants, peppers, pumpkins, summer and winter squash, tomatoes, and assorted vegetables grown at Lockwood Farm were donated to the Albert J. Solnit Children's Center in Middletown, Connecticut Food Bank in Wallingford, Hamden/North Haven YMCA, Masonicare in Wallingford, 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 6,868 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 20, 2017, Mr. Mark Creighton was awarded the Connecticut Wartime Service Medal by Governor Malloy and Commissioner Connolly from the Department of Veterans Affairs.

On September 30, 2017, Dr. Jason White and Dr. David Tsao (BP Corp.) were co-recipients of the Stephen D. Ebbs Award for distinguished service to the field of phytotechnologies at the 14th International Phytotechnologies Conference held in Montreal, Quebec, Canada.

On October 12, 2017, Mr. Joseph P. Barsky elected to serve as Vice Chair of the Connecticut State Consulting Committee for Agricultural Science and Technology Education during their quarterly meeting.

On October 25, 2017, Dr. Theodore Andreadis was awarded the Bronze Medal by the Federated Garden Clubs of Connecticut at their annual meeting held in Southington.

On December 5, 2017, Dr. Gillian Eastwood was presented the John McColgan Grant-in-Aid Award for investigations of *Aedes albopictus* at the Annual Northeastern Mosquito Control Association meeting held in Plymouth, MA.

On December 5, 2017, Mr. John Shepard was elected as Treasurer of the Northeastern Mosquito Control Association at their annual meeting held in Plymouth, MA.

On January 8, 2018, Mr. Robert Durgy was appointed by the All-America Selections Board of Directors as judge for the AAS Edibles Variety Trials at the Connecticut Vegetable and Small Fruit Growers' Conference held in Windsor.

On January 11, 2018, Dr. Jatinder Aulakh was elected to serve as co-chair for the turf and ornamental section for the NEPPS conference in 2019 at the Northeastern Pest, Plant and Soil Conference held in Philadelphia, PA.

On January 18, 2018, Dr. Richard Cowles was honored with the Award of Merit by the Connecticut Tree Protective Association at their annual meeting held in Plantsville.

On January 18, 2018, Dr. Claire Rutledge was re-elected to the Board of Directors for a third term at the Annual Meeting of the Connecticut Tree Protective Association held in Plantsville.

On February 1, 2018, Dr. Jatinder Aulakh was elected to serve as co-chair for the Turf and Ornamental section and chair for the extension and teaching session for the WSSA meeting in Oregon 2019 at the Weed Science Society of America meeting held in Arlington, VA.

On February 23, 2018, Mr. Gregory Bugbee was named chairman of the Hydrilla workgroup at a meeting of the Connecticut River Watershed Water Chestnut and Hydrilla Workgroups held at the Valley Laboratory.

On March 5, 2018, Dr. Chris Maier was appointed to the Endangered Species Advisory Committee of the Department of Energy & Environmental Protection by Susan Whalen, Deputy Commissioner of Environmental Conservation.

On March 20, 2018, Dr. Megan Linske was elected Secretary of the Northeast Section of the Wildlife Society.

On March 30, 2018, Ms. Dasha Pokutnaya received an award for second-best presentation for her talk about her work in the Tick Testing Laboratory, under the supervision of Dr. Goudarz Molaei, at the annual meeting and student competition of the Connecticut Entomological Society held at the University of Connecticut.

On March 31, 2018, Dr. Scott Williams was elected President-Elect of the Northeast Section of The Wildlife Society.

On April 16, 2018, Dr. Scott Williams was awarded the John Pearce Memorial Award, which is made by the Northeast Section of The Wildlife Society to Society members in the Northeast for outstanding professional accomplishments in wildlife conservation through contribution of knowledge and leadership over a period of several years in any area of wildlife work, including research, management, administration, or education – as evidenced by publications, skillful development, and/or application of effective management or educational programs or methods.

On April 19, 2018, Dr. Blaire Steven was awarded an Adjunct Assistant Research Professor in the Department of Natural Resources and the Environment, University of Connecticut.

On May 1, 2018, Dr. Megan Linske was accepted into the National Wildlife Society's 2018 Leadership Institute.

On May 6, 2018, Mr. Joseph P. Barsky was elected as Park Naturalist for the Sleeping Giant Park Association.



## THE PUBLIC SPEAKS

In July 2017, Katrina Varner, United States Environmental Protection Agency, Las Vegas, NV, wrote the following to Jason White. “You did an outstanding job of filling us in on applications and implications and can’t wait to find out more regarding an omics approach!”

On July 1, 2017, Alexander Kopper wrote the following about Rose Hiskes. “This letter is to express my appreciation for the outstanding advice and professional services I have received for many years from Rose Hiskes. My wife and I were avid gardeners. Our  $\frac{3}{4}$  acre lot in West Simsbury was landscaped and about 80% planted by us with a wide variety of perennials, annuals, shrubs, trees and roses. I raised over 100 hybrid tea roses which I exhibited, quite successfully, at the Pond House as a member of the CT Rose Society. We are indebted to Rose for her identification and advice for eliminating and controlling pests and plant diseases over the years. My awards for prize roses would not have been possible without her advice. Most recently, just before we sold our home of 45 years, we decided to hire a contractor to plant an extensive lawn for us. We followed his watering and fertilizing instructions carefully. However, when the lawn was coming up, we noticed that it had a mixture of taller and very different grass throughout. I brought samples of this grass in for Rose to examine and identify. She identified them as an invasive grass: Quack Grass. She also gave me instructions on how I could eliminate this grass. However, the grass was so extensive and invasive, that I finally asked the contractor to replant the lawn or give me a refund. He refused. I finally had to resort to filing a lawsuit against the contractor. I used Rose’s professional identification in my claim and I was able to win a judgement against the contractor in Small Claims Court and I was able to collect almost half of what I had paid for the work. Without her professional assistance, I would not have been able to obtain that judgement. My wife and I will be forever thankful for Rose Hiskes and her help over the years.”

On July 14, 2017, Jenny Byers, Edgerton Park Grounds Committee, wrote the following to Yonghao Li. “Thank you, Dr. Li!! Your observations are extremely helpful, and we are very grateful for your expert help. We’re lucky to have you, and the Ag. Station, as near and knowledgeable neighbors!”

On August 2, 2017, Alan Paskewich wrote the following about Lindsay Patrick. “Your presentation was the best to date I’ve heard about the subject of pruning! Providing well defined bold graphic illustrations with a style and a smile that made it easy to follow. What I’m thinking is that your educational talent would be well utilized in other venues as well (not that you may already be busy with CAES) but I’m thinking of the Tree Warden’s Association (which does give workshops affiliated with CAES) and another area would be the UConn Natural Resources department in West Hartford that sponsors similar program education. Just a thought Lindsay. Oh yeh, I almost forgot to ask you my original request to help me find the handouts for pruning techniques as you spoke to and also the Apple tree pruning guide...I have a wild apple tree propagated from a Baldwin rootstock that I cut down 5 years ago and has grown into a fully well proportioned fruiting many clusters to date! I called the AG station in NY close to Cornell...and the scientist there told me it would be difficult to determine what variety it might be...I was hoping it was genetic related to the original stock from the Caucasus Mountains region.”

On September 6, 2017, Jasmine Wolf, conference organizer, “Chronic Lyme Disease: Restoring Balance in the Body,” wrote the following to Jeffrey Ward. “Thank you so much for presenting at our Lyme Disease Conference year after year. As you know, Charlotte and I believe the information you share is extremely valuable to protect the health of people & pets and perhaps the most underused method of prevention of tick-borne illness. Charlotte and I (and Connecticut) are very lucky to have you.”

On September 22, 2017, Ingeborg Venus, President, Federated Garden Clubs of Connecticut, wrote the following to Kirby Stafford. “On behalf of The Federated Garden Clubs of Connecticut, Inc., I would like to extend our appreciation to you for having addressed our over sixty Connecticut Garden Club Presidents

and 35 Board members on September 20, 2017 at Jones Auditorium. Your comments were most illuminating and well received. Thank you again for being available on such short notice.”

On September 22, 2017, Gloria Rothfeld Stelkovich wrote the following about Gale Ridge. “My reason for writing to you today is to relate to you our experience with Dr. Gale Ridge at the CT Agricultural Experiment Station. We came to see Dr. Ridge with some samples of what we thought were bugs, given to us by our daughter. She claims that these bugs have infested her body, (skin, eyes, etc.). Dr. Ridge checked these samples and determined that there were no bugs involved. She then patiently sat down with my husband and I and explained about a condition thought to be caused by long term use of antibiotics, among other causes. Our daughter has chronic Lyme disease and has been on antibiotics for long periods of time. She explained about small thread neuropathy and suggested that Robin consult with Dr. Oaklander at Harvard Medical School and MGH. She then repeated this information in a conference call with our daughter. I cannot think of anyone who has been so generously giving of her knowledge, patience and expertise in all of my almost 90 years of living! My daughter is not the easiest person to convince of something and evidently this condition has built in resistance. We were besides ourselves with confusion, worry, and anxiety about Robin and the horror she is going through. I do not know if she will come around to Dr. Ridge’s view and at least consult with the neurologist suggested, but Dr. Ridge has shown us a path to follow. She did this with the most extraordinary patience, kindness and thoughtfulness. At this point the ball is in Robin’s court. The whole family is behind her with whatever support she needs. I just wanted you to know what an incredible face you present to your community with this scientist and to thank you for having the foresight to have her represent your organization to the public.”

On October 3, 2017, Mrs. Quinn Wade wrote the following about Gale Ridge and Katherine Dugas. “I am writing in regards to bed bugs. My husband and I found a bug in our home several days ago that looked like a bed bug. Because there is so much alarm in regards to these bugs I began to immediately research information on the computer. In my search I spoke to at least 10 people and one person who finally gave me the name of Dr. Gale E. Ridge, Entomologist. After careful research it was my understanding that if you had a concern of a bug you should seek professional information on the bug. Dr. Gale Ridge calmed my fears and after much discussion with her on these bugs I left more relaxed and certainly more informed. Ms. Katherine Dugas who is a lovely young woman is the first person we encountered who believed what I had brought into their lab was a bed bug, but she hurriedly sought the Dr. out for confirmation. Since our meeting I did all the Dr. suggested to keep ourselves feeling more secure in our environment and that all the steps we received from the Dr.’s CCABB informational would help us step by step. We called in the canine group of Ms. Jill Mayer and we are satisfied with the results. I called Dr. Ridge yesterday October 2, 2017 to advise the canine was on his way. I also called her after the evaluation of the results. She was kind enough to ask me to call her once the canine left and I had the results. What a wonderfully kind, patient, informed person you have on staff, Dr. Ridge. She spent considerable time with me and my husband to calm our fears and to direct us in our steps of CCABB. We thank Katherine for being the first person we encountered when we arrived at 123 Huntington Street. When I told her our immediate concern she said “you have come to the right place.” Thank you Katherine. Dr. Ridge we thank you for all of your help. We are so very thankful that you were there when we most needed you to calm us and most of all to inform us.”

On October 11, 2017, Melinda K. Plaisier, Associate Commissioner for Regulatory Affairs, U.S. Food & Drug Administration, wrote the following to Jason White. “On behalf of the Office of Regulatory Affairs (ORA), U.S. Food and Drug Administration (FDA), I would like to extend our sincere congratulations to the Connecticut Agricultural Experiment Station for achieving International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC) 17025 accreditation. As you know, science is the foundation of all of the work that we do. Our partnership with you and other state laboratories plays a vital role in ensuring the safety and quality of the nation’s human and animal food

supply. Consequently, ISO/IEC 17025 accredited state laboratories with increased expertise in methodology capacity advances our collective efforts to protect public health. In supporting our state laboratory partners in achieving IO/IEC 17025 accreditation, together we are actively promoting the goals of the Food Safety Modernization Act. One of these major goals is to build a national Integrated Food Safety System (IFSS), of which laboratory capacity is a critical component. As we move closer toward this seamless partnership of an IFSS, you have taken an important step in this process by ensuring the equivalency of your laboratory results to that of any other accredited laboratory. With the development of this wide network of ISO/IEC 17025 accredited laboratories, the framework of mutual reliance among FDA and our state laboratories is taking form. Again, congratulations on this important achievement. We look forward to continuing our collaboration with Connecticut Agricultural Experiment Station to advance the IFSS and protect the nation's human and animal food supply."

On November 14, 2017, Kelly Lenz from Cheshire Public Schools wrote the following to Joseph P. Barsky. "Thank you for "hearing" the call and making time to participate in Sophomore Career Day this year! We know how much effort it takes to rearrange schedules and prioritize challenging workloads. By being here today, you show kids they matter. Thank you again for sharing information about your career because by doing that, you open up the world of what is possible for our students. "Listening" to professionals in addition to educators serves to link what they are learning to what they can become."

On November 16, 2017, Karen Bennett, UNH Cooperative Extension, Durham, NH, wrote the following to Jeffrey Ward. "Many thanks for your wonderful presentations at the Mixed Oak-Hickory session of the silviculture institute. I learned a lot as did our attendees. The field trip was great and you and Mark made a great team. I also appreciate your help planning this session back when we responded to the RFP. The work we did back then really paid off. And my last appreciation is for your good and meticulous work on the red oak booklet. I am getting much good feedback about it."

On December 18, 2017, Duane W. Greene, Stockbridge School of Agriculture, University of Massachusetts, Amherst, wrote the following to Quan Zeng. "I want to thank you very much for taking the time at this very busy time of the year to share your thoughts with us on understanding and controlling fire blight. You did an excellent job and I know that many of the audience did appreciate hearing your presentation. Fire blight has emerged as a major disease here and hopefully you will continue to continue your work on providing better understanding and controls of it. I was sorry that I did not have any time to interact with you but being session chairperson is somewhat confining. The NEVFC occurs every other year. It would be wonderful if you could attend this event in coming years to interact with the growing community. I hope that your return trip was uneventful and you did not encounter any poor weather on your return to Connecticut. Thank you for doing a great job in making a presentation on one of our most difficult and harmful diseases."

On February 9, 2018, Judy Stone, Garden Committee Chairperson, Dudley Farm Museum, North Guilford, wrote the following about Rose Hiskes, Scott Williams, and Victoria Smith to fellow gardeners. "As I was looking for information on cover crops and pasture seed mixtures, I came across the following--an analysis of clover seed from 1908. Not 2018! And that was when clover was valued for both pastures and lawns. As it should be, for soil health and pollinators. We are so privileged to have this resource so close. I have gone in frequently to Huntington St., New Haven, and even if you don't go into New Haven for any other reason, do visit--take a sample of something that you are puzzled by. You can also email pictures to them but nothing like doing it in person. Free soil samples, ID of insects, plants, info on critters, powerful microscopes to blow up your insect into a sci fi movie star! And while you are there, visit the community garden at Edgerton Park, just down the street, and the wonderful greenhouses open all year. This article from the past gives you an idea of how detailed the research is, and in my experience there is no question that they have not responded to. Keep in mind Plant Science Day at Lockwood Farm in Hamden in midsummer. <http://www.ct.gov/caes/lib/caes/documents/publications/bulletins/b160.pdf>.

Recently I realized that I might be seeing emerald ash borer damage on my walks and unfortunately--after I sent pictures--it was the case. Their current website: <http://www.ct.gov/caes/site/default.asp>. I also call your attention to "Ladybug" <http://www.ladybug.uconn.edu/>, with all kinds of great information. You can sign up online to get their info. I am cc'ing a few of the folks at the Ag Station who have helped me out--thanks!

And do let your state reps know that you value these services--they should not be taken for granted."

On February 14, 2018, Kathleen Archambault wrote the following to Yonghao Li. "I wanted to thank you for your speedy response to my inquiry about a problem with my Tide Hill boxwood plants. I am so relieved to note that it is matter of winter kill not a blight! You were so nice to take the time to look at the plant right away after your seminar. I cannot thank you enough!!! Your assistant is really sweet and was very nice to me both days."

On March 6, 2018, Chris Frattarola wrote the following to Goudarz Molaei. "Thank you. This is the second tick I've sent in and you give me piece of mind. Four members of my immediate family and my wife have all been diagnosed with Lyme disease and I count myself lucky not to have been. I'm glad to have my tax payer dollars going to fund a great service that you provide."

On March 8, 2018, Laura Sorensen, Orchard Valley Garden Club, Southington, wrote the following to Yonghao Li. "On behalf of The Orchard Valley Garden Club of Southington, I wish to express my thanks for your informative presentation. You were able to demystify the subject of pruning, a topic which can make even the most experienced gardener feel nervous. The number of questions heard from the floor was a good indication that people were interested and engaged in your talk. I also received positive feedback from our members. We had several guests in attendance specially to hear you, which resulted in three new members for our club!

On March 29, 2018, Gordon W. Kenneson wrote the following to Diane Riddle. "In all the years I have been associated with the Experimental Station, from Dr. Taylor to Dr. Rathier to being asked to help design some of the grounds I have always been grateful and impressed. Those feelings have NOT dimmed one iota. I cannot believe the rapid turnaround on the requested soil test especially at this time of year. I was warned to be prepared for a wait of two weeks to two months for a return. Three days is flabbergasting. Thank you so much."

On March 30, 2018, Karen Hatcher wrote the following to Diane Riddle. "Wow – you got these soil test results to me in three days – actually, two and a half – that's impressive. Thank you so much. I mentioned the first time I came in how fortunate I feel having the AES in my hometown of Windsor, and now I am fortunate for having a staff member who is so responsive and efficient. Now – if I can just translate my good fortune into better soil and happier plants! But at least you have given me a very good start on that."

On April 9, 2018, Bruce Baker wrote the following about Yonghao Li. "I want to thank the Station and most recently Yonghao Li for their great service to the public. The Station has given me personally and patients I have seen much invaluable service for many years. (Re: patients – When Ken Welch was there we would discuss the issue of people who came in with fomite complaints.) Over the past several years Yonghao Li has been most generous with very helpful advice on my landscape trees and shrubs. He is consistently willing to help and gives very accurate advice."

On April 16, 2018, Jennifer Dacey, Technical Director, Waltham Services, wrote the following about Gale Ridge. "I wanted to thank you for allowing Dr. Gale Ridge to speak about Delusionary Parasitosis at our customer symposium last week. She spoke to a diverse audience, including representatives from the housing industry. She was also kind enough to answer additional questions on bed bugs. The property managers present were extremely impressed with her knowledge and grateful that she was able to share

her expertise with them. Dr. Ridge is an excellent representative of the Connecticut Agricultural Experiment Station and an extremely valuable resource to our community.”

On April 17, 2018, Joslyn Pollock, Arbor Services of CT, Inc., wrote the following to Yonghao Li. “Yes that is great information, thank you for that. You and the CT AG Station are a great resource for our business all these years. When I send in our annual donation, I will earmark it for your lab.”

On April 19, 2018, Taryn Donovan wrote the following to Goudarz Molaei. “Thank you so much!!! I can’t begin to explain how grateful I am that this service is provided to CT residents. Many thanks for the great work that you and your lab staff do every day.”

On April 27, 2018, Ann Beaudin, Chair, Windsor Conversation Commission, wrote the following to Richard Cowles. “In behalf of the Windsor Conservation Commission, I extend our gratitude to you for providing your valuable time and expertise at our Forum on Pollinators. Your presentation provided our audience with perspectives and studies on various causes of the impacts to the Bee population. It also gave insights into the life span and life trajectory of these pollinators. Most importantly, it outlined ways people can create more inviting habitats to attract and protect pollinators. Your information was of intrinsic value to all of us interested in protecting the environment and creating viable habitats for pollinators, which affects our ecosystems crops, trees, and landscape. Those of us who live in Windsor and have had occasion to tap into CAES, respect and highly regard the work all of you at the Experiment Station do.”

In May 2018, Don Mitchell, Director of Health, Chatham Health District, wrote the following to Goudarz Molaei. “Thank you so much for coming to speak to our group in Hebron on May 7th. Everyone remarked on how knowledgeable you are and even more so, how nice you are! Your presentation was greatly appreciated.”

On May 29, 2018, Arun Sathyagal wrote the following to Goudarz Molaei. “Thank you very very much for emailing me the results. I forgot the form and realized it at the post office. Hurriedly I inserted a piece of paper with my contact information. Thanks for following up on it. Appreciate all that you do.”

In June 2018, Dr. Tahia Thaddeus Kamp, Assistant Director, Franke Program in Science and Humanities, Yale University, wrote the following to Goudarz Molaei. “Your supererogatory efforts on behalf of my family deserve, at the least, a special note of gratitude; we are all so thankful for your professionalism, expertise, and kindness. It is very rare to find someone who is both knowledgeable and generous with that great knowledge, and you are both. We understand how fortunate we are to have you as a resource, and while we hate to have occasion to see you so frequently, it is always a pleasure to be in your company.”

On June 2, 2018, Ashish Singh wrote the following to Goudarz Molaei. “Thank you very much for performing the analysis and this report. This is a wonderful service that you provide for the residents of Connecticut.”

On June 8, 2018, Joan Kliger wrote the following to Goudarz Molaei. “I want to extend my gratitude to you and CAES for so promptly testing the lone star tick that I brought in. I sincerely appreciate the concern and expertise of your laboratory. It is reassuring to know that the historic and respected CAES is so conveniently accessible to the public. Thank you.”

On June 18, 2018, Susan Gray wrote the following to Yonghao Li. “Thank you so much for your quick response. It is a great service that you provide. My partner works for the DEEP Wildlife Diversity Program, so I know how you can be overwhelmed by requests from the public. This has been something I

have wanted to do for a while. I will read the information and if I have any further questions, I will email you.”

On June 21, 2018, Chrissie Desopo wrote the following to Rose Hiskes. “Rose! Thank you so much for the information. Very helpful and I think we can help these topiaries out! You are the best!”

On June 25, 2018, Katie O’Leary wrote the following to Goudarz Molaei. “Thank you so much. This is a terrific service that relieves a ton of worrying and a whole lot of guessing.”

On June 26, 2018, Bob Sandstrom wrote the following to Goudarz Molaei. “Thank you so much for responding to my tick inquiry. I am sorry that I sent it to the wrong place. But, I am grateful to you for analyzing this tick. We used to live in CT, so I must have just copied the CT address instead of the out-of-state address from NY. I appreciate your time and analysis on this tick. Good to know. I have had Lyme disease and Ehrlichiosis, so I was treated at Westchester Medical Center and was in a research study for 10 years there in the 1990s. Thanks again for taking the time for calling me, sending this data sheet and your analysis of the tick. I appreciate it!

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, 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 (ad-hoc), FDA Food Emergency Response Network (FERN) Method Coordination Committee (MCC)
- Member, FDA Flexible Funding Model (FFM) Workgroup

BRIAN D. EITZER

- Member, Conservation Commission for the Town of Bethany
- Member, Regional Water Authority Representative Policy Board
- Member, Organizing Committee for the North American Chemical Residue Workshop

CHRISTINA S. ROBB

- Board Member, Eastern Analytical Symposium (Program Vice-Chair 2017, Program Chair 2018)

DEPARTMENT OF ENTOMOLOGY

KIRBY C. STAFFORD III

- Member, Board, Connecticut Coalition Against Bed Bugs

- Member, Tick IPM Working Group
- Ph.D. Graduate Advisor, Megan Linske, University of Connecticut, Storrs
- 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

#### CHRIS T. MAIER

- Curatorial Affiliate in Entomology, Peabody Museum of Natural History, Yale University
- Member, Advisory Committee, Cooperative Agricultural Pest Survey, USDA
- Member, Advisory Committee, 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
- Assistant Clinical Professor, Department of Medical Sciences, Frank H. Netter MD School of Medicine, Quinnipiac University
- 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 Protective Association, Chair Education Committee

#### VICTORIA LYNN SMITH

- Member and Past President, Eastern Plant Board
- 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
- 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



## DEPARTMENT OF ENVIRONMENTAL SCIENCES

### DR. JOSEPH J. PIGNATELLO

- Editorial Board, *Molecules*
- Editorial Board, *Environmental Engineering Science*
- Agriculture, Food & Nutrition Technical Board Chair, Connecticut Academy of Science and Engineering

### DR. PHILIP 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
- Chair, Executive Council of the American Committee on Medical Entomology
- Guest Editor, *PLOS Neglected Tropical Diseases*

### DR. 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

### MR. GREGORY J. BUGBEE

- Panelist, Northeast Aquatic Nuisance Species Panel
- Chairman, Connecticut River Hydrilla Working Group
- Director, Clear Lake Improvement Association
- Contributor for CT updates, *Northeast Aquatic Plant Management Society Newsletter*

### DR. GOUDARZ MOLAEI

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

### MR. JOHN SHEPARD

- Treasurer, Northeastern Mosquito Control Association

### DR. BLAIRE STEVEN

- Adjunct Assistant Research Professor, Department of Natural Resources and the Environment, University of Connecticut

### MR. MICHAEL THOMAS

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

## DEPARTMENT OF FORESTRY AND HORTICULTURE

### JEFFREY S. WARD

- Immediate Past Chair, New England Society of American Foresters
- Secretary, Connecticut Tree Protection Examination Board

- Member, Audubon Connecticut Science Committee
- Ex-Officio Member, Goodwin Scholarship Committee

JOSEPH P. BARSKY

- Vice Chair, State Consulting Committee for Agricultural Science and Technology Education
- Editor, NESAF News Quarterly, New England Society of American Foresters
- Park Naturalist, Sleeping Giant Park Association
- Member, Consulting Committee, Vernon E. Cleaves Agricultural Science and Technology Program
- Member, Connecticut Environmental Review Team

MARTIN P. N. GENT

- 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
- President Elect, 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
- Commissioner, 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

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, Southern Connecticut State University
- Member Thesis, Advisory Committee, University of Texas at El Paso
- Member Thesis, Advisory Committee, Federal University Lavras, Brazil

FRANCIS J. FERRANDINO

- Member, Connecticut Wine Council
- Member, Science/Education Committee, Connecticut Wine Council

YONGHAO LI

- Member, Christmas Tree Improvement Committee, Connecticut Christmas Tree Growers Association
- Member: Scholarship Committee, Connecticut Nurseryman's Foundation

ROBERT E. MARRA

- Member, Phytopathology Committee, Mycological Society of America
- Member, Forest Pathology Committee, American Phytopathological Society
- Mentor and member, Advisory Committee, Southern Connecticut State University
- Member, Connecticut Conference on Natural Resources Steering Committee. Founding Member
- President, Executive Committee, Northeastern Division, American Phytopathological Society

NEIL P. SCHULTES

- Fellow, Linnaean Society of London
- Vice President & Executive Board Member, Quinnipiac Chapter of Sigma Xi

LINDSAY R. TRIPLETT

- Associate Editor, *Phytopathology*
- Associate Editor, *Phytobiomes*
- Faculty Affiliate, Colorado State University
- Adjunct Faculty, Quinnipiac Netter School of Medicine
- Member, APHIS Widely Prevalent Bacteria Committee
- Member, National Academy of Science Advisory Committee on Citrus Greening Disease
- Member, Thesis Advisory Committee, Michigan State University
- Chair, Bacteriology Committee, American Phytopathological Society

QUAN ZENG

- Immediate Past Chair, Bacteriology Committee, American Phytopathological Society

VALLEY LABORATORY

CAROLE CHEAH

- Fellow, Cambridge Philosophical Society, UK

RICHARD S. COWLES

- Connecticut Entomological Society (co-President, 2016 to 2017)

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*
- Chair, 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
- GLOBAL Globodera Alliance Advisory Board
- American Phytopathological Society Professional Development Forum
- Chair, Northeastern American Phytopathological Society Division Forum

DEWEI LI

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

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.

### ANDREADIS, THEODORE G.

- Participated in a meeting of Connecticut's Invasive Plant Council held at the Valley Laboratory in Windsor *July 11, 2017*
- Was interviewed about the first detection of West Nile virus in mosquitoes this season in West Haven by Renee Chmiel, WTNH TV 8 *July 12*
- Was interviewed about Plant Science Day 2017 by Ray Andrews, WQUN AM 1220, in Hamden *July 25*
- Was interviewed about the detection of West Nile virus in four new Connecticut towns by Charlotte Liber, WSHU Public Radio *July 26*
- Presided over a quarterly meeting of the Station's Board of Control held at Lockwood Farm *August 2*
- Participated in a press conference held at the Station with Senator Richard Blumenthal concerning ticks and the rising incidence of tick-borne diseases in Connecticut *August 9*
- Was interviewed about the current status of ticks and tick-borne diseases in the state and the Station's Tick Testing Program by Matt McFarland, WFSB, Hartford *August 9*
- Was interviewed about the Station's research, surveillance, and diagnostic services and programs by Eric Clemons, Comcast Newsmakers *August 9*
- Met with Dr. Sonny Ramaswamy, Director of the National Institute of Food and Agriculture (NIFA), at UCONN in Storrs, and gave an overview of the Station's research, regulatory, and public service programs *August 14*
- Was interviewed about the prevalence of Lyme disease and other tick-related human disease cases in Connecticut by Greg Hladky, Hartford Courant *August 15*
- Hosted a group of physicians from the Department of Emergency Medicine Yale School of Medicine, and gave an overview of the Station's research, regulatory, and public service programs (12 attendees) *August 23*
- Attended a reception for Sonny Perdue, US Secretary of Agriculture, held at Prides Corner Farms in Lebanon *August 31*
- 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 26*
- Hosted State Senators Kevin Kelly, George Logan, Tony Hwang, and State Representatives Jason Perillo and Ben McGorty and gave an overview of the Station's research, regulatory, and public service programs followed by a tour of several laboratories *October 2*
- Presented a seminar entitled "Reflections on the ecology and epidemiology of mosquito-borne viruses in Connecticut: an analysis from 20 years of research and surveillance" to the Department of Biology at Fordham University in New York (25 attendees) *October 4*
- Presented an update on Station activities at a Board Meeting of the Experiment Station Associates *October 11*
- Presented an invited talk entitled "Ecology and epidemiology of mosquito-borne viruses in Connecticut" at the annual meeting of the Connecticut Valley Branch of the American Society of Microbiology held at UCONN in Storrs (50 attendees) *October 13*
- Presided over a quarterly meeting of the Station's Board of Control held at the Valley Laboratory in Windsor *October 18*

- Attended the 65<sup>th</sup> Annual Meeting of the Entomological Society of America and presented an invited symposium talk entitled “Evolutionary strategies and adaptations for survival among mosquito parasitic microsporidia: evidence for coevolution and host switching” and attended an Editorial Board Meeting of the *Journal of Medical Entomology* held in Denver, CO *November 5-8*
- Participated in a meeting of Connecticut’s Invasive Plant Council held in Hartford *November 14*
- Attended the annual meeting of the Connecticut Farm Bureau held in Wallingford *November 17*
- Presented a talk entitled “The Northeast Regional Center for Excellence in Vector-Borne Diseases” at the 63rd Annual Meeting of the Northeastern Mosquito Control Association held in Plymouth, MA (180 attendees) *December 5*
- Was interviewed about current concerns and priorities regarding mosquitoes and mosquito-borne diseases in the Northeast, important points residents in the region should know, and basic recommendations for mosquito control and prevention by Jolene Hansen, representing a corporate client, Amdro *December 17*
- Presided over a quarterly meeting of the Station’s Board of Control held in Hartford *January 19, 2018*
- Hosted and participated in the first annual meeting of the Northeast Regional Center for Excellence in Vector-Borne Diseases, held at the Station (75 attendees) *January 26*
- Presented an update on Experiment Station activities at a meeting of the Experiment Station Associates Board of Directors in Jones Auditorium (8 attendees) *January 31*
- Participated in a meeting of the Connecticut Invasive Plant Council held at the Valley Laboratory in Windsor *February 13*
- Attended a meeting of Connecticut Agricultural Leaders held at the Connecticut Farm Bureau in Rocky Hill *February 15*
- Participated in a round table discussion with Dr. Anne Schuchat, Acting Director of the Centers for Disease Control and Protection, held at Yale University *February 22*
- Presented an invited talk entitled “*The Northeast Regional Center of Excellence in Vector-Borne Diseases*” at the 84th Annual Meeting of the American Mosquito Control Association held in Kansas City, MO (800 attendees) *February 26-28*
- Participated in the spring meeting of the Northeastern Regional Association of State Agricultural Experiment Station Directors held in Arlington, VA *March 5-7*
- Attended the joint UConn/CAES collaborative meeting held at the University of Connecticut in Storrs *March 12*
- Attended a breakfast meeting with U.S. Senator Chris Murphy held in Cheshire *March 19*
- Presented a keynote address entitled *Reflections on the Ecology and Epidemiology of Mosquito-Borne Viruses in Connecticut: An Analysis from 20 Years of Research and Surveillance* at the 15th 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 20-22*
- Participated in a press conference held at the Station with US Senator Richard Blumenthal concerning ticks and the rising incidence of tick-borne diseases in Connecticut *April 4*
- Hosted Governor Dannel Malloy and presided over a quarterly meeting of the Station’s Board of Control held at the Station *April 11*
- Presented welcoming remarks and an update on Experiment Station activities at the Annual Meeting of the Experiment Station Associates held at the Station *April 11*
- Participated in a meeting of principal investigators of the five Regional Centers of Excellence in Vector-Borne Diseases held at the Centers for Disease Control and Prevention Division of Vector-Borne Diseases in Fort Collins, CO *April 18-19*
- Was interviewed about the Experiment Station’s research and surveillance programs on ticks, mosquitoes, and associated vector-borne diseases in the state by Aaron Kupec, WTIC Radio *May 16*

- Participated in a “boot camp” workshop on identification of mosquitoes sponsored by the Northeast Regional Center of Excellence in Vector-Borne Diseases held at Fordham University’s Calder Center in Armonk, NY (20 student attendees) *May 23*
- Hosted an informational meeting held at the Station between faculty from the University of Connecticut’s Department of Pathobiology and scientists from CAES’s Center for Vector Biology & Zoonotic Diseases to discuss potential research collaborations (15 attendees) *May 31*
- Participated in the joint summer meeting of the Northeastern Regional Association of State Agricultural Experiment Station and Extension Directors held in Bethany Beach, DE *June 4-7*
- Presented welcoming remarks and an overview of the Experiment Station and its various research, regulatory, and public service programs to a group of students from Central Connecticut State University (12 attendees) *June 20*
- Was interviewed about mosquito control and personal protection by Sam Kantrow, WTNH TV 8 *June 25*
- Was interviewed about the CAES tick testing program and the increased prevalence of *Borrelia burgdorferi*, the agent of Lyme disease, in tick specimens submitted by state residents by Greg Hladky, Hartford Courant *June 25*
- Presented an update on CAES activities at a Board Meeting of the Experiment Station Associates held at the Station *June 27*
- Was interviewed about the current status of mosquitoes, ticks, and associated vector-borne diseases in the state and the research and surveillance activities of the Station’s Center for Vector Biology & Zoonotic Diseases by Steve Kotchko, Connecticut Radio Network *June 28*

#### ARMSTRONG, PHILIP M.

- Was interviewed about the mosquito trapping and testing program by News Channel 3 *July 3, 2017*
- Was interviewed about the detection of West Nile virus in Connecticut by the Connecticut Post *July 11*
- Was interviewed about the detection of West Nile virus in Connecticut by WTIC News Radio *July 11*
- Was interviewed about the detection of West Nile virus in Connecticut by News Channel 12 *July 11*
- Was interviewed about the rapid increase and spread of West Nile virus activity in Connecticut by WNPR *August 24*
- Was interviewed about the rapid increase and spread of West Nile virus activity in Connecticut by News Channel 8 *August 24*
- Gave a talk entitled “Zika virus and mosquitoes: assessing the threat” to the Mystic Aquarium in Mystic (30 attendees) *October 4*
- Gave a presentation entitled “Northern range expansion of the Asian tiger mosquito” at the Northeastern Epidemiology Conference held in Northampton, MA (50 attendees) *October 19*
- Was interviewed about the extended mosquito season this year by the Connecticut Post *October 19*
- Gave a talk entitled “Northern range expansion of the Asian tiger mosquito (*Aedes albopictus*): analysis of mosquito data from Connecticut USA 1997-2006” (approx. 100 attendees) and organized a symposium “New and young investigators in medical entomology” at the Annual Meeting of the American Society of Tropical Medicine and Hygiene held in Baltimore, MD *November 6-7*
- Gave a talk entitled “Northern range expansion of the Asian tiger mosquito (*Aedes albopictus*): analysis of mosquito data from Connecticut USA” at the Annual Northeastern Mosquito Control Association Meeting held in Plymouth, MA (approx. 100 attendees) *December 5*
- Gave a lecture entitled “Dengue and Other Arboviral Diseases” for the Principles of Infectious Diseases course held at the Yale School of Public Health (30 attendees) *January 30, 2018*
- Served as chair and presented his research at the NE1443: Biology, Ecology, & Management of Emerging Disease Vectors Regional Project Meeting in St. Augustine, FL (30 attendees) *March 22*
- Gave a lecture entitled “Regional Vector-Borne Diseases and Emerging Threats” for the Vector

- Biology Bootcamp Course held at the Louis Calder Center in Armonk, NY (40 attendees) *May 22*
- Presented his research and met with University of Connecticut faculty at a meeting on vector-borne diseases held at CAES (20 attendees) *May 31*
- Was interviewed about the statewide mosquito and arbovirus surveillance program, West Nile virus, the Asian Tiger mosquito, and other mosquito-related issues affecting Connecticut residents by the Connecticut Post *June 5*
- Was interviewed about the statewide mosquito and arbovirus surveillance program, West Nile virus, the Asian Tiger mosquito, and other mosquito-related issues affecting Connecticut residents by WNPR *June 5*
- Was interviewed about the statewide mosquito and arbovirus surveillance program, West Nile virus, the Asian Tiger mosquito, and other mosquito-related issues affecting Connecticut residents by Fox 61 News *June 6*
- Was interviewed about the statewide mosquito and arbovirus surveillance program, West Nile virus, the Asian Tiger mosquito, and other mosquito-related issues affecting Connecticut residents by the Stamford Advocate *June 14*
- Was interviewed about the statewide mosquito and arbovirus surveillance program, West Nile virus, the Asian Tiger mosquito, and other mosquito-related issues affecting Connecticut residents by WTIC *June 26*

#### AULAKH, JATINDER S.

- Conducted a demonstration on non-native invasive plants and answered the weed identification and management inquiries at Plant Science Day in Hamden *August 2, 2017*
- Gave a talk on management of perennial weeds at the Connecticut Christmas Tree Growers Twilight meeting at Keneally Christmas Tree Farm in Easton *August 29*
- Participated in the Connecticut Invasive Plant Working Group steering committee meeting held at the Valley Laboratory in Windsor *October 5*
- With Mr. Thomas Rathier and Ms. Rose Hiskes, gave a Pesticide Applicator Certification training session to Christmas tree growers at the Valley Laboratory in Windsor (26 attendees) *October 12*
- Participated in the IR-4 Ornamental Horticulture Workshop held in San Diego, CA *October 17-19*
- Participated in the Connecticut Invasive Plant Working Group steering committee and Invasive Plant Council meetings held at the Valley Laboratory in Windsor *November 14*
- Attended and served as a judge for the NEPPSC graduate student poster competition at the Northeastern Pest, Plant and Soil Conference held in Philadelphia, PA *January 8-12, 2018*
- Presented a research paper entitled “Response of Some Herbaceous Ornamentals to Two Pre-packaged Herbicide Mixtures” at the Weed Science Society of America meeting held in Arlington, VA (~60 attendees) *January 28-February 2*
- Presented a talk entitled “Chemical control of invasive plant species” and a research demonstration “Herbicide application techniques for invasive plant control” at the Invasive Plant Control Workshop held at the Valley Laboratory in Windsor (89 participants) *June 12*
- Participated in the CT Invasive Plant Working Group (CIPWG) meeting *June 19*
- Spoke about weed management and backpack sprayer calibration at the CCTGA twilight meeting (25 attendees) *June 19*

#### AYLOR, DONALD E.

- Was a judge for the Connecticut Tech Challenge held in Bristol where teams of engineering students from colleges throughout Connecticut competed by designing a technological solution to reduce waste in the farm-to-table food delivery chain (50 undergraduate students participated) *November 16, 2017*
- Was a judge for finalists in the Physical Sciences at the Connecticut Science Fair held at Quinnipiac University in Hamden (18 students participated) *March 15, 2018*



BARSKY, JOSEPH P.

- Served as a judge for the FFA Regional Agriscience Fair held in West Springfield, MA (10 students, 3 teachers) *September 15, 2017*
- Participated in the Executive Committee meeting of the New England Society of American Foresters held in Concord, NH *September 19*
- Staffed a CAES display at the Brooksville Fall Festival in Hamden (50 visitors) *September 30*
- Participated in a STEM panel group presentation during the Cheshire High School Career Day (61 students) *November 14*
- Participated in a New England Society of American Foresters Executive Committee quarterly meeting via conference call *December 14*
- Participated in the Quarterly Executive Committee Meeting of the New England Society of American Foresters *January 26, 2018*
- Attended the NESAF annual meeting and, with Dr. Jeffrey Ward, presented a research poster on “Influence of crop tree release on black birch growth” in Nashua, NH (25 attendees) *March 26-29*
- Participated in the triennial review of the Middletown High School Regional Agriscience Program *April 25*
- Staffed a Natural Resources Career booth at the North Branford High School Environmental Science Fair (10 students, 5 teachers) *May 4*
- Participated in an Executive Committee meeting of the New England Society of American Foresters in Concord, NH *June 13*

BLEVINS, TIA M.

- Attended the 2017 HIS-Eastern Chapter’s Interstate Inspection held in College Park, MD. Participants discussed Pennsylvania’s boxwood blight compliance agreements and issues dealing with exporting to PA. The group reviewed the process for addressing non-conformance in SANC (Systems Approach to Nursery Certification) program facilities. Attendees toured three USDA/APHIS facilities; The National Agricultural Library, Plant Germplasm and Quarantine Facility, and the US National Arboretum South Farm (22 participants) *October 24-26, 2017*
- Participated in the 37th annual Horticultural Inspection Society, Eastern Chapter’s meeting in Worcester, MA. As Treasurer, she presented the financial report to the members *April 11-14, 2018*

BRACKNEY, DOUGLAS E.

- Gave a talk entitled “Successive bloodmeals enhance virus dissemination within mosquitoes and increase transmission potential” at the Northeast Regional Center for Excellence in Vector-Borne Diseases Annual Symposium at CAES (approx. 75 attendees) *January 26, 2018*
- Gave a seminar entitled “Journey to transmission: an arbovirus tale” to students and faculty at Quinnipiac University (approx. 70 students) *April 9*

BRANSFIELD, ANGELA B.

- Participated in the Federal Select Agent Program’s SAMS training webinar *July 11, 2017*

BRAVO, JOAN L.

- Was interviewed about the effect of weather on when grapes ripen by WTNH Connecticut *August 25, 2017*

BUGBEE, GREGORY J.

- Spoke on “Control of curlyleaf pondweed” to members of the Crystal Lake Association, Senator Len Suzio, and CT DEEP legislative liaison Lee Sawyer in Middletown (10 attendees) *July 20, 2017*
- Spoke on the 2016 CAES IAPP plant surveys of Bashan Lake and progress on control of phragmites

and variable watermilfoil to the Bashan Lake Association at the Old Town Hall in East Haddam (approx. 60 attendees) *July 26*

- Gave a talk entitled “Connecticut’s invasive aquatic plant problem: the state of the state” at a meeting of the Friends of Bolton Lakes held at the Newhoca Lodge in Vernon (approx. 60 attendees) *July 27*
- Gave a talk entitled “Pond weed management” at a symposium on irrigation water for nursery crops sponsored by UCONN Extension Service and held at the Valley Laboratory in Windsor (approx. 50 attendees) *August 15*
- Was interviewed about aquatic weed problems in Lake Zoar by the Connecticut Post *August 18*
- Reported on the 2017 CAES aquatic plant survey of Besock Lake at a meeting at the Middlefield Community Center; in attendance were Middlefield First Selectman Edward Bailey, Senator Len Suzio, and State Representative Buddy Altobello *September 27*
- Was interviewed about invasive aquatic plants in nearby lakes by the Danbury News-Times *October 3*
- Gave a talk entitled “What your soil needs to support a healthy landscape” at the Healthy Yards Workshop sponsored by the Town of Greenwich (approx. 75 attendees) *October 18*
- Gave a seminar entitled “Plant management in farm ponds” as part of the University of New Hampshire, Farm Irrigation Pond Management Meeting Series held in Goffstown, New Hampshire (approx. 25 attendees) *November 28*
- Presented the results of the 2017 CAES Aquatic Plant Survey of Pachaug Pond to the Pachaug Pond Association at the Griswold Town Hall (approx. 60 attendees) *November 29*
- With Ms. Abigail Wiegand, presented the results of the 2017 CAES Aquatic Plant Survey of Lake Housatonic at a meeting of the Lake Housatonic Authority held at the New Haven Rowing Club in Oxford (approx. 20 attendees) *November 30*
- With Ms. Summer Stebbins, proctored the multistate aquatic license recertification program at the Northeast Aquatic Plant Management Society meeting in New Castle, NH *January 9-11, 2018*
- With Ms. Summer Stebbins, gave two Invasive Aquatic Plant Workshops as part of the 2018 Envirothon held at Goodwin Community College in East Hartford (approx. 70 attendees) *February 10*
- Gave a talk entitled “Container Gardening Indoors and Out” to the Caudatowa Garden Club in Ridgefield (approx. 45 attendees) *February 13*
- Spoke on CAES IAPP lake surveys to the South Central Connecticut Regional Water Authority Land Use Board at their headquarters in New Haven (approx. 12 attendees) *February 21*
- Hosted a meeting of the Connecticut River Watershed Water Chestnut and Hydrilla Workgroups at the Valley Laboratory, spoke to the Hydrilla workgroup on “Hydrilla Morphology, Reproduction and Distribution in Connecticut,” and was named chairman of the Hydrilla workgroup (approx. 25 attendees) *February 23*
- Gave a talk entitled “Connecticut’s Invasive Aquatic Plant Problem – The State of the State” at the Connecticut Conference on Natural Resources held at the University of Connecticut, Storrs (approx. 40 attendees) *March 12*
- Gave a talk entitled “Container Gardening Indoors and Out” to the Newtown Town and Country Garden Club (approx. 40 attendees) *March 14*
- Gave a talk entitled “Container Gardening Indoors and Out” as part of the Cheshire Public Library speaker series (approx. 40 attendees) *March 19*
- Spoke on soil testing and invasive aquatic plants to a tour group from The Stamford Regional Agriscience and Technology Center (6 attendees) *March 26*
- With Ms. Summer Stebbins, presented the results of CAES IAPP invasive aquatic plant monitoring of Lakes Candlewood, Lillinonah, Zoar, and Squantz Pond to the FirstLight Power working group and FirstLight Power Headquarters in New Milford (approx. 12 attendees) *March 29*
- With Ms. Summer Stebbins, gave a seminar on invasive aquatic plants at Three Rivers Community

- College in Norwich (approx. 40 attendees) *April 4*
- With Mr. Michael Cavadini, proctored the Herpetology event at the Science Olympiad at Robbins Middle School in Farmington (approx. 40 attendees) *April 21*
- With Ms. Summer Stebbins, reported on the 2017 Aquatic Plant Survey of Taunton Lake at the Newtown Public Library (approx. 20 attendees) *April 26*
- With Ms. Abigail Wiegand, spoke on the results of the CAES 2017 Aquatic Plant Survey of Lake Forest at the annual meeting of the Lake Forest Association in Bridgeport (approx. 50 attendees) *May 2*
- Participated as a judge in the Future Farmers of America Science Fair held in Jones Auditorium *May 3*
- Spoke on control of phragmites in Columbia Lake at a special meeting of the Columbia Board of Selectman held at Yeoman's Hall (approx. 50 attendees) *June 7*
- Spoke on "Invasive Aquatic Plants in Lakes" on a pontoon boat at Lake Beseck Day (approx. 12 attendees) *June 16*
- Provided scientific expertise at a meeting on invasive aquatic plants in Crystal Lake in Middletown called by State Senator Len Suzio (approx. 10 attendees) *June 28*

#### CHEAH, CAROLE A.

- Was interviewed about the renewal of the biological control of the HWA program in Connecticut through small scale releases of *Sasajiscymnus tsugae* (donated by Tree-Savers, Greentown, PA) by Bob Miller of the Danbury News-Times *July 24, 2017*
- Was interviewed about mile-a-minute detection in the Town of Monroe by Marven Moss for the Trumbull Daily Voice and the Monroe Courier *September 15*
- Was interviewed about biological control of mile-a-minute weed in Greenwich and the rest of Connecticut by Jennifer Turiano of the Greenwich Time *September 26*
- Was interviewed by John Burgeson of the Connecticut Post on the effects of the recent cold outbreak on hemlock woolly adelgid *January 23, 2018*
- Presented a CAES Seminar entitled "Climate Impacts on Hemlock Woolly Adelgid in the Northeast" in Jones Auditorium (50 attendees) *January 31*
- Was interviewed about hemlocks and hemlock woolly adelgid by William Hobbs of The Day *February 2*
- Was interviewed about hemlocks and hemlock woolly adelgid by the Experiment Station Associates *February 5*
- Was interviewed about the effects of the recent cold outbreak on hemlock woolly adelgid by Will Langhorne for the Yale Daily News *February 14*
- Gave a presentation on hemlocks and other trees under siege to the New Hartford Land Trust (25 attendees) *February 22*
- Attended and presented a summary of research at the joint UConn/CAES collaborative meeting held at the University of Connecticut in Storrs (27 attendees) *March 12*
- Gave two presentations on biological control of hemlock woolly adelgid at an invasives workshop for the Connecticut Land Conservation Conference held at Wesleyan University in Middletown (40 attendees) *March 17*
- Attended and spoke on hemlocks during a tour of Edgerton Park, New Haven, with members of the Board of Edgerton Park Conservancy (8 attendees) *May 4*
- Participated and spoke on old growth hemlocks during a tour of Great Mountain Forest Corporation, Norfolk (13 attendees) *May 29*
- Gave two presentations and demonstrations on biological control of mile-a-minute weed at the Invasive Plant Control Workshop held at the Valley Laboratory in Windsor (89 attendees) *June 12*
- Met with Ann Astarita, Director of the Roxbury Land Trust, to check hemlocks at the Mine Hill

Preserve and spoke to students and a teacher from the University of Bridgeport Summer Scholars Program on biological control of HWA (4 attendees) *June 15*

- Gave a presentation on biological control of hemlock woolly adelgid at the University of Connecticut Hot Topics series for the Master Gardeners Program (200 attendees) *June 20*

COWLES, RICHARD S.

- Presented “Real facts about climate change: how should we prepare?” at the CT Tree Protective Association summer meeting held in Farmington (170 attendees) *July 20, 2017*
- Displayed “Soil pH affects health of Christmas trees,” coauthored by Dr. James A. LaMondia, and had a hands-on station for children to learn about pH at Plant Science Day *August 2*
- Presented “Bees and the neonicotinoid controversy” as a short talk at Plant Science Day (220 attendees) *August 2*
- Represented a large collaborative project by presenting “Systemic insecticide risk assessment for pollinators in ornamental horticulture crops,” coauthored by Cristi Palmer, James Bethke, Juang-Horng Chong, Dr. Brian Eitzer, Daniel Potter, David Smitley, and Nishanth Thayaril, at a Pollinator Risk Assessment Symposium session of the American Chemical Society National Meeting held in Washington, D.C. (60 attendees) *August 21*
- Participated in discussing insect pests in the twilight meeting of the CT Christmas Tree Growers Association in Easton (40 attendees) *August 29*
- Discussed pros and cons of plant variation, insect, mite, and phytophthora disease management at the walking tour of the CT Christmas Tree Growers Association fall meeting in New Hartford (45 attendees) *September 9*
- Presented “Insecticides for managing emerald ash borer” for a CT Tree Protective Association workshop in Haddam (45 attendees) *September 21*
- Presented “What’s wrong with our bees” for a continuing education class at Quinnipiac Valley Community College in Danielson (40 attendees) *October 10*
- Presented “Cyclical, emerging, and disappearing pests” at New England Grows, Boston, MA (400 attendees) *November 30*
- Presented “SWD Update” at the UConn Extension Vegetable & Small Fruit Growers’ Conference in South Windsor (180 attendees) *January 8, 2018*
- Spoke on the subject of “Latest research: Neonics vs. pollinators” to the MA greenhouse growers educational conference organized by UMass, in Sturbridge, MA (100 attendees) *January 11*
- Discussed “IPM and the effects of a changing climate” at the annual meeting of the MA Assoc. of Landscape Professionals, Sturbridge, MA, (180 attendees) *January 24*
- Presented “Methods for obtaining nectar and pollen samples” for the SCRI research meeting in St. Louis, MO (25 attendees) *February 7*
- Presented “Spotted wing drosophila in grapes” to the CT Vineyard and Winery Association (20 attendees) *February 12*
- Spoke on the subject “Organic management of turf insects” to the CGKA Association, New Haven (40 attendees) *February 22*
- Discussed “Diversionary plantings and fixed land honey production” at the 3rd Annual Creating and Improving Pollinator Habitat Conference, New Haven (70 attendees) *February 27*
- Presented “Natives vs. exotics: insect pest management considerations” to the CGKA winter meeting, Cromwell (250 attendees) *February 28*
- Presented “Fir genetic improvement project update” for the CT Christmas Tree Growers Association, Middletown (45 attendees) *March 3*
- Lectured on “Arthropod pests of roses” to the CT Rose Association, Plainville (30 attendees) *March 4*
- Co-presented a fruit IPM webinar with Mary Conklin (UConn Cooperative Extension) on “Mating disruption of fruit insects” *March 7*
- Presented “Real facts about climate change and urban trees: How should we prepare?” for the noon

Urban Forestry Today webinar series hosted by Rick Harper (UMass Cooperative Extension) (330 attendees) *March 15*

- Presented “Pollinator health: What citizens can do” for the Windsor Conservation Commission, Windsor (17 attendees) *April 26*
- Participated in the CT Christmas Tree Growers Association twilight meeting, New Milford (25 attendees) *June 19*
- Presented “Zimmerman pine moths” and “Growing exotic firs to avoid phytophthora root” for the MA Christmas Tree Growers’ Association, Southwick, MA (40 attendees) *June 23*

#### CREIGHTON, MARK H.

- Was interviewed about honey bee health topics for an upcoming story by the New Britain Herald *July 6, 2017*
- Attended a reorganization meeting of The Philomen J. Hewitt Jr. Honeybee Museum and Research Center Inc. in Bethlehem. Philomen J. Hewitt was a past bee inspector at The Connecticut Agricultural Experiment Station and donated his estate and honey bee collection, to be preserved for future beekeepers. The organization has been dormant for the past several years and several ideas were discussed as to the best approach to move forward with this project *July 21*
- Spoke on “Bees and pollination” at the Middlesex Institute for Life Learning Education at Middlesex Community College in Middletown (55 attendees) *October 9*
- Assisted Marlese Lessing, University of Connecticut, on filming a short documentary about the state of Connecticut’s bees and how colony collapse disorder would affect the bees on and around campus *November 2*
- Participated in a panel discussion on honey bees at the University of Connecticut to provide an educational opportunity to students and help celebrate UConn’s Bee Campus USA status (45 student attendees) *November 17*
- Visited Southington High School, dropped off honey extraction equipment in support of their apiary program (funded by a High School Youth Beekeeping Grant provided from the CT Department of Agriculture), and spoke with 40 students on honey bee management strategies *December 21*
- Presented several talks to twenty students at Avon Old Farms High School on honey bee anatomy and physiology, history of beekeeping, and honey bee dissection *January 3-4, 2018*
- Spoke at the Connecticut Beekeepers annual bee school here at the Station and discussed bee health and the Honey Bee Registration program (118 new beekeepers) *January 20*
- Staffed the CAES booth and provided information about the Station and a display on honey bees *February 24*
- Spoke to beekeepers at the Portland CT Senior Center on managing colonies coming out of winter (4 local beekeepers attended) *March 25*
- Planned and coordinated a Bee School for High School students here at the Experiment Station. This event attracted 84 students representing 8 high schools from the greater New Haven area and was funded by a USDA Specialty Crop Block Grant under the supervision of the Connecticut Department of Agriculture *March 26*
- Presented a bee talk on caring for bees in the spring at Shag Bark Supply in East Haddam (20 beekeepers attended) *April 14*
- Spoke to students at Ridgefield Elementary School on honey bees; the students were able to view live honey bees in our educational observation hive and learn about pollination (360 students) *April 23*
- Staffed a CAES booth and provided an observation hive to display honey bees to the visitors at a pollinator event held at the Connecticut Science Center in Hartford (400 attendees) *May 3*
- Spoke with 2nd and 3rd grade students at East Conn in Hampton on honey bees and their role in pollination; the students were very excited to view the bees in an observation hive (310 students) *May 18*

## CUI, ZHOUQI

- Presented a talk entitled “Dynamic expression of T3SS genes in single cells of *Dickeya dadantii* during the interaction with potato” at the Annual Meeting of the American Phytopathological Society held in San Antonio, TX *August 5-9, 2017*

## DUGAS, KATHERINE

- Staffed a Forest Pest table at the East Haddam Farmers’ Market *July 12, 2017*
- Conducted an EAB lecture and tree walk for the Quinnipiac Valley Audubon Society at the Riverbound Farm Sanctuary in Cheshire *July 16*
- Staffed a CAES table at the Connecticut Tree Protective Association summer meeting held at Prides Corner Farm in Lebanon *July 20*
- Staffed a CAES table at the Connecticut Nursery and Landscape Association summer meeting held at the Farmington Club in Farmington *July 26*
- Set up and staffed a CAES display booth at the Woodstock Fair *September 4-9*
- With Mr. Mark Creighton and Mr. Zachary Brown, staffed a joint Forest Pest/Honey Bee booth in the Connecticut building at the Big E in West Springfield, MA *September 22*
- With Dr. Gale Ridge, gave a short presentation about the Insect Information Office and CAPS program to a visiting group from the Federated Garden Clubs of Connecticut *September 27*
- Gave a talk entitled “The gypsy moth in Connecticut” to the Old Lyme Lion Club (20 attendees) *October 11*
- With Ms. Vickie Bomba-Lewandoski, conducted an apples and honey bees workshop as part of the Farm City program to visiting Grades 3-5 students at the Blue Slope Farm Museum in Franklin (100 students from Norwich participated) *October 24*
- With Dr. Gale Ridge, attended and staffed a CAES/CCABB booth at the University of Bridgeport Health and Wellness Fair *October 26*
- Staffed a Forest Pest booth at the annual CT Association of Conservation and Inland Wetlands Commission (CACIWC) meeting held in Cromwell *November 18*
- With Dr. Kirby Stafford and Dr. Victoria Smith, attended and ran the State CAPS Committee meeting held at the Lockwood Cottage (12 participants) *December 13*
- Gave a talk entitled “Insect Problems in Connecticut” to the Burlington Garden Club (15 attendees) *January 17, 2018*
- Staffed a CAPS and Forest Pest booth at the CT Tree Protective Association Winter Meeting in Watertown *January 18*
- Staffed a Forest Pest Outreach booth at the CT RV and Camping Show held at the CT Convention Center in Hartford *January 19-20*
- Staffed a CAPS and Forest Pest booth at the CT Nursery and Landscape Association Winter Meeting in Watertown *January 24-25*
- Hosted an Entomology table activity as part of the Girl Scouts STEMagination Family Science Night held at Naugatuck Valley Community College (over 50 scouts and 34 scout leaders were in attendance) *February 9*
- Staffed the CAES booth, which included Station information and a display on honey bees, at the CT Flower Show in Hartford *February 23, 25*
- With Jude Hsiang, staffed a table covering CAES, including Forest Pest information, at the Master Gardener Association Annual Symposium held at Connecticut College in New London (bags handed out to every attendee contained the CAES gypsy moth document, as well as fact sheets about EAB, winter moth, and spotted lanternfly) *March 17*
- Gave a small entomology program to 12 Girl Scouts and leaders at the Bethany Public Library *March 28*

- Gave a brief EAB and gypsy moth update during the CT Tree Wardens Association's 26th annual dinner meeting held at the Gelston House in East Haddam *March 29*
- Staffed a Forest Pest Outreach booth at North Haven Earth Day (approx. 90 people stopped by the booth) *April 7*
- With Mr. Jeffrey Fengler, Dr. Victoria Smith, and Ms. Tia Blevins, hosted and attended the combined meeting of the Eastern Plant Board, the Horticultural Inspection Society, and the Cooperative Agricultural Pest Survey, held in Mystic (90 participants) *April 9-12*
- Staffed a Forest Pest Outreach booth at Hamden Earth Day (approx. 128 people stopped by the booth) *April 21*
- Gave a talk about Gypsy moths at the Duck River Garden Club in Old Lyme (30 attendees) *April 23*
- Gave a tour of the Insect Information Office to visiting students from Norwich Technical High School (9 attendees) *May 24*
- Organized and ran the State CAPS Committee meeting held in Jones Auditorium (15 participants) *June 14*

#### DURGY, ROBERT J.

- Attended as a member of the steering committee and ran the audio-visuals at the Connecticut Vegetable and Small Fruit Growers' Conference held in Windsor (245 attendees) *January 8, 2018*
- Taught a University of Connecticut Master Gardener Program class on vegetables in Norwich (39 attendees) *February 6*
- Taught a University of Connecticut Master Gardener Program class on vegetables in Stamford (26 attendees) *February 12*
- Taught a University of Connecticut Master Gardener Program class on vegetables in New Haven (38 attendees) *February 15*
- Taught a University of Connecticut Master Gardener Program class on vegetables in Vernon (31 attendees) *February 23*
- Taught a University of Connecticut Master Gardener Program class on vegetables and in Torrington (29 attendees) *March 14*
- Taught Math Calculations and Calibration for Pesticide Applicator's Training in West Hartford (36 attendees) *February 20*
- Delivered a lecture entitled "The All-America Selections Variety Trials in Vernon" (17 attendees) *March 10*

#### EASTWOOD, GILLIAN

- Gave a talk entitled "Connecticut - Mosquito Trapping Methods" at the Annual Meeting of the Northeast Regional Center of Excellence for Vector-borne Diseases held in Jones Auditorium *January 26, 2018*
- Gave a presentation and activity session on mosquitoes - ecology, monitoring techniques, and vector-borne diseases to girl scouts at Nathan Hale Middle School in Norwalk as part of a STEM program (14 girl scouts) *March 6*
- Presented a poster entitled "The Potential Ecology of La Crosse Virus in Connecticut" and a talk entitled "Northern Range Expansion of the Asian Tiger Mosquito (*Aedes albopictus*): Analysis of Mosquito Data from Connecticut" at the New Jersey Mosquito Control Association's 105th Annual Meeting held in Atlantic City, NJ (approx. 30 students and 120 other attendees) *March 14-15*
- Gave a talk and led a discussion at the Indian Rock Nature Preserve on "Mosquitoes and ticks and vector-borne disease in Connecticut" as part of Environmental Learning Centers of Connecticut's monthly lecture series (8 attendees) *April 28*
- Presented a summary of her research at a joint meeting with University of Connecticut faculty on vector-borne diseases held in Jones Auditorium (20 attendees) *May 31*

EITZER, BRIAN D.

- Chaired a session and presented a paper entitled “Collection and analysis of plant nectar and pollen and honey bee collected pollen at ornamental nurseries” at the 54th Annual North American Chemical Residue Workshop held in Naples, FL *July 23-26, 2017*
- Was a judge for the Connecticut Science and Engineering Fair held at Quinnipiac University in Hamden *March 14-15, 2018*
- Gave an oral presentation entitled “FERN Screening Methods: How to Find Them and Out Them into Use” with co-author Ms. Terri Arsenault at the FDA FERN cCAP 2018 Technical Conference in Baltimore, MD (40 attendees) *April 17-18*
- Was an instructor for the LB511 FDA/FERN Chemistry Training Course for LC-MS held in Cincinnati, OH (12 attendees) *April 23-27*
- Gave a keynote talk entitled “Bees and Pesticides: Challenges in Measurement and Toxicology” at the 12th European Pesticide Residue Workshop held in Munich, Germany (400 attendees) *May 22*

ELMER, WADE H.

- Participated in a data analysis exercise with the Plant Health Interns at Southern Connecticut State University (10 students) *July 28, 2017*
- Chaired the Widely Prevalent Fungi List Committee and attended the Academic Unit Forum meeting at the Annual Meeting of the American Phytopathological Society held in San Antonio, TX *August 5-9*
- Presented an invited talk entitled “Using nanoparticles of micronutrients to suppress root disease and enhance plant health” at the 50th Congress of the Brazilian Phytopathological Society held in Uberlandia, Brazil (150 attendees) *August 23*
- Participated by video conference in Ishaq Adisa’s Ph.D. defense exam at the University of Texas, El Paso *August 28*
- Gave an invited keynote talk entitled “Asparagus decline and replant problem, a look back and a look forward at strategies for mitigating losses” at the 14th International Asparagus Symposium held in Potsdam, Germany (175 attendees) *September 3-6*
- Co-sponsored the UConn-CAES greenhouse meeting “Keeping Those Dratted Diseases Out of Your Crops” and presented a talk entitled “How nutrition can affect contagious plant diseases” (60 attendees) *September 21*
- Met with six Connecticut state legislators from Fairfield County and Mr. Terry Jones and provided a brief description of the Plant Disease Information Office *October 2*
- Presented an invited seminar entitled “Nanoparticles of metallic oxides for plant disease suppression” to the Department of Plant Biology at Rutgers University (25 attendees) *October 20*
- Moderated the Graduate Student Award session at the Annual Meeting of the Northeastern Division of the American Phytopathological Society held in Quebec City, Quebec, Canada (62 attendees) *November 1-3*
- Spoke about “Sudden vegetation dieback and the role of nanoparticles in plant pathology” to Dr. Chris Tuccia’s Greenhouse Management Class at Naugatuck Valley Community College (10 attendees) *November 8*
- Organized a departmental tour for Mr. George Baldwin’s senior biology class from the Sound School and spoke on “Sudden vegetation dieback and nanoparticles in agriculture” (7 students and 1 adult) *December 1*
- Presented a CAES Seminar entitled “Nanoparticles in Plant Disease Control” in Jones Auditorium (44 attendees) *January 3, 2018*
- Participated in the Southern Connecticut State University Stem Fair (50 attendees) *January 31*
- Presented an invited seminar entitled “Nanoparticles in Plant Disease Control” to the Department of Plant Science at the University of Connecticut (32 attendees) *February 9*



- Presented a webinar entitled “Using Mineral Nutrition to Prevent Root-borne Pathogens” for the Webinar Series: Rooting for Success: Managing the Root Zone for Healthy Plants (44 attendees) *February 28*
- Organized the symposium “Nanotechnology and its Increasing Role in IPM” and presented a talk entitled “The role of metal oxide nanoparticle on plant disease” at the International Integrated Pest Management Meeting held in Baltimore, MD (32 adults attended) *March 19-22*
- Served on a Master’s Thesis examination committee for Ms. Cora McGehee’s Master defense at the University of Connecticut *April 5*
- Gave a presentation to Governor Dannel Malloy and the Board of Control on the duties of the Plant Disease Information Office *April 11*
- Gave a presentation to the Experiment Station Associates entitled “Can nanoparticles be used to control plant diseases” in Jones Auditorium (23 attendees) *April 11*

#### GENT, MARTIN P.N.

- Presented a paper on “Factors affecting relative growth rate of lettuce and spinach” at the American Society for Horticultural Science meeting held in Waikoloa, Hawaii (30 attendees) *September 19-22, 2017*

#### GLORIA-SORIA, ANDREA

- With Ms. Angela Bransfield, conducted an interactive outreach activity about mosquitoes at Tender Care Learning Center in Hamden (approx. 30 children and 4 adults) *June 6, 2018*
- Participated in a career panel for early career female scientists pursuing a non-traditional/non-faculty track profession organized by the Women in Science at Yale (WISAY) group at Yale University (60 attendees) *June 19*
- Taught the “Documenting your research” lecture of the “Entering Research” class for first year Yale Undergraduates (25 students) *June 20*

#### HISKES, ROSE T.

- Gave a talk entitled “Insects: the good, the bad, the beautiful and the just plain ugly” at the Cheshire Library (22 attendees) *July 13, 2017*
- With Mr. Thomas Rathier and Dr. Jatinder Aulakh, gave a Pesticide Applicator Certification training session to Christmas Tree Growers at the Valley Laboratory in Windsor (14 attendees) *October 12*
- With Mr. Thomas Rathier and Dr. Jatinder Aulakh, gave a Pesticide Applicator Certification training session to Christmas Tree Growers at the Valley Laboratory in Windsor (14 attendees) *October 26*
- Staffed an Experiment Station Discovery table at the Kennedy School, grades 3, 4 and 5, Family Science Night in Windsor (60 attendees) *October 27*
- Gave a guest lecture on “Invasive insects” to the Pest Control Class at Naugatuck Valley Community College in Waterbury (25 attendees) *November 8*
- Participated in the Symposium Planning Committee meeting of the Connecticut Invasive Plant Working Group in Windsor *November 14*
- Participated in the Symposium Planning Committee meeting of the Connecticut Invasive Plant Working Group in Windsor *February 13, 2018*
- With Mr. Thomas Rathier and Dr. Yonghao Li, assisted the Connecticut Tree Protective Association arborist certification students at the Tree Conditions Lab in Wallingford (33 attendees) *March 2*
- Participated in the Symposium Planning Committee meeting of the Connecticut Invasive Plant Working Group in Windsor *March 29*
- With Mr. Thomas Rathier, assisted the Connecticut Tree Protective Association arborist certification students at the hands-on night in Wallingford (33 attendees) *April 11*

- Participated in the Symposium Planning Committee meeting of the Connecticut Invasive Plant Working Group in Windsor *April 19*
- With Mr. Thomas Rathier and Dr. Jatinder Aulakh, taught a Private Applicator Pesticide Certificate Preparation Class to hops, tobacco, vegetable, and fruit growers (25 attendees) *April 12, 19, 25*
- Participated in the Symposium Planning Committee meeting of the Connecticut Invasive Plant Working Group in Windsor *May 17*
- Participated in the Cooperative Agricultural Pest Survey (CAPS) meeting held in Jones Auditorium *June 14*
- Participated in the Spotted Lanternfly response meeting held in Jones Auditorium *June 14*
- Participated in the Symposium Planning Committee meeting of the Connecticut Invasive Plant Working Group in Windsor *June 19*

#### KROL, WALTER J.

- Presented a talk entitled “Pesticide Residues in Food Sold in Connecticut” at Albertus Magnus College in New Haven (25 attendees) *April 20, 2018*
- Served as a judge at the Sigma Xi Quinnipiac Chapter Seventh Annual Student Research Conference held at Quinnipiac University (40 attendees) *April 26*

#### LAMONDIA, JAMES A.

- 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 *July 10, 2017*
- Attended and participated in the quarterly meeting of the Connecticut Hop Growers Association *July 12, 2017*
- Spoke about integrated pest management of hops and conducted a tour of field plots as a part of the Connecticut Agricultural Experiment Station Hops Summer Meeting and Field Day held at the Valley Laboratory in Windsor (25 attendees) *July 12*
- Presented a poster about research entitled “*Calonectria pseudonaviculata* microsclerotia viability after exposure to fungicides” and participated in the APS Division Forum Representatives meeting at the annual meeting of the American Phytopathological Society held in San Antonio, TX *August 6-10*
- Presented a poster entitled “Effects of resistant or susceptible tobacco (*Nicotiana tabacum*), eastern black nightshade (*Solanum ptychanthum*), and litchi tomato (*Solanum sisymbriifolium*) on reproduction of the tobacco cyst nematode *Globodera tabacum*” at the Society of Nematologists meeting held in Williamsburg, VA *August 13-17*
- Participated in Ayse Adams Master’s thesis research proposal meeting at Central Connecticut State University *August 28*
- Spoke about research and services and conducted a tour of the Valley Laboratory Research Farm for participants in a Farm Credit East Customer Service Council meeting held at the Station *August 29*
- Spoke about the history of the Valley Laboratory, research and services conducted at the Station and the Valley Laboratory, as well as examples of plant pathology research to the Windsor Garden Club (30 attendees) *September 11*
- 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 *September 13*
- Taught a class on identification, biology, and management of tree diseases to students in the Connecticut Tree Protective Association’s Arboriculture 101 class held in Wallingford (40 attendees) *October 4*
- Participated in the quarterly CT Hop Growers Association meeting held at the Valley Laboratory and spoke about the recently developed IPM Guideline Bulletin for growers (25 attendees) *October 12*
- Spoke about nematode management research results at the annual meeting of the Northeast Regional Multistate Nematology Technical Committee (NE-1640) held in Newport, RI (15 attendees) *October*

18-20

- Presented “*Calonectria pseudonaviculata* dispersal mechanisms and implications for boxwood blight management” (60 attendees) and participated in the NED Business meeting as the Division Forum Representative at the Annual Meeting of the Northeastern Division of the American Phytopathological Society held in Quebec City, Quebec, Canada *November 1-3*
- Chaired the quarterly American Phytopathological Society Division Forum conference call meeting *November 7*
- Presented research results during the potato cyst nematode multi-agency research call (20 participants) *November 14*
- Participated in the Hops Conference Research meeting in Hamilton, NY (25 attendees) *December 1*
- Presented “Low versus high trellis hop research in Connecticut” at the 2017 Cornell/Northeast Hop Alliance Conference in Morrisville, NY (150 attendees) *December 2*
- Participated in an AmericanHort Horticultural Research Institute conference call to develop national boxwood blight resistance and tolerance screening protocols *December 5*
- Was interviewed about tobacco varieties, breeding, and history by Darcy Cahill for American History Magazine *December 6*
- Participated in the UConn Extension Vegetable & Small Fruit Growers’ Conference in South Windsor (25 attendees) *January 8, 2018*
- Spoke about “Identifying, understanding and managing nematode diseases in potatoes” (50 attendees) and “Identifying, understanding and managing nematode diseases in vegetables” (75 attendees) at the Long Island Agricultural Forum held in Riverhead, NY *January 10-11*
- Spoke about “Integrated pest management in Connecticut hops” at the Connecticut Hop Growers Association Annual Meeting held in Northford (40 attendees) *January 13, 2018*
- Was interviewed about hop research by Steve Jensen for the Connecticut Weekly Agricultural Report *January 13*
- Attended the 48th Tobacco Workers Conference in Myrtle Beach, SC to present a plenary session talk on “Connecticut cigar wrapper leaf: the result of practical research and 375 years of tobacco production” (245 attendees from 11 countries) *January 16*
- Moderated a session and discussion on Nematodes and Nematicides (50 attendees) *January 16*
- Presented “Management of target spot in broadleaf cigar wrapper tobacco” (45 attendees) *January 18*
- Was interviewed about tobacco research and production in Connecticut by Christopher Bickers for the Tobacco Farmer Newsletter *January 16*
- Was interviewed about hop research and hop production in Connecticut by Joanie Stiers for Connecticut Grown magazine *January 22*
- Participated in the Connecticut Agricultural Information Council meeting regarding Agriculture Day at the Capitol and the Connecticut Outstanding Young Farmer Award *January 23*
- Spoke about “Fungicide management of boxwood blight” as a part of the American Boxwood Society meeting “Boxwood management, today and tomorrow” in Beltsville, MD (170 attendees) *February 20*
- Spoke about “Hidden menace: Alternate hosts and tolerant boxwood as pathogen refugia,” presented “Fungicides and sterilants” and discussed future research objectives and priorities during the Boxwood Research Summit held in Beltsville, MD (25 attendees) *February 21*
- Participated in the Connecticut Vegetable and Small Fruit Conference Steering Committee meeting in Tolland *February 26*
- 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 26*
- 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 27*

- 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 (32 attendees) *February 28*
- Spoke about "Identification and management of boxwood blight" as a part of the 2018 Nursery and Greenhouse Educational seminar hosted by Helena in Ledyard (50 attendees) *March 1*
- Participated in the Connecticut Agricultural Information Council meeting regarding Agriculture Day at the Capitol and the Connecticut Outstanding Young Farmer Award in Windsor *March 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 *March 7*
- Spoke to growers about "Identifying, understanding and managing nematode diseases in vegetables" at the CPS Vegetable Growers meeting held in Glastonbury (65 attendees) *March 7*
- Was interviewed about Ag Day at the Capitol by Rebecca Eddy for the Dept. of Agriculture Newsletter *March 12*
- Spoke about Integrated Pest Management for the 2018 season at the CT Hop Growers Association Quarterly Meeting in Windsor (15 attendees) *March 15*
- Hosted and chaired the quarterly APS Division Forum conference call meeting *March 20*
- Participated in Agriculture Day at the Capitol, speaking about the 2017 Century Farm Award recognizing Kasheta Farms (100 attendees) *March 21*
- Participated in the Connecticut Agricultural Information Council meeting recapping Agriculture Day at the Capitol and the Connecticut Outstanding Young Farmer Award in Windsor *March 28*
- 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 29*
- Conducted a boxwood blight training program for Prides Corner Farms *April 4*
- Spoke about "Hops, a new (old) crop for Connecticut" to the North Haven Garden Club in North Haven (30 attendees) *May 10*
- Participated in an HRI sponsored researcher conference call to develop a national boxwood blight resistance screening protocol (10 attendees) *May 17*
- Welcomed participants at the CAES Invasive Plant Workshop held at the Valley Laboratory (89 attendees) *June 12*
- Chaired the APS Division Forum meeting held in conjunction with the APS Pacific Division annual meeting in Portland, OR (125 attendees) *June 24-28*

#### LI, DEWEI

- Organized and hosted the Pan-American Aerobiology Association 2017 annual meeting and Spore Camp held at the Valley Laboratory in Windsor *August 4-6, 2017*
- Took a one-month sabbatical leave at Nanjing Forestry University (NJFU), Hubei Academy of Forestry and Jiangsu Normal University to conduct collaborative research including field trips to collect fungal specimens from October 26 to November 25, 2017 in mainland China. He made two presentations, "Phylogenetic relationships of Chlamydomyces, Harzia, Olpitrichum, and their sexual allies, Melanospora and Sphaerodes" and "Update on Ethnomycology: fungi and human beings" at College of Forestry, NJFU (59 attendees); and presented "Phylogenetic relationships of Chlamydomyces, Harzia, Olpitrichum, and their sexual allies, Melanospora and Sphaerodes" also at Jiangsu Institute of Medicinal Plants, Jiangsu Normal University" (62 attendees) *November 16*
- Was invited to visit Taiwan, Republic of China (ROC) to visit two mycologists, Dr. Sheng-Hua Wu, Curator of Botany at the National Museum of Natural Science and Dr. Pi-Han Wang, professor at Tunghai University, and as a speaker in the workshop "Microbiology of the Built Environment in Hot, Humid Climate" held in Taichung, ROC. He gave two presentations "Airborne Fungi and

Human Health” and “Fungal Ecology in Indoor Environments” to the workshop (70 and 55 attendees, respectively) *November 28 - December 2*

- Gave a lecture entitled “Introduction to Mycology” at Yale School of Forestry and Environmental Studies (15 graduate students) *January 26, 2018*
- Participated in the PAAA meeting and Spore Camp in Clearwater, FL and gave a presentation “New species and records of hyphomycetes from indoor environments” (16 attendees and unknown number of people online via webinar) *March 1-3*
- Was interviewed about indoor molds and their health effects by Christine Woodside, Connecticut Health Investigative Team, Editor, *Appalachia Journal May 14*

#### LI, YONGHAO

- Presented “Spring and Summer Gardening Tips” to members of the Olde Ripton Garden Club in Shelton (35 adults) *July 10, 2017*
- Staffed the CAES booth at the CTPA Summer Meeting in Farmington *July 20*
- Was interviewed about growing palm trees in Connecticut by Mr. Matthew Zabierek at the Record-Journal *July 20*
- Participated in the CTPA Arboriculture 101 course meeting and discussed continuous improvement of the arborist training program in Branford *July 24*
- Presented “Plant Disease Diagnostics” to the Summer Undergraduate Fellows in Plant Health and Protection program in New Haven (10 adults) *July 26*
- Presented “Foliar Diseases of Christmas Trees and Their Management” at the CCTGA twilight meeting in Easton (35 adults) *August 29*
- Hosted three scientists, Drs. Yanli Xu, Surong Ding, and Wenxiu Zou, from the Northeast Institute of Geography and Agroecology at the Chinese Academy of Sciences *September 6*
- Presented a talk about foliar diseases on Christmas trees and their control at the CCTGA annual fall meeting held in New Hartford (40 adults) *September 9*
- Co-sponsored “Keeping Those Dratted Diseases Out of Your Crops Program” and presented a diagnostic overview of diseases of ornamentals in Jones Auditorium (59 adults) *September 21*
- Was interviewed about fungal diseases and autumn foliage this year by Robert Miller at the News-Times *September 26*
- Was interviewed about “When will the colors pop?” by Sam Kantrow at News 8 (WTNH) *September 26*
- Presented a talk about the Plant Disease Information Office to Federated Garden Club of Connecticut members during a tour of the Station (26 adults) *September 27*
- Presented “Bonsai Tree Disease Management” to the Bonsai Society of Greater Hartford in Rocky Hill (15 adults) *October 9*
- Staffed the Station booth at the College & Career Night event held at Nonnewaug High School in Woodbury (80 youths) *October 10*
- Was interviewed about the foliage this fall by Dan Amarante at Fox 61 News *October 17*
- Staffed the Tree Conditions Laboratory for the CTPA Arboriculture 101 class in Wallingford (40 adults) *October 25*
- Presented “2017 Plant Disease Updates” at the APS Northeastern Division Annual Meeting in Quebec City, Canada (40 adults) *November 1*
- Presented “Plant Disease Information Office and Plant Disease Diagnostics” to Naugatuck Valley Community College students during a tour of the Station (8 adults) *November 8*
- Presented “National Plant Diagnostic Network” to faculty and students at the Northeast Agricultural University, Harbin, China (60 adults) *November 13*
- Visited the Northeast Forestry University in Harbin, China, and met with Dr. TingBo Jiang and his graduate students to discuss drought tolerance in trees (6 adults) *November 14*

- Presented “Plant Disease Diagnostics” to visiting Sound School students in George Baldwin’s Biotech class (7 students and 1 adult) *December 1*
- Staffed the CAES booth at the UConn Extension Vegetable & Small Fruit Growers’ Conference held in South Windsor *January 8, 2018*
- Presented “Bonsai Tree Disease Management” to the Bonsai Society of Greater New Haven in Hamden (20 adults) *January 9*
- Staffed the CAES booth at the CTPA Annual Meeting held in Plantsville *January 18*
- Staffed the CAES booth at the CNLA Winter Symposium held in Plantsville *January 24*
- Staffed the CAES booth at the Wallingford Public Library Agricultural Open House in Wallingford *February 15*
- Presented “Disease Management of Spring Greenhouse Crops” in the UConn Spring 2018 Bedding Plant Programs for Greenhouse Growers held in Torrington (35 adults) *February 13*
- Presented “Disease Management of Spring Greenhouse Crops” in the UConn Spring 2018 Bedding Plant Programs for Greenhouse Growers held in Vernon (30 adults) *February 22*
- Staffed the CAES booth at the CT Flower and Garden Show in Hartford *February 24*
- Gave a talk “Pruning 101” to The Orchard Valley Garden Club in Southington (40 adults) *February 27*
- Staffed the CAES booth at the CGGA Winter Conference in Cromwell *February 28*
- Gave a talk entitled “Spring and Summer Gardening Tips” at the Cheshire Public Library (32 adults) *March 5*
- Presented “Common Vegetable Diseases and Their Management” at the CT NOFA Winter Conference held in Danbury (43 adults) *March 10*
- Spoke about common tree diseases for the CTPA Tree Condition class in Wallingford (33 adults) *March 22*
- Spoke about the Plant Disease Information Office to a visiting group of high school students and teachers from the Stamford Regional AgriScience and Technology Center (4 youths and 2 adults) *March 26*
- Participated in the CT Nurseryman’s Foundation Scholarship Committee meeting and interviewed candidates for the scholarship in New Haven *April 4*
- Presented “Pruning 101” at the Cherry Brook Garden Club meeting in Canton (35 adults) *April 10*
- Gave a talk entitled “How to Start a Vegetable Garden” with community garden members in North Haven (17 adults) *April 11*
- Spoke about the Plant Disease Information Office and disease diagnosis to Youth Interns with Mr. Ian Grosfelt in New Haven (6 youths and 1 adult) *April 18*
- Presented “Plant Doctor” to students and teachers in the Ecology Day at the Brown Middle School in Madison (45 youths and 7 adults) *May 4*
- Presented “Common Garden Diseases” to the Nichols Garden Club in Trumbull (24 adults) *May 8*
- Presented “Spring and Summer Garden Tips” to members of the Watertown Community and Senior Center in Watertown (11 adults) *May 9*
- Attended the Northeastern Plant Diagnostic Network Meeting and presented “CAES Plant Disease Updates” in Ithaca, NY (20 adults) *May 17*
- Spoke about the Plant Disease Information Office to visiting students from Norwich Technical High School (8 youths, 1 adult) *May 24*
- Staffed the CAES booth in the Greater New Haven Bonsai Show in Hamden *June 2*
- Presented “Spring weather conditions and foliar diseases of Christmas trees” at the CCTGA twilight meeting in New Milford (30 adults) *June 19*
- Presented “PDIO and Plant Disease Diagnosis” to CCSU students and faculty during the CAES tour in New Haven (15 adults) *June 20*

LINSKE, MEGAN A.

- Presented a talk on the professional life of graduate school and conducting research studies in the CAES Center for Vector Biology & Zoonotic Diseases at Nazareth College in Rochester, NY (20 attendees) *September 29, 2017*
- Gave an invited lecture entitled “Diversity and Disease: The Role of Wildlife in Lyme Disease Ecology” at the Living with Wildlife Speaker Series co-hosted by the Town of Guilford Conservation Commission and the Guilford Land Conservation Trust (100 attendees) *January 17, 2018*
- Discussed careers in wildlife biology and management with Girls Scouts for STEM guest speaker series at Nathan Hale middle school in Norwalk (12 students) *January 23*
- Participated in the Northeast Regional Center for Excellence in Vector-Borne Diseases meeting hosted by CAES in New Haven (75 attendees) *January 26*
- Spoke to Lyman Hall High School students about career paths and research opportunities at the Connecticut Agricultural Experiment Station (10 students) *January 29*
- Presented current research projects for the Northeast Regional Center for Excellence in Vector-Borne Diseases Trainee Seminar Series (10 attendees) *February 26*
- Hosted a wildlife biology and management learning station for Girl Scout’s STEMagination Family Science Day (100 attendees) *February 25*
- Gave an invited lecture entitled “Blacklegged tick reservoir host diversity and abundance impacts on dilution of *Borrelia burgdorferi* in residential and woodland habitats in Connecticut” at the New Jersey Mosquito Control Association annual meeting (200 attendees) *March 15*
- Participated in the Northeast Regional Center for Excellence in Vector-Borne Diseases Trainee Seminar (15 attendees) *March 28*
- Ran two professional development workshops at the NEAFWA conference entitled “Q & A about Q & A: Designing effective human dimensions research tools and getting the most from the data” (13 attendees) and “Use of unmanned aerial vehicles for wildlife research and monitoring” (13 attendees) *April 15*
- Gave an invited lecture for the One Health Practice and Wildlife Management Symposium at the NEAFWA conference (45 attendees) *April 17*
- Participated in a joint meeting with USDA and US Biologic staff on current and future research projects and funding opportunities *April 19*
- Judged students’ presentations for Quinnipiac University’s Sigma Xi Student Research Conference *April 26*
- Participated in the Northeast Regional Center for Excellence in Vector-Borne Diseases trainee seminar *April 30*
- Discussed wildlife biology professional opportunities and research with Connecticut FFA students (55 students) *May 3*
- Participated in the joint meeting between the Center for Vector Biology & Zoonotic Diseases and the University of Connecticut’s Department of Pathobiology and Vector Biology group *May 31*

LITTLE, ELIZA A. H.

- Gave a presentation entitled “Spatiotemporal dynamics of *Borrelia burgdorferi* infection in blacklegged ticks, *Ixodes scapularis*, in Connecticut, 1996-2016” to the Yale Epidemiology of Microbial Diseases Research Forum *September 21, 2017*
- With Dr. Goudarz Molaei, organized the Northeastern Mosquito Control Association symposium “Continuous Plague of Ticks and Tick-associated Diseases in the Northeastern United States” *December 5*
- Gave a presentation entitled “Spatiotemporal dynamics of *Borrelia burgdorferi* infection in blacklegged ticks, *Ixodes scapularis*, in Connecticut, 1996-2016” at the annual meeting of the Northeastern Mosquito Control Association held in Plymouth, MA *December 5*

- Gave an invited presentation on her dissertation work entitled “The influence of climate and socio-ecological factors on *Ae. albopictus* in northeastern US cities at the annual meeting of the Northeastern Mosquito Control Association held in Plymouth, MA *December 5*
- Presented updated work on “Spatiotemporal dynamics of *Borrelia burgdorferi* infection in blacklegged ticks, *Ixodes scapularis*, in Connecticut, 1996-2016” at the Northeast Regional Center for Excellence in Vector-Borne Diseases meeting hosted by CAES in New Haven *January 26, 2018*
- Using an additional year of data (2017) and different methodology, she presented “Spatiotemporal dynamics of *Borrelia burgdorferi* infection in blacklegged ticks, *Ixodes scapularis*, in Connecticut, 1996-2017” at the Northeast Regional Center for Excellence in Vector-Borne Diseases training seminar *April 30*

#### MAIER, CHRIS T.

- Was interviewed about deer and horse flies by Robert Miller of the Danbury News-Times *July 5, 2017*
- Displayed copies of Fly Times, the newsletter of the North American Dipterists Society, at a meeting of the Connecticut Entomological Society at Yale University in New Haven *October 20*
- Discussed recent research on periodical cicadas at a meeting of the Connecticut Entomological Society held at Wesleyan University in Middletown *November 17*
- Distributed written information on the brown marmorated stink bug at the Annual Meeting of the Connecticut Pomological Society in Middletown *November 28*
- Discussed the lily leaf beetle and several forest insects at a meeting of the Advisory Committee of the Cooperative Agricultural Pest Survey (CAPS) at Lockwood Farm in Hamden *December 13*
- Distributed information on the brown marmorated stink bug and displayed longhorn beetles commonly found in firewood at the Annual Meeting of the Connecticut Tree Protective Association in Southington *January 18*
- Exhibited new entomological literature at a meeting of the Connecticut Entomological Society held at Yale University in New Haven (35 attendees) *January 19*
- Spoke about the spotted lanternfly at a meeting of the Connecticut Pomological Society held at Bishop’s Orchard, Guilford (70 attendees) *June 13*

#### MARRA, ROBERT E.

- Presented a talk entitled “Fungi of the Forest” to the Town & Country Garden Club in Sandy Hook (40 adults) *September 13, 2017*
- Presented a talk entitled “Three Important Tree Diseases You Should Know About” to the Enfield Garden Club in Enfield (20 adults) *September 27*
- Presented “Tropical Storms, Hurricanes, and Superstorms: Impact and Influence on Tree Diseases” for the Bethany Garden Club in Bethany (25 adults) *November 13*
- Participated in a meeting of the Steering Committee for the Connecticut Conference on Natural Resources at the University of Connecticut, Storrs (11 adults) *December 18*
- Presented “Fungi of the Forest: Friends and Foes” to the Cheshire Garden Club (15 adults) *February 5*
- Presented “Tropical Storms, Hurricanes, Superstorms: Impacts on Trees,” followed by “Drought and Its Impact on Tree Health,” to the Master Gardener Program at Bartlett Arboretum (30 adults) *February 15*
- Presented “Accurately accounting for decay and carbon loss in trees: a novel nondestructive approach using tomography” to the Biology Department of Eastern Connecticut State University (20 adults) *March 2*
- Presented “Fungi of the Forest: Friends and Foes” to the Watertown Garden Club (30 adults) *March 22*



- Presented “Accurately accounting for decay and carbon loss in trees: a novel nondestructive approach using tomography” to the Stockbridge School of Agriculture at the University of Massachusetts, Amherst (35 adults) *March 26*
- Assisted in judging the Future Farmers of America (FFA) AgriScience Fair held in Jones Auditorium (37 students) *May 3*
- With Dr. Abigail Maynard, served as special-award judges 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.” This year’s award was given to Matilda Pethrick, a 7th grade student at Betsy Ross Arts Magnet School, for her project “From Biomass to Biogas” *May 14-16*

#### MAURER, KATJA

- Spoke about current hop research as part of the hop field meeting held at the Valley Laboratory in Windsor (25 attendees) *July 12, 2017*

#### MAYNARD, ABIGAIL A.

- Judged fruits and vegetables at the North Haven Fair *September 7, 2017*
- Discussed the Learning Garden at Hamden Hall Country Day School (2 teachers, 27 children) *September 11, 21, 27*
- Spoke on “Composting and Utilization of Compost” to a sustainability class at Hamden Hall Country Day School in Hamden (1 teacher, 12 students) *October 3*
- Spoke on “Composting and Utilization of Compost” to another sustainability class at Hamden Hall Country Day School in Hamden (1 teacher, 15 students) *October 3*
- Spoke about Station activities at a quarterly meeting of the Council of Soil and Water Conservation in Vernon (12 adults) *October 5*
- Spoke on “Composting and Utilization of Compost” at the Healthy Yards Workshop in Greenwich (75 adults) *October 18*
- Spoke about growing vegetables and gave a tour of Lockwood Farm to a preschool class from Hamden Hall Country Day School (2 teachers, 8 adults, 13 children) *October 23*
- Reported on Station activities at a meeting of the State Technical Committee held in Vernon (18 attendees) *October 25*
- Reported on Station activities at a quarterly meeting of the Council on Soil and Water Conservation in Middletown (8 attendees) *January 25, 2018*
- Described the New Crops Program to seek possible collaboration at the joint UConn/CAES collaborative meeting held at the University of Connecticut in Storrs (approx. 27 attendees) *March 12*
- With Dr. Robert Marra, judged exhibits for the CAES prize at the New Haven Science Fair *May 14 & 15*
- Reported on Station activities at a quarterly meeting of the Council on Soil and Water Conservation held in Vernon (15 adults) *May 17*
- Participated in a meeting of the State Technical Committee in Tolland *May 24*

#### MOLAEI, GOUDARZ

- Was interviewed on “Study: Lyme disease treatments surging” by the Connecticut Post <http://www.ctpost.com/local/article/Study-Lymedisease-treatments-surging-11438365.php> *July 26, 2017*
- Hosted Dr. Heather Ruff, Clinical Fellow at the Yale School of Medicine, and provided her with information on the CAES services and research activities on mosquito- and tick-borne pathogens of human diseases *August 9*
- Was interviewed on “Tick population, Lyme disease infections surge as predicted” by Darien News CT <http://www.dariennews.com/news/article/Tick-population-Lyme-disease-infections-surge->

[as-11742109.php](#) August 14

- Hosted Yale School of Medicine residents in the CAES Tick Testing laboratory and discussed services and research on mosquito- and tick-borne pathogens of human diseases (12 attendees) August 23
- Was interviewed on “*Ticks carry more than just Lyme disease, scientist says*” by the Record-Journal, Meriden <http://www.myrecordjournal.com/news/state/10777146-154/ticks-carry-more-than-just-lyme-disease-scientist-says.html> August 25
- Gave a short talk on his research at the Department of the Epidemiology of Microbial Diseases, EMD Seminar Series-Orientation Session, Yale School of Public Health (50 attendees) August 31
- Was interviewed on “Found a Tick on Yourself? How to Submit it for Testing and Identification” by NBC Connecticut, published online at <https://www.nbcconnecticut.com/news/local/Found-a-Tick-on-Yourself-How-to-Submit-it-for-Testing-and-Identification-454165273.html> October 30
- Was interviewed about the tick season in Connecticut by WTNH News 8 <http://wtnh.com/2017/11/02/tick-season-is-still-going-strong-in-connecticut/> November 2
- Co-moderated the symposium “The Challenge of Tickborne Diseases,” presented a talk entitled “Four decades of ticking in Connecticut and the plague of Lyme and other tick-associated diseases” (approx. 70 attendees), and co-presented another talk entitled “Habitat and winter survival of *Ixodes scapularis* and *Amblyomma americanum*” (approx. 70 attendees) at the Annual Meeting of the Entomological Society of America held in Denver, CO November 4-8
- Organized the symposium Continuous Plague of Ticks and Tick-associated Diseases in the Northeastern United States, and presented a talk entitled “Rising Tick Populations and Changing Patterns of Tick-associated Diseases in the Northeastern United States” in Plymouth, MA (190 attendees) December 5
- Was interviewed on “The extreme cold might help tick population” by WTNH News 8, which was broadcasted and posted online at <http://wtnh.com/2018/01/09/the-extreme-cold-might-help-tick-population/> January 9, 2018
- Participated at the Central Connecticut State University, Department of Biology Internship and Career Fair, New Britain and presented a short talk on his research and services offered at the CAES Tick Testing Laboratory (38 attendees) February 26
- Was interviewed on “Tick problems already starting” by WTNH News 8 <http://wtnh.com/2018/02/27/tick-problems-already-starting/> February 27
- Was interviewed on “Mild temps means ticks are coming back” by WFSB 3 <http://www.wfsb.com/story/37614141/mild-temps-means-ticks-are-coming-back> February 28
- Hosted students and faculty from the Stamford Regional Agriscience and Technology Center at the Tick Testing Laboratory (4 students, 2 teachers) March 26
- Attended the annual meeting and student competition of the Connecticut Entomological Society at the University of Connecticut along with Ms. Dasha Pokutnaya, who gave a talk on her work in the Tick Testing Laboratory, which received an award for second-best presentation (approx. 10 faculty members and 25 students) March 30
- Was interviewed on “Good news about tick season” by WTNH News 8, which was broadcasted and posted online at <http://www.wtnh.com/news/health/good-news-about-tick-season/1101837042> April 4
- Was interviewed on the current status of tick activity and forecast for the upcoming season by Connecticut News 12 April 4
- Hosted a student group, “Youth Interns with Mr. Ian Grosfelt,” at the CAES Tick Testing Laboratory (8 students) April 18
- Was interviewed on “*Insect-borne Diseases Have Tripled. Here's Why*” by Wired Magazine/Wired.com <https://www.wired.com/story/insect-borne-diseases-have-tripled-heres-why/> May 2
- Was interviewed on “*New kind of tick could find its way to Connecticut*” by Eyewitness News 3 wfsb.com <http://www.wfsb.com/story/38114627/new-kind-of-tick-could-find-its-way-to-connecticut>

May 4

- Gave an invited talk entitled “*Continuous Plague of Ticks and Tick-associated Diseases in Connecticut and throughout Northeastern U.S.*” at an event organized by the Chatham Health Department and hosted by Hebron Gilead School in Hebron (9 attendees, 1 student) *May 7*
- Was interviewed on “*Current Status of Tick Activity and Prevalence of Tick-borne Pathogens in Connecticut*” by *Rivereast News Bulletin, The Glastonbury Citizen* *May 15*
- Was interviewed on “*Here’s Why Lyme Disease Keeps Spreading in the U.S.*” by *Heathline.com* <https://www.healthline.com/health-news/heres-why-lyme-disease-keeps-spreading-in-the-us#1> *May 21*
- Discussed ticks and tick-associated diseases to visiting students from *Norwich Technical High School* (9 attendees, 8 students) *May 24*
- Was interviewed about tick abundance and infection with tick-borne pathogens, potential impact of past winter in tick activity and abundance this year, and the status of other tick-associated diseases and invasive tick species in Connecticut by *NBC Connecticut* *May 25*
- Was interviewed about the Tick Testing Program, current status of tick activity in Connecticut, and tick bite prevention by *Fox 61* <http://fox61.com/2018/06/06/mosquito-testing-program-takes-shape-in-connecticut/> *June 6*
- Was interviewed about the Tick Testing Program, current status of tick activity in Connecticut, and tick bite prevention by *WFSB TV* <http://www.wfsb.com/story/38414527/experts-say-state-is-on-track-for-a-typical-tick-year> *June 7*
- Was interviewed about the Tick Testing Program, current status of tick activity in Connecticut, and tick bite prevention by *Hearst Connecticut Media Group* <https://www.thehour.com/news/article/Percentage-of-Connecticut-ticks-testing-positive-12995287.php> *June 12*
- Was interviewed about the Tick Testing Program, current status of tick activity in Connecticut, and tick bite prevention by *WTIC News Talk 1080* <https://wtic.radio.com/articles/news/ag-station-another-bad-year-ticks> *June 25*
- Was interviewed about the Tick Testing Program, current status of tick activity in Connecticut, and tick bite prevention by *WTNH Channel 8 News* <http://www.wtnh.com/news/health/uptick-in-ticks-and-diseases-in-ct/1264751866> *June 26*
- Was interviewed about the Tick Testing Program, current status of tick activity in Connecticut, and tick bite prevention by *NBC Connecticut/WVIT* <https://www.nbcconnecticut.com/news/local/Researchers-Report-Peak-Tick-Season-486508261.html> *June 26*
- Was interviewed about the Tick Testing Program, current status of tick activity in Connecticut, and tick bite prevention in Connecticut by *CBS Radio* *June 27*
- Spoke to Assistant Director *Melanie McCloskey* of the *Specialty Services and Dermatology, Yale Health*, about the *CAES Tick Testing Program* and how the *Yale community and Health Center* can submit ticks for testing *June 7*
- Hosted *Dr. John Paul Lavik* the *Yale Medical School* and discussed *mosquito and tick research projects and services offered in the Tick Testing Program* *June 13*
- Hosted a group from *Central Connecticut State University, New Britain* at the *CAES Tick Testing Laboratory* and discussed *ticks and mosquitoes and their disease-causing pathogens* (15 students, 1 faculty member) *June 20*

PIGNATELLO, JOSEPH J.

- Hosted *Prof. Joel Pedersen, University of Wisconsin*, for the *Lockwood Lecture* *October 17, 2017*
- Gave a talk entitled “*Gastrointestinal Bioaccessibility of PAHs and PAH Derivatives Natively Present in Soot Particles Using an in Vitro Model: Effects of Soot Aging with Soil*” at the *annual Soil Science Society of America Meeting in Tampa, FL* (approx. 25 attendees, 15 students) *October 25*

- Gave a departmental seminar entitled “Interactions of Organic Compounds with Pyrogenic Carbonaceous Matter (Black Carbon) – Beyond Adsorption” to the Department of Environmental Health and Engineering, Johns-Hopkins University, Baltimore, MD (approx. 100 attendees total, 60 students) *December 5*
- Gave a CAES Seminar entitled “Roles of Biochars and Other Carbons in Agricultural and Environmental Management” in Jones Auditorium (approx. 60 attendees) *January 17, 2018*
- Presented a poster entitled “Development of Novel Applications of Animal Wastes and Biochar for Nutrient Capture and Subsequent Fertilizer Value” at the USDA-NIFA NSF Water and Soils workshop for grantees in Washington, DC (approx. 150 attendees) *January 29-31*
- Co-organized and co-chaired a symposium on carbonaceous materials and gave a talk entitled “Inherent reactivity of chars from model feedstocks, lignin and cellulose: persistent free radicals, reactive oxygen species, and non-radical direct reacting sites” (approx. 30 attendees) in the Division of Environmental Chemistry at the National Meeting of the American Chemical Society held in New Orleans, LA *March 21-22*
- Gave a guest lecture entitled “Roles of Pyrogenic Carbon Materials in the Fate, Bioavailability, and Management of Pollutants” in the Environmental Health course at the University of St. Joseph in West Hartford (approx. 15 students) *March 28*
- Participated as a member of a review panel for the Helmholtz Center for Environmental Research (UFZ) in Leipzig, Germany *April 9-11*
- Presented an overview of research in the Department of Environmental Sciences to visiting students from Norwich Technical High School (8 students, 1 teacher) *May 24*

#### PRAPAYOTIN-RIVEROS, KITTY

- Gave a presentation highlighting the process of conducting effective internal audits and of common issues related to internal auditing at the 2018 Animal Feed Regulatory Program Standards (AFRPS) Face-to-Face Meeting held in Jacksonville, FL (60 attendees) *March 20-22, 2018*
- Gave a presentation on the ISO Lab Mentorship Program – Mentor/Mentee Collaboration and experiences at the 2018 APHL (Association of Public Health Laboratories) Annual Meeting and Twelfth Government Environmental Laboratory Conference held in Pasadena, CA (approx. 100 attendees) and participated in a workshop on the development of the Laboratory Flexible Funding Model (LFFM) on the behalf of Dr. Jason C. White during an invitational APHL lunch-session for laboratories who are funded through FDA cooperative agreement programs (ISO CAP) *June 3-5*

#### RIDGE, GALE E.

- Was interviewed about why chipmunks and squirrels seem to be currently damaging tomatoes by Harlan Levy of the Journal-Inquirer *July 24, 2017*
- Was interviewed about swarming ants by Andrew Regalia of the Record-Journal *September 6*
- Was interviewed about swarming ants by NBC News Connecticut *September 6*
- Was interviewed about population increases of the brown marmorated stink bug in Connecticut by WTNH TV *September 28*
- Was interviewed about population increases of the brown marmorated stink bug in Connecticut by NBC News Connecticut *September 29*
- Was interviewed about the increase of hickory tussock moth caterpillar reports and their medical significance by Tracy Phelan, CBS News *October 6*
- Was interviewed about pantry pests found in pet food by Harlan Levy of the Journal-Inquirer *October 16*
- Presented a talk about bed bugs to the DCF Regional Resource Group of nurses in Rocky Hill (34 attendees) *October 24*
- With Ms. Katherine Dugas, staffed a bed bug table at the annual Bridgeport University Health Fair (200 attendees) *October 26*

- Spoke about “Delusions of Parasitosis” at the National Pest Management Association regional conference in Taunton, MA (300 attendees) *November 3*
- Presented a talk on mosquitoes, ticks, and bed bugs at the Connecticut Environmental Council conference in Plainville (268 attendees) *November 21*
- Was interviewed about arthropods and dermatitis by Amina Wilson from the Discovery Network, Los Angeles, CA *November 30*
- Was interviewed about freeze killing bed bugs during a current extended period of very cold weather by Diane Orson, WNPR *December 29*
- Presented a webinar about bed bugs to mattress recyclers throughout the United States and Canada from the DEEP auditorium in Hartford *February 27, 2018*
- Presented a bed bug workshop to numerous agencies under the leadership of the Connecticut Coalition Against Domestic Violence on the psychological impacts of bed bugs as well as an introduction to Delusions of Parasitosis in Wethersfield (38 attendees) *February 27*
- Presented a talk about bed bugs to Connecticut Park Service personnel in Hamden (62 attendees) *March 1*
- Spoke about bed bugs to staff at the Yale Child Learning Center *March 12*
- Hosted students from the Stamford Agricultural Science School visiting the Insect Information Office *March 26*
- Spoke about bed bugs to doctors at the Bridgeport Mental Health Center (42 attendees) *March 27*
- Spoke about bed bugs at the annual training of health care professionals held at Southern Connecticut State University (67 attendees) *March 28*
- With Dr. Kirby Stafford, attended the Capstone Scholars Day at Quinnipiac University in North Haven to listen to student and staff presentations and to see our students’ posters *April 6*
- Presented a talk on “Delusions of Parasitosis” at a pest management conference in Marlborough, MA (65 attendees) *April 11*
- Spoke about insects and the Insect Information Office to visiting students from Norwalk Technical High School, who were very enthusiastic about every insect (10 students) *April 18*
- Was interviewed about the brown marmorated stink bug in Connecticut by CNBC TV *April 30*
- Was interviewed about delusory infestations by Erika Engelhaupt for National Geographic Magazine *June 6*
- Was interviewed about tomato pests by Harold Levi from the Journal-Inquirer *June 11*
- Was interviewed about the Asian tiger mosquito by Frankie from Connecticut Public Radio *June 12*
- Was interviewed about mosquitoes by Coastal Connecticut Magazine *June 20*
- Was interviewed about ticks in Connecticut by NBC News *June 26*

#### ROBB, CHRISTINA S.

- Did science outreach and taught an experiment on the topic of solids, liquids, and gases to a kindergarten class (20 children, 4 adults) and a first grade class (20 children, 4 adults) at the John Trumbull Primary School in Watertown *September 18, 2017*
- Attended the Board meeting, ran the program planning meeting, and performed the duties of Vice-chair of the EAS program committee at the Eastern Analytical Symposium in Plainsboro, NJ *November 12-16*
- Attended Board meetings of the Eastern Analytical Symposium for which she is the 2018 Program Chair *February 1 & 2, 2018*
- Gave an oral presentation entitled “Plates to Peaks: A Proposal to move ELISA to the LC-MS platform” with co-author Dr. Walter Krol at the FDA FERN cCAP 2018 Technical Conference in Baltimore, MD (40 attendees) *April 17-18*
- Presented a seminar for the CAES Seminar Series entitled “Select Agent Analysis at CAES” in Jones Auditorium (35 attendees) *May 23*

- Performed science experiments with first grade students from John Trumbull Primary School *June 18*

RUTLEDGE, CLAIRE E.

- Conducted training sessions for the Wasp Watcher Citizen-Scientist program in Wilton, Westbrook, Meriden, North Stonington, Glastonbury, and Litchfield (26 adults) *July 6, 9-12, 2017*
- Hosted a visit from Dr. Hugh Evans and Dr. David Williams of UK Forestry and Dr. Gernot Hoch of the Austrian Research Centre for Forests to learn about emerald ash borer and bronze birch borer *July 19-21*
- Gave a talk entitled “Wasps versus Beetles: How we are fighting the Emerald Ash Borer in Connecticut” at the Wilton Public Library (20 adults and 2 youths) *September 19*
- Organized, presented, and participated in the 6th Annual Emerald Ash Borer Workshop sponsored by the Connecticut Tree Protective Association in Haddam (45 adults) *September 21*
- Was interviewed about southern pine beetle in Connecticut by Patrick Skahill of WNPR in Hartford; the resulting segment ran on both NEXT with John Dankosky and the local environmental segment of Morning Edition *September 25*
- Taught “Insects that Attack Trees” for the CTPA Arboriculture 101 course in Wallingford (40 adults) *October 18*
- Was a guest on WNPR’s show “Where We Live” along with Patrick Skahill, WNPR science reporter and Chris Martin, CT State Forester, for a program entitled “What’s Eating the Trees” <http://wnpr.org/post/whats-eating-trees> *October 24*
- Taught “Tree Conditions Laboratory, Insects” for the CTPA Arboriculture 101 course in Wallingford (40 adults) *October 25*
- With Ms. Katherine Dugas, ran “Dr. Rutledge’s Insectorium and Petting Zoo” exhibit at the Brooklyn Botanical Garden’s Ghouls & Gourds event in Brooklyn, NY (12,000 youth and adult attendees) *October 28*
- Presented a talk entitled “Bronze birch borer, *Agrilus anxius* (Coleoptera: Buprestidae)” while attending the annual meeting of the Entomological Society of America in Denver, CO *November 5-8*
- Participated in the SCSU STEM Career Fair in New Haven (100 adults) *January 31, 2018*
- Taught “Insects that Attack Trees” for Arboriculture 101 for the Connecticut Tree Protective Association in Wallingford (45 adults) *February 14*
- Gave a guest lecture on “Emerald Ash Borer” for a 674b Seminar in Forest Ecosystem Health and Climate Change at the Yale School of Forestry and Environmental Studies in New Haven (20 adults) *February 21*
- Taught “Tree conditions laboratory” for the Connecticut Tree Protective Association’s Arboriculture 101 class in Wallingford (45 attendees) *March 22*
- Gave a talk about emerald ash borer and *Cerceris fumipennis* to a Master Gardeners’ class in New Haven (40 adult attendees) *April 26*
- Presented a workshop entitled “The Biological Control of Emerald Ash Borer in Connecticut” for the Connecticut Botanical Society in Middlefield and Cromwell (field trip) (20 adults) *April 28*
- Hosted an intern from New Haven Academy magnet high school, Adriana Rodriguez, who worked in the forest entomology laboratory four days a week for three weeks *May 7*
- Hosted Dr. David Williams from UK Forestry, who assisted field set-up for the UK Forestry-funded bronze birch borer project that her lab is undertaking this summer *May 22-25*
- Gave an interview about emerald ash borer and biological control, which will be part of the program NEXT from the New England News Collaborative that will air on July 5, to John Dankosky at WNPR in Hartford *June 18*

SCHULTES, NEIL P.

- Presented a short talk entitled “Functional analysis of *Erwinia amylovora* nucleobase cation symporter 2 transporters” at the 77th Annual Meeting of the Northeastern Division of the American Phytopathological Society in Quebec City, Canada (90 attendees) *November 1-3, 2017*
- Gave a seminar entitled “Nucleobase Transporters in Plants and Microbes” for the Dr. Henry Voegeli Seminar Series at the Department of Biology and Environmental Sciences, University of New Haven, in West Haven (50 attendees) *November 9*
- Gave a seminar entitled “Nucleobase Transporters in Plants” for senior high school students visiting the Station from the Sound School in New Haven (7 students) *December 1*
- Spoke to Yale Forestry students about the use of PCR and DNA sequence analysis as applied to fungal taxonomy (15 students) *January 26, 2018*
- Spoke to undergraduate science majors about the current research and internship opportunities at The Experiment Station at the STEM Career Fair held at Southern Connecticut State University (50 adults) *January 31*
- Presented three lectures as a module on “Genetic Modification in Agriculture” in a Yale Undergraduate course (Scie031) “Topic in Science” (14 students) *January 26, February 2 & 9*
- Gave a seminar entitled “Nucleobase Transporters in Plants and Microbes” for the Dept. of Biology, Eastern Connecticut State University, in Willimantic (20 attendees) *March 9*
- Gave a seminar entitled “Genetic Engineering in Agriculture” for a class in Plant Physiology at Southern Connecticut State University (20 attendees) *April 12*
- Served on a Master’s Thesis examination committee for Candace Alexander at the Department of Biology at Indiana Perdue University in Ft. Wayne, IN *April 13*
- Served as a judge in the Sigma Xi Quinnipiac Chapter Seventh Annual Student Research Conference at Quinnipiac University (40 participants) *April 26*

#### SHEPARD, JOHN J.

- Was interviewed about mosquito trapping and West Nile virus by WTNH News 8 *August 24, 2017*
- Gave a talk entitled “Arbovirus Activity in Connecticut, 2017” at the 63rd Annual Meeting of the Northeastern Mosquito Control Association held in Plymouth, MA (approx. 200 meeting attendees) *December 4-6*
- Presented information about the Connecticut Arbovirus Surveillance Program to students from the Stamford Regional Agriscience and Technology Center (4 students, 2 teachers) *March 26, 2018*
- Presented an invited seminar “Mosquito and Tick-Borne Diseases in Connecticut” at the Annual Meeting of the Horticultural Inspection Society, Eastern Branch, in Mystic (17 attendees) *April 10*
- Participated in the Milford Health Department’s kick-off event for their Mosquito Control Program and was interviewed by reporters from WFSB - 3, WTNH - 8, WTIC – Fox 61, WVIT-30, News 12, and the Connecticut Post about the state Mosquito and Arbovirus Surveillance Program *April 18*
- Presented an invited seminar “Mosquito-Borne Diseases and Mosquitoes of Connecticut” at the Clarke Mosquito Control Workshop held in Bridgeport (20 attendees) *April 19*
- Spoke to two groups of Agriscience students about the State Mosquito Trapping and Arbovirus Surveillance Program (55 students, 2 adults) *May 3*
- Presented mosquito trapping information and arbovirus surveillance data at a meeting of the Stamford Health Department’s Vectorborne Disease Prevention Taskforce (10 attendees) *May 16*
- Presented a seminar entitled “Taxonomic Identification of Adult Female Mosquitoes” and was an instructor for a workshop on identification of adult mosquitoes as part of a Vector Biology Boot Camp sponsored by the Northeast Regional Center of Excellence in Vector-Borne Diseases (22 students) *May 23*
- Spoke to a group of visiting students from Norwich Technical High School about the State Mosquito Trapping and Arbovirus Surveillance Program (8 students, 1 adult) *May 24*
- Presented his research and met with University of Connecticut faculty at a meeting on vector-borne

diseases held at CAES (20 attendees) *May 31*

- Spoke to students from Central Connecticut State University about the State Mosquito Trapping and Testing Program, West Nile virus, and Eastern Equine Encephalitis (15 students, 1 professor) *June 20*

#### SHORT, MICHAEL R.

- With Mr. Joseph P. Barsky and Ms. Megan Linske, staffed the CAES booth at the 29th Annual Connecticut Urban Forest Council Conference and 13th Annual Forest Forum in Plantsville (200 attendees) *November 7, 2017*
- Presented a poster entitled “Quantifying wild turkey (*Meleagris gallopavo*) annual productivity utilizing camera trap methodologies in Connecticut, USA,” based on collaborative research with CT-DEEP-Wildlife Division, at the 74th Annual Northeast Fish & Wildlife Conference held in Burlington, VT (300 attendees) *April 15-17, 2018*

#### SMITH, VICTORIA L.

- Presented a talk on inspection and registration to Experiment Station interns, directed by Lindsay Triplett, at the Experiment Station (13 participants) *July 19, 2017*
- Presented a talk entitled “Forest Health – Insects and Diseases” to the Summer Meeting of the Connecticut Tree Protective Association held at the Farmington Club in Farmington (approx. 700 attendees) *July 20*
- Participated in a workshop, sponsored by US Forest Service and PA Department of Natural Resources, on Oak Wilt and Emerald Ash Borer, held at the Frick Environmental Center in Pittsburgh, PA (60 participants) *July 24-27*
- Participated in a meeting of Gypsy Moth Program managers, sponsored by the US Forest Service via conference call in, to report on gypsy moth conditions in Connecticut (approx. 25 participants) *August 8*
- Participated in a meeting of the Yale Biosafety Committee in New Haven (20 participants) *October 19*
- Participated in the annual meeting of the US Forest Service Durham Field Office cooperators, held at Rhode Island Department of Environmental Management Office in Providence, RI, with a presentation on CT forest conditions, including the recent gypsy moth outbreak (40 participants) *October 24-25*
- Participated in a meeting of the Yale Biosafety Committee in New Haven (20 participants) *November 16*
- Participated in a joint seminar, with USDA-APHIS-Plant Protection and Quarantine and USDA-APHIS-Veterinary Services, on the regulatory and permitting process, held at Yale University Environmental Health and Services in New Haven (20 participants) *November 29*
- Participated in the winter meeting of the Cooperative Agricultural Pest Survey committee, held at the Cottage at Lockwood Farm (12 participants) *December 13*
- Participated in a meeting of the Yale Biosafety Committee in New Haven (20 participants) *December 21*
- With Dr. Kirby Stafford, participated in the Cooperative Management Review of programs at CAES in cooperation with USDA-US Forest Service. The review was held at DEEP Headquarters in Hartford (15 participants) *February 10, 2018*
- Participated in a meeting of the Yale Biosafety Committee in New Haven (20 participants) *March 15*
- With Ms. Tia Blevins, Ms. Katherine Dugas, Mr. Jeffrey Fengler, and Mr. Zachary Brown, organized, hosted, and moderated the 93rd annual meeting of the Eastern Plant Board (EPB), the Horticultural Inspection Society (HIS), and the Cooperative Agricultural Pest Survey (CAPS), held at the Mystic Hilton. Ninety participants, representing the EPB, HIS, CAPS, USDA-Plant Protection and Quarantine, US Forest Service, and US Customs and Border Protection, attended meetings, presentations, and panel discussions on a wide range of topics. HIS members went on a field trip to



Prides Corner Farms in Lebanon. Everyone enjoyed a New England lobster bake at the Mystic Aquarium *April 9-12*

- Was interviewed about the threat of Spotted Lantern Fly by Patricia del Rio of WFSB News *May 14*
- Participated in the spring Cooperative Agricultural Pest Survey committee meeting, held in the Jones Auditorium (12 participants) *June 14*
- Participated in a meeting of the Yale Biosafety Committee in New Haven (20 participants) *June 21*

#### SOGHIGIAN, JOHN S.

- Gave an invited talk entitled “Convergence in habitat specialization and morphology in *Aedes* mosquitoes” at the 2017 Entomological Society of America Annual Meeting in Denver, CO (approx. 30 attendees) *November 8, 2017*

#### STAFFORD, KIRBY C., III

- Was interviewed about ticks and Lyme disease on the Chaz and AJ morning show on WPLR *July 11, 2017*
- Was interviewed about tick activity by Robert Miller, Danbury News Times *July 18*
- Was interviewed on Lyme disease trends and tick management by David Scales, WBUR Boston *July 19*
- Spoke on Lyme disease and tick control at the Public Library in Cheshire (17 attendees) *July 26*
- Was interviewed about flying ants by Ajhani Ayres, Republican-American *September 7*
- Presented a talk on ticks at the Tilde Café in Branford (35 attendees) *September 16*
- Welcomed the Federated Garden Club of Connecticut to the Station in Jones Auditorium *September 20*
- Was interviewed about the lone star tick by Channel 3 WFSB-TV *September 20*
- Was interviewed about the lone star tick by Ed Stannard, New Haven Register *September 20*
- Was interviewed about the lone star tick by NBC CT *September 21*
- Was interviewed about the lone star tick by Tony Terzi, Fox61 *September 21*
- Was interviewed about the lone star tick by John Voket, Connoisseur Media *October 5*
- Spoke on ticks and tick-borne diseases at the 52nd annual regional meeting of the American Society for Microbiology at the University of Connecticut in Storrs (35 attendees) *October 13*
- Presented a tick training session for pest management professionals and Maine Cooperative Extension (122 attendees) and visited the Maine Medical Center Research Center group to discuss collaborative research in Portland, ME *October 18*
- Was interviewed about lone star ticks by Chris Woodside, Connecticut Health Initiative *October 23*
- Presented two talks for an EPA webinar on Healthy Schools: Managing Ticks in Your School District (342 registered attendees) *October 24*
- Presented a talk on ticks and tick-borne diseases for the Bethany Land Trust in Bethany (50 attendees) *October 26*
- With Dr. Goudarz Molaei, co-organized the symposium The Challenge of Tick-Borne Diseases and presented a talk entitled “Habitat and winter survival of *Ixodes scapularis* and *Amblyomma americanum*,” while attending the annual meeting of the Entomological Society of America in Denver, CO (70 attendees) *November 5-8*
- Presented a talk entitled “Tick IPM Toolbox: An Update on Tick Control” at the annual meeting of the Northeastern Mosquito Control Association in Plymouth, MA (120 attendees) *December 5*
- Participated in the winter meeting of the Cooperative Agricultural Pest Survey committee, held at the Cottage at Lockwood Farm (12 participants) *December 13*
- Testified for the State Attorney’s Office about entomological forensic evidence *January 10, 2018*

- Spoke about tick-borne diseases and tick control at the Ledge Light Health District, New London, for an initial Lyme disease task force meeting and taped an interview for their Health Watch show in Groton (30 attendees) *January 10*
- Participated in and presented a talk at the first annual meeting of the Northeast Regional Center of Excellence for Vector-Borne Diseases held in Jones Auditorium *January 26*
- Participated in a meeting of Connecticut IACUC Administrators at UConn Health Center in Farmington *January 31*
- With Dr. Victoria Smith, participated in the US Forest Service forest health program review in Hartford (15 participants) *February 6*
- Presented a talk on ticks and tick management at the NOFA Land Care course at Three Rivers Community College in Norwich (40 attendees) *February 10*
- Was interviewed about tick activity in winter by Ketirah Selder-Hogan, NPR *February 23*
- Presented a talk on tick-associated disease and integrated tick management at the American Mosquito Control Association annual meeting held in Kansas City, MO *March 2*
- Presented a talk on ticks and tick control at the Scoville Memorial Library in Salisbury (62 attendees) *March 24*
- Was interviewed about a report of stolen honey bee hives in Sprague by Jordan Otero Sisson, Hartford Courant *April 2*
- Presented the welcome and participated in the 93rd annual meeting of the Eastern Plant Board (EPB) held in Mystic *April 9-12*
- Spoke about ticks and tick-borne diseases to the Lyme Garden Club in Lyme (40 adult attendees) *May 7*
- Was interviewed about a recent CDC report on increased tick activity and tick-borne diseases by Bob Myers, Cornwall Chronicle *May 8*
- Was interviewed about tick activity and sampling for ticks by Rebecca Schuetz, Norwalk Hour *May 15*
- Was interviewed about gypsy moth activity by John Silva, WTIC-1080 Radio *May 17*
- Was interviewed about gypsy moth activity for 2018 by Cherie Monte, WINY Radio *May 22*
- Participated in the NEVBD “Boot Camp” for public health personnel and provided training on tick identification and tick management *May 22-24*
- Was interviewed about ticks by Kate, New York Times *May 23*
- Was interviewed about tick activity by Martha Shanahan, The Day *May 29*
- Participated in the joint meeting between CAES and the University of Connecticut Department of Pathobiology on vector biology-related research in Jones Auditorium (15 attendees) *May 31*
- Was interviewed about gypsy moth by Sam Kantrow, WTNH *June 11*
- Was interviewed about the National Honey Bee Survey by Gregory Hladky, Hartford Courant *June 12*
- Participated in a meeting of the CAPS committee and a meeting on Spotted Lanternfly Outreach and Response in Jones Auditorium (12 participants) *June 14*
- Was interviewed about tick biology and behavior by Michele Debczak for Mentalfloss.com *June 18*

#### STEVEN, BLAIRE T.

- Gave a departmental seminar entitled “Sudden Vegetation Dieback as a Model for Carbon Cycling in a Coastal Wetland” in the Department of Natural Resources and the Environment at the University of Connecticut (approx. 15 faculty members and 25 students) *September 22, 2017*
- Hosted students from Henry Abbott Technical School for a four-week program on identification of antibiotic resistant bacteria in Connecticut soils (6 student attendees) *April 6-27, 2018*
- Hosted a guest lecture on the role of microorganisms in plant health and physiology in the Plant Physiology class at Southern Connecticut State University (20 student attendees) *April 10*

STONER, KIMBERLY A.

- Was interviewed about bees, pollination, and pesticide exposure of bees on the WPKN radio program “The Organic Farmstand” by Bill Duesing and Guy Beardsley *July 6, 2017*
- Was interviewed about bee health and pollination by John Burgeson of the Connecticut Post *August 2*
- Presented a poster “Connecticut Native Plants for Bees” as part of a Department of Transportation lunchtime session during a conference on transportation design for Departments of Transportation nationwide at the CT Department of Transportation Headquarters in Newington *August 7*
- Presented a workshop “Planting for the Bees’ Needs” at the NOFA Summer Conference, Hampshire College, Amherst, MA (63 attendees) *August 13*
- Organized and hosted a meeting of the Connecticut Native Plants for Pollinators and Wildlife Working Group, with guest speaker Michael Piantedosi of the New England Wildflower Society, at the Valley Laboratory in Windsor (8 attendees) *September 15*
- Presented a poster “Pesticides in Trapped Honey Bee Pollen from Ornamental Plant Nurseries” at the Protecting Urban Pollinators Conference, Traverse City, MI *October 11*
- Met with George Davis, a member of the Board of Directors of the Edgerton Park in New Haven, to discuss possibilities for a pollinator meadow at Edgerton Park *October 16*
- Provided Maria Vogel-Short, graduate student at Quinnipiac University, with information on the economic value of pollination services, honey production, and honey bee colony numbers for the US and spoke to the annual meeting of the North Central Conservation District on “Planting for the Bees’ Needs” at the Tolland Agricultural Center in Vernon (20 attendees) *October 25*
- Spoke on “Planting for the Bees’ Needs” at the CT Audubon Center in Glastonbury (20 attendees) *November 6*
- Organized a tour of the Bee Laboratory and Wade Elmer’s laboratory and greenhouse for the Greenhouse Management class from the Naugatuck Valley Community College (8 students and 1 teacher, Chris Tuccio, participated) *November 8*
- Organized and led a meeting of the Connecticut Native Plants for Pollinators and Wildlife Working Group at the Yale Peabody Museum (7 participants) *November 8*
- Organized and moderated a conference session on Wildlife Management at the New England Vegetable and Fruit Conference in Manchester, NH (75 attendees) *December 12*
- Was interviewed by Colin McEnroe of Connecticut Public Radio (WNPR) about pollinator habitat and the potential for competition between honey bees and native bees, which aired on the Colin McEnroe show on January 30 *January 29, 2018*
- Was visited by a Restoration Ecology class from Sacred Heart University, led by Dr. Jennifer Matthei, in which Dr. Stoner spoke about the work of the Station and about bee research (17 attendees; 16 were students) *January 30*
- Was interviewed about habitat for bees on the Organic Farmstand program on WPKN, 89.5 FM, Bridgeport, by Bill Duesing and Guy Beardsley *February 1*
- Spoke at the Biennial Specialty Crop Research Initiative Stakeholder-Researcher Conference about current research evaluating the attractiveness of ornamental plants to pollinators and the analysis of trapped pollen from ornamental plant nurseries to determine sources of hazardous pesticides held in St. Louis, MO (20 attendees, with 6 more listening to conference audio) *February 7*
- Organized the 3<sup>rd</sup> annual day-long “Creating and Improving Pollinator Habitat Conference” and spoke on Protecting Bees from Pesticides held in Jones Auditorium (75 attendees) *February 27*
- Presented a workshop “Integrating Pollinator Habitat into Your Farm” at Organiconn, the NOFA Connecticut winter conference, at Western Connecticut State University (45 attendees) *March 10*
- Participated in a joint meeting between CAES and UConn College of Agriculture to explore possibilities for cooperation in the areas of specialty crops, crop improvement, and integrated pest management, at the University of Connecticut (18 participants from both institutions) *March 12*

- Presented a CAES Seminar entitled “Tracking Sources of Pesticides in Pollen” in Jones Auditorium (40 attendees) *March 15*
- Organized and moderated a symposium “Pollinator Habitat in Northeastern Landscapes: Diversity, Crop Pollination, and Pesticide Exposure” and presented a talk entitled “Tracking Sources of Systemic Insecticides Using Trapped Honey Bee Pollen” (35 attendees) *March 19*
- Spoke to a visiting class from the Stamford Regional Agriscience and Technology Center about bees and pesticides (7 attendees, of which 5 were high school students) *March 26*
- Spoke to the Bee School for High School conference on “Honey Bees vs. Wild Bees” with 75 high school students from the following schools: Lyman Hall, Common Ground, The Sound School, E.O. Smith, West Hill, Nonnewaug, and Bloomfield, and also home-schooled kids (84 attendees) *March 26*
- Was interviewed about pesticides and bees by Hanna Holcomb for an article in Connecticut Woodlands magazine *April 6*
- Spoke on “Planting for the Bees’ Needs” at the Weston Library as part of the launch of the Weston and Ridgefield Pollinator Pathway programs (45 attendees) *April 9*
- Governor Malloy and members of the Board of Control visited the Bee Lab and heard about the diversity of bees in Connecticut and current projects measuring pesticide exposure of honey bees through pollen *April 11*
- Spoke on “Planting for the Bees’ Needs” at the annual meeting of the Burlington Land Trust at the Whigville Grange (35 attendees) *April 11*
- Spoke on “Integrating Pollinator Habitat into Your Farm” as part of the “Healthy Soils = Healthy Crops” workshop, organized by the Natural Resources Conservation Service and CT NOFA, at South Farm in Morris (76 attendees) *April 26*
- Served on the Master’s degree committee of Ben Gluck at the University of Connecticut, along with Ana Legrand and Julia Cartabiano *May 8*
- Was interviewed about research on pesticide residues in trapped honey bee pollen from Connecticut nurseries by Kim Trella of CT DEEP for their Pollution Prevention newsletter *May 10*
- Served on the doctoral committee of John Campanelli of the University of Connecticut, along with Julia Kuzovkina and Ana Legrand *May 23*
- Presented a talk entitled “Beyond the Honey Bee – Native Bees of Connecticut” as the keynote of a symposium on bees at the Bruce Museum in Greenwich (65 adults attendees) *June 13*
- Presented a talk entitled “Planting for the Bees’ Needs” at the Connecticut State Library in Hartford (45 adults attended) *June 21*

#### TRIPLETT, LINDSAY R.

- Presented two posters entitled “Survey of toxin-antitoxin system distribution and diversity among genomes of plant-associated bacteria,” and “Cofactor engineering as a novel pathogenesis strategy: a *Xanthomonas* secreted effector modifies NAD *in planta*” and participated in a meeting of the APS Bacteriology Committee, serving as co-chair, at the Annual Meeting of the American Phytopathological Society in San Antonio, TX (100 attendees) *August 5-9, 2017*
- Was interviewed for an article entitled “I don’t know how she does it: Stories of plant scientists with children” for *Plantae.org*, a blog of the American Society of Plant Biologists *September 5*
- Was an invited speaker to the Department of Plant Sciences at the University of Arizona and presented a seminar entitled “A weapon of suicide or warfare: Understanding the functions of the bacterial virulence effector and universal toxin *AvrRxo1*” and met with faculty and students (42 attendees) *September 26*
- Participated in a webinar that followed the National Academy of Science’s Citrus Greening Committee Meeting held July 23-25 in Washington, DC to evaluate the success of ten years of Citrus Greening research in the US and to make recommendations for future research *September 28*
- Was a guest instructor for the MCDB380/680 course at Yale (Topics in Plant Molecular Biology),

giving three lectures, leading three paper discussions on molecular plant microbe interactions, and grading one essay assignment (11 undergraduate and graduate students attended) *October 6-November 3*

- Met with students and faculty at the Department of Plant Pathology and Environmental Microbiology at Penn State University, State College, PA and presented an invited seminar entitled “A weapon of suicide or warfare: Understanding the functions of a bacterial virulence effector and universal toxin” (28 attendees) *October 23*
- Presented “Self-killing turned outward: a new role for toxin-antitoxin systems in bacterial infection” as the keynote speaker at the Graduate Research Symposium in the Department of Plant Pathology, Physiology and Weed Science at Virginia Tech (40 attendees) *November 6*
- Presented a laboratory tour and equipment demonstration for visiting students from The Sound School (8 adults) *December 1*
- Manned a recruitment table for the Plant Health Fellows summer internship program at the New Haven Promise Career Fair (19 adults expressed interest) *January 10, 2018*
- Presented a general interest program entitled “The rice that helped America grow” at the Cheshire Library (11 attendees) *February 26*
- Was interviewed about the history of rice by Joy VanderLek for an article that appeared in the March 8 issue of the Cheshire Citizen <https://issuu.com/cheshirecitizen/docs/cheshirecitizen20180308> *February 26*
- Hosted a tour stop for students from the Stamford Regional AgriScience and Technology Center and presented information about plant disease and demonstrated bacteria swimming under a microscope (4 students and 2 adults attended) *March 26*
- Served as a judge for undergraduate poster presentations at the Sigma Xi Quinnipiac Chapter Student Research Conference at Quinnipiac University (40 participants) *April 26*
- Presented a classroom lecture entitled “Bacterial diseases in the ancient world” to a group of 3rd and 4th graders at Spring Glen Church (8 youths, 2 adults) *May 20*
- Presented a lecture on careers in plant pathology to a visiting group of students from Norwich Technical High School (10 students and 1 adult) *May 24*

#### VOSSBRINCK, CHARLES R.

- Gave three talks entitled “Genome size in Microsporidia—An evolutionary hypothesis,” “Phylogeny of Microsporidia—Impact of molecular approaches,” and “The Microsporidia as Eukaryotes Microsporidia” at the Society of Invertebrate Pathology Annual Conference held in San Diego, CA *August 13, 2017*
- Gave a CAES Seminar Series talk entitled “Genomic Ecology of the Microsporidia” in Jones Auditorium (approx. 50 attendees) *October 11*

#### WARD, JEFFREY S.

- Led an interpretative walk in Naugatuck State Forest (12 attendees) *July 15, 2017*
- Was interviewed about barberry control and ticks by Anne Semmes of the Greenwich Times *July 18*
- Was interviewed about barberry control and ticks by Shyang Puri of NBC-30 *July 24*
- Was interviewed about fall foliage by Matt Ormseth of the Hartford Courant *August 21*
- Spoke about Japanese barberry control and relationship to tick densities at the “Lyme disease: Restoring balance in the body” workshop in Tolland (14 attendees) *August 27*
- With Mr. Joseph P. Barsky, participated in a Connecticut Society of American Foresters field meeting in Voluntown *August 30*
- With Mr. Joseph P. Barsky, met with Scott Graves (Southern Connecticut State University) to identify trees and shrubs on a natural area in West Haven *September 6*

- Participated at the annual meeting of the Rhode Island Chapter of the Society of American Foresters in Foster, RI *September 13*
- Chaired the Executive Committee meeting of the New England Society of American Foresters in Concord, NH *September 19*
- Led a workshop “Outdoor identification of plants” for the Gardening Study School 2017 in New Haven (27 attendees) *September 26*
- Met with Karen Bennet (University of New Hampshire), Mark Ashton (Yale University), and Kyle Lombard (New Hampshire Forest and Lands) to discuss oak management in Union *October 9*
- Was interviewed about the effect of drought on fall color by Fox-61 *October 17*
- Led an interpretative walk “Forest Bathing with a Forester” at Steep Rock Preserve in Washington (26 attendees) *October 21*
- Presented an invited talk entitled “Crop tree management in fully and poorly stocked stands” at the Oak Symposium: Sustaining Oak Forests in the 21st Century through Science-based Management in Knoxville, TN (70 attendees) *October 24-26*
- Was interviewed about the impact of warm weather on late fall colors by John Burgeson of the Connecticut Post *October 26*
- Gave invited co-lectures with Dr. Mark Ashton (Yale) on “Silvics of individual species and stand dynamics” and “Silvicultural systems and practices” along with leading a field workshop on oak management and ecology at the Northeast Silviculture Institute for Foresters Mixed Oak-Hickory Symposium in Sturbridge, MA *October 30*
- Participated in the Society of American Foresters House Society of Delegates annual meeting in Albuquerque, NM *November 14-15*
- Presented the poster “Influence of Invasive Shrubs and Deer Browsing on Regeneration in Temperate Deciduous Forests” at the Society of American Foresters annual convention in Albuquerque, NM *November 16*
- Was interviewed about princess pines by Robert Miller of the Danbury News-Times *December 12*
- Hosted a New England Society of American Foresters Executive Committee quarterly meeting via conference call *December 14*
- Participated in a State Vegetation Management Task Force meeting in Middlefield *December 19*
- Gave two webinars on “Rehabilitation of degraded hardwood stands” for the Cornell University ForestConnect series (202 attendees who collectively manage over 33 million acres) *December 20*
- Was interviewed by John Burgeson of the Connecticut Post about the impact of the recent cold snap on invasive species *January 10, 2018*
- Provided an update on current CAES tree research at the Connecticut Tree Protective Association annual meeting in Plantsville (400 attendees) *January 18*
- Spoke on “Cada Árbol Tiene su Lugar” at the Connecticut Nursery and Landscape Association Winter Symposium in Plantsville (34 attendees) *January 25*
- Gave an invited talk entitled “The historical and future impacts of exotic insects and diseases on Connecticut’s forests” for a Yale Forestry seminar (17 attendees) *January 31*
- Was interviewed about crown shyness by Will Rowlands of the Connecticut Gardener *February 15*
- Was interviewed by Hallie Metzger about rehabilitating high-graded forest by Hallie Metzger of the Cutting Edge (CT-TIMPRO Quarterly) *February 16*
- Gave an invited talk entitled “Rehabilitation of degraded hardwood stands” at the Yale Forest Forum *February 22*
- Was interviewed about the effect of weather and climate change on maple syrup production by Bob Miller of the Danbury News-Times *February 27*
- Participated in New England Society of American Foresters Executive Council meeting *March 26*

- Gave an invited talk entitled “Ecology and management of northern red oak in New England - tending prescriptions” at the New England Society of American Foresters’ annual meeting held in Nashua, NH (150 attendees) *March 27*
- Hosted a guest lecture at Southern Connecticut State University in the Plant Physiology class on the role of microorganisms in plant health and physiology (20 student attendees) *April 10*
- Hosted students from Henry Abbott Technical School for a four-week program on identification of antibiotic resistant bacteria in Connecticut soils (6 student attendees) *April 6-27*
- Spoke on “Foresters for the Birds” to the Cheshire Garden Club (16 attendees) *May 7*
- Presented a paper entitled “B-level and crop tree management in mature oak stands: 10-year results” at the 21st Biennial Central Hardwood Forest Conference held in Bloomington, IN (70 attendees) *May 15*
- Participated in an Executive Committee meeting of the New England Society of American Foresters in Concord, NH *June 13*

WHITE, JASON C.

- Attended the 3rd Annual Parma Nano-Day at the University of Parma in Parma, Italy, and gave a plenary lecture entitled “Nanomaterials and the food supply: Assessing the balance between applications and implications” (50 attendees) *July 11-15, 2017*
- Attended the 2017 International Conference on the Biogeochemistry of Trace Elements (ICOBTE) in Zurich, Switzerland, and gave a keynote lecture entitled “Accumulation of engineered nanoparticles in terrestrial food chains: Correlating physiological and molecular response” (50 attendees) and a 2-minute “flash presentation” entitled “Nanoscale nutrients suppress plant disease and increase crop yield” (50 attendees) *July 16-20*
- Gave an invited lecture entitled “Nanomaterials and the food supply: Assessing the balance between applications and implications” at Zhejiang University as part of a new 111 Project entitled “Crop Produce Quality and Safety,” which was awarded this summer from the Chinese Ministry of Education and the State Administration of Foreign Experts Affairs *August 7-11*
- With Dr. Theodore Andreadis and Mr. Michael Last, met with the Commissioner of Agriculture and his staff regarding a new FDA program called the Produce Safety Rule *August 30*
- With Dr. Theodore Andreadis, attended a meeting at Prides Corner Farms in Lebanon with the US Secretary of Agriculture, Mr. Sonny Perdue, as part of the Secretary’s “listening tour” *August 31*
- Served as a judge for the FFA Agriscience Fair at the Big E in Springfield, MA *September 15*
- Attended the 14th International Phytotechnologies Conference in Montreal, Quebec, Canada, chaired an Editorial Board meeting of the International Journal of Phytoremediation (25 attendees), and was the co-recipient of the Stephen D. Ebbs Award for distinguished service to the field of phytotechnologies *September 25-28*
- Gave an invited Brace Seminar entitled “Engineered nanomaterials in agriculture: assessing the balance between implications and applications” at McGill University in Montreal, Quebec, Canada (25 attendees) *September 28*
- With Dr. Theodore Andreadis, met with several legislators and discussed CAES programs and provided a tour of the Station *October 2*
- Attended the annual “all hands” meeting for the NSF-funded Center for Sustainable Nanotechnology at the University of Illinois-Urbana Champaign and gave a presentation entitled “The use of nanoscale micronutrients to suppress disease” (70 attendees) *October 6-8*
- Was interviewed about a recently published paper focusing on the use of Surface Enhanced Raman Spectroscopy (SERS) to detect and map pesticides on apples by Ms. Janet Pelley of Chemical and Engineering News *October 23*
- Was an invited attendee at the AgroBio Nanotechnology Conference in Saltillo, Mexico, which was organized for the Center for Applied Analytical Chemistry (CIQA) and gave a presentation entitled “Nanomaterials in agriculture: Assessing the balance between applications and implications” (200 attendees) *October 24-28*

- Attended the 6th annual Sustainable Nanotechnology Organization (SNO) Conference and presented a lecture entitled “Nanotechnology and the food supply: Assessing the balance between applications and implications” (20 attendees) and chaired a session entitled “Food/Agriculture” *November 5-8*
- Participated in an FBI WMD, CT Civil Support Team, and US EPA Table Top Exercise in Windsor Locks *November 28*
- Presented an invited lecture entitled “Nanomaterials and the food supply: Assessing the balance between applications and implications” at Nanjing Agricultural University in Nanjing, China (100 attendees) (*December 6*) and presented an invited lecture entitled “Nanomaterials and food/agriculture: assessing the balance between applications and implications” at the Institute of Botany of the Chinese Academy of Sciences in Nanjing, China (30 attendees) *December 4-8*
- Participated as a Jury member in the Ph.D. Dissertation Defense of Inge Jambon of Hasselt University in Hasselt, Belgium *December 17-19*
- With Mr. Michael Cavadini, appeared in front of the Commission on Human Rights and Opportunities (CHRO) at the Legislative Office Building in Hartford to answer questions about the CAES Affirmative Action Plan *January 10, 2018*
- Attended the New Haven County Farm Bureau annual meeting at the Sound School in New Haven and provided an update on CAES projects and funding issues *January 16*
- With the rest of the Analytical Chemistry Department, hosted the FBI Weapons of Mass Destruction Coordinator (New Haven Field Office) and the 14<sup>th</sup> Civil Support Team of the CT National Guard and discussed an upcoming field training exercise involving a chemical terrorism threat and analysis of samples by Department staff *February 9*
- Gave an invited lecture at the University of Massachusetts Department of Food Science entitled “Nanomaterials and the Food Supply: Assessing the Balance Between Applications and Implications” and served as a judge in the Hultin Scholarship graduate student platform presentation competition *February 12*
- Gave an invited lecture on the Center for Sustainable Nanotechnology at Georgia Southern University and recruited students for the Center REU program *February 14-15*
- Hosted Professor Yangchao Luo of the UConn Department of Nutritional Sciences for the CAES Seminar Series (February 21).
- Attended the Center for Sustainable Nanotechnology “All Hands” meeting at Johns Hopkins University in Baltimore, Maryland, and gave a presentation entitled “Nano-enabled agriculture: A tutorial” (65 attendees) *March 4-6*
- Remotely gave a presentation entitled “Nanoparticles in the environment” at the 9th International IPM Symposium in Baltimore, MD (25 attendees) *March 21*
- Attended the Ph.D. defense of Dr. Aidee Ilyia Medino Velo at the University of Texas-El Paso *March 28-29*
- Gave an oral presentation at the Stockbridge School of Agriculture at UMass Amherst entitled “Nanomaterials and the food supply: Assessing the balance between applications and implications” (25 attendees) *April 2*
- With Dr. Roberto De La Torre-Roche and Dr. Nubia Zuverza-Mena, hosted an undergraduate student from Muhlenberg College who conducted analysis of samples as part of a collaborative research project *April 9-10*
- Was an invited plenary speaker at the 4th International Symposium on the “Environmental Application and Implication of Engineered Nanoparticles” in Wuxi, China, and gave a lecture entitled “Nanomaterials in agriculture: A current perspective on applications and implications” (120 attendees) *May 7-11*
- Participated by ZOOM in the Thesis Background Exam (TBE) of Ms. Jaya Borgatta, who is a PhD student at the University of Wisconsin and in the Center for Sustainable Nanotechnology *May 15*
- Provided welcoming comments and a tour of the Department of Analytical Chemistry laboratory and programs to visiting students from Norwich Technical High School (9 students) *May 24*



- Participated as a committee member in the PhD dissertation defense of Dr. Huiyuan Guo of the University of Massachusetts *May 30*
- With Dr. Nubia Zuverza-Mena, Dr. Roberto De La Torre-Roche, and Dr. Chuanxin Ma, mentored interns from the Southern Connecticut State University (SCSU) Plant Health Program as well as interns from the Center for Sustainable Nanotechnology *June-August*
- Had a Zoom call with Ms. Jaya Borgatta and Professor Robert Hamers of the University of Wisconsin regarding Jaya's Ph.D. research (he is a committee member); attended the Nanoscale Science and Engineering for Agriculture and Food Systems Gordon Research Conference at Mt. Holyoke College and gave a plenary presentation entitled "Applications versus implications for safe implementation of nanotechnology in food and agriculture" (145 attendees) and gave a poster presentation entitled "Nanoscale elements suppress plant disease, enhance macronutrient use efficiency, and increase crop yield" as part of the annual USDA NIFA Project Investigators meeting *June 3-8*
- Hosted Professor Om Parkash and Ms. Ayousha Shahi (graduate student) of the University of Massachusetts (he is on Ayousha's Ph.D. committee) *June 15*

#### WILLIAMS, SCOTT C.

- With Ms. Megan Linske, hosted Trinity College post-doc Krista Ehlert and two undergraduates to demonstrate *Borrelia* detection via indirect fluorescent antibody staining technique *July 17, 2017*
- With Ms. Megan Linske, gave a field demonstration on small mammal capture and handling techniques to students in the Natural Resources Conservation Academy at the University of Connecticut (12 students, 4 teachers) *July 21*
- With Ms. Megan Linske and Mr. Michael Short, was interviewed about the blacklegged tick and Japanese barberry relationship by NBC-30 Troubleshooters reporter Shyang Puri *July 27*
- With Mr. Michael Short and Ms. Megan Linske, spoke with Yale medical students and residents about ticks and tick-borne disease ecology (14 students, 1 professor) *August 23*
- Was interviewed about overabundant suburban deer management by Taylor Shortal of the Columbia Missourian newspaper *August 14*
- Hosted a meeting of the Connecticut Urban Forest Council (8 attendees) *September 22*
- Gave an invited lecture about environmental employment opportunities at Middlesex Community College in Middletown (12 students, 1 teacher) *October 16*
- With Ms. Megan Linske and Mr. Michael Short, was interviewed about the blacklegged tick and Japanese barberry relationship (<https://www.nbcconnecticut.com/news/local/Popular-Shrub-Linked-to-Rising-Rates-of-Lyme-Disease-in-Ticks-447990093.html>) by NBC-30 Troubleshooters reporter Shyang Puri *October 18*
- Was interviewed about Japanese barberry and blacklegged ticks by WNPR environmental reporter Patrick Skahill (<http://wnpr.org/post/invasive-shrub-deer-tickhaven>) *October 19*
- Gave an invited co-lecture with DEEP Wildlife Division Biologist Michael Gregonis entitled "Acorn abundance patterns and their implication for wildlife" at the Northeast Silviculture Institute for Foresters Mixed Oak-Hickory Symposium held in Sturbridge, MA (62 attendees) *October 30*
- As Executive Treasurer, participated in the 29th Annual Connecticut Urban Forest Council Conference and 13th Annual Forest Forum in Plantsville *November 7*
- As a graduate committee member, participated in the successful oral defense of Kelsey Schwenk's Master's degree from the University of Connecticut in Storrs *November 16*
- With Mr. Joseph P. Barsky, Mr. Michael R. Short, and Ms. Megan Linske, hosted the FFA Forestry Career Development Event held at Lockwood Farm (36 students, 9 teachers) *November 17*
- As a graduate committee member, participated in the successful Ph.D. dissertation defense of Dr. Megan Linske from the University of Connecticut in Storrs *November 27*
- Gave an invited lecture entitled "Charismatic and complicit: impacts of increased abundances of white-tailed deer on ticks and tick-borne diseases" at the Northeastern Mosquito Control Association Meeting held in Plymouth, MA (190 attendees) *December 5*

- Gave an invited lecture entitled “Use of repellents for averting deer and rabbit damage” at the New England Vegetable & Fruit Conference held in Manchester, NH (120 attendees) *December 12*
- Participated in a iCRV radio program “Nature” with Ranger Russ Miller about ticks, their hosts, and tick-borne diseases in Ivoryton *January 15, 2018*
- Gave an invited lecture about deer and ticks and other “Misunderstood Wildlife Species” at the Living with Wildlife Speaker Series co-hosted by the Town of Guilford Conservation Commission and the Guilford Land Conservation Trust (100 attendees) *January 17*
- Hosted a meeting of the Connecticut Urban Forest Council, Hamden *January 23*
- Gave an invited presentation entitled “Less-toxic Integrated Control and Host Reservoir Dilution of Ixodes scapularis in Residential Settings” and participated in the Northeast Regional Center for Excellence in Vector-Borne Diseases meeting held in the Jones Auditorium (75 attendees) *January 26*
- Spoke to Lyman Hall High School students about career paths and research opportunities at the Connecticut Agricultural Experiment Station (10 students, 1 teacher) *January 29*
- Gave a CAES seminar entitled “Tick-borne disease ecology: Concerns for forest and public health alike” in Jones Auditorium *March 28*
- Gave an invited lecture entitled “Charismatic and Complicit: Impacts of Increased Abundances of White-tailed Deer on Ticks and Tick-borne Diseases” at the One Health Symposium at the NEAFWA conference (45 attendees) *April 17*
- Spoke with Popular Science reporter Kate Baggaley about the positive relationship with blacklegged ticks and Japanese barberry *April 25*
- Presented a guest lecture entitled “Tick-borne disease ecology: concerns for forest and public health alike” and visited with professors from the School of Biology and Ecology at the University of Maine, Orono (100 attendees) *April 26-28*
- Participated in a meeting of the Advisory Board of the Environmental Science Program at Middlesex Community College *June 11*

#### ZARRILLO, TRACY

- Gave a brief demonstration about how she creates bee trap nests to the students of Sacred Heart, and answered questions about using artificial nest boxes (16 students, 1 teacher) *January 30, 2018*
- Participated in a joint meeting between CAES and UConn College of Agriculture to explore possibilities for cooperation in the areas of specialty crops, crop improvement, and integrated pest management, at the University of Connecticut (18 attendees) *March 12*
- Organized and led a honey tasting station for a High School conference on beekeeping held in the Jones Auditorium, with 75 high school students from the following schools: Lyman Hall, Common Ground, The Sound School, E.O. Smith, West Hill, Nonnewaug, and Bloomfield, and also home schooled kids (84 attendees) *March 26*
- Gave a talk entitled “A Safe Haven for Pollinators: Creating a Backyard Oasis” for the Hamden Land Conservation Trust, held at Whitney Center in Hamden (30 attendees) *April 13*

#### ZENG, QUAN

- Was interviewed about biological controls of fire blight by John Burgeson, Connecticut Post *August 2, 2017*
- Was interviewed about fire blight management and development and application of antisense antimicrobials for plant agriculture by Charlotte Webber, WSHU Public Radio *August 29*
- Attended and chaired the APS Bacteriology Committee meeting (80 attendees) and gave a poster presentation entitled “Exploration of using PNA-CPP as a novel antimicrobial against *Erwinia amylovora* and control of fire blight” (100 attendees) at the Annual Meeting of the American Phytopathological Society held in San Antonio, TX *August 5-9*
- Was interviewed about the recently funded USDA-NIFA project by Mr. Luther Turmelle from the New Haven Register *October 17*

- Presented “Evaluation of organic management options for fire blight in Connecticut” at the Third Annual Integrated Pest Management (IPM) Online Conference *October 23*
- Gave a research presentation entitled “Genotyping and migration of fire blight pathogen, *Erwinia amylovora*” (50 adult attendees) and had research conferences about fire blight research with Drs. Srdjan Acimovic, Daniel Cooley, David Rosenberger, and Alan Eaton at the 79th New England, New York and Canadian Fruit Pest Workshop in Burlington, VT *October 24-25*
- With Dr. Blaire Steven, was interviewed about the recently funded USDA-NIFA project by Ms. Kate Pregelmann from Good Fruit Grower Magazine *November 9*
- Hosted Dr. Jie Wang from Michigan State University who gave a seminar at the Station (35 adults) *November 7*
- Presented “Plant diseases caused by bacteria” to visiting students from The Sound School (8 attendees) *December 1*
- Gave a presentation entitled “Management of fire blight under the humid climate in the Eastern United States” at the 2017 New England Vegetable and Fruit Conference in Manchester, NH (200 adults) *December 12*
- Participated in the SCSU STEM Career Fair (50 adults) *January 31, 2018*
- Hosted high school students from the Stamford Regional AgriScience and Technology Center and gave a lab demonstration of examining plant pathogens using a fluorescence microscope (2 adults, 7 children) *March 26*
- Served as a judge for undergraduate poster presentations at the Sigma Xi Quinnipiac Chapter Student Research Conference at Quinnipiac University (40 participants) *April 26*
- Presented “Research on Plant Pathology” on behalf of CAES at the JAX/SCSU bioscience careers forum at Southern Connecticut State University (20 adults) *April 27*

#### ZUVERZA-MENA, NUBIA

- Mentored two undergraduate students from the Southern Connecticut State University (SCSU) Plant Health Program *June 5 to August 4, 2017*
- With Roberto De La Torre-Roche and Chuanxin Ma, hosted three graduate interns from the Center for Sustainable Nanotechnology *July 24-28*
- Presented a poster entitled “Effects of silver based nanoparticles on potato and red worms in soil” at the 14th International Phytotechnologies Conference (IPC) held in Montreal, Quebec, Canada (317 attendees) *September 25-28*
- Presented a talk entitled “Nanoscale nutrients suppress plant disease and increase crop yield” at the Materials Research Society (MRS) symposium “Materials Innovation for Sustainable Agriculture and Energy” held in Boston, MA (20 attendees) *November 27*
- Hosted Daniel Kier, a student from Muhlenberg College, and conducted analysis on worms for a collaboration project *April 9 and 10*
- Gave presentations entitled “Supplying nano-size nutrients enhance yield and suppress fungal diseases in crop plants” and “Comparative environmental fate and toxicity of copper nanomaterials” as an invited speaker during the 2018 Nanotechnology conference held in Anaheim, CA (50 attendees) *May 14-16*

## 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	117
Department of Consumer Protection	269
Department of Energy and Environmental Protection	70
FDA, Health Depts., Cities/Towns, Misc. Foundations	156
Proficiency Test Samples	30
University Research Collaborators	856
CAES Departments	2100
<b>Grand Total</b>	<b>3,598</b>

#### **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 longstanding 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 and that levels of aflatoxins, if present, are below regulatory limits.
- **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 findings to the product dealer and/or manufacturer and conduct regulatory response as required. In addition, data are reported to the FDA through an online data exchange platform called eLEXNET.
- **Results:** From July 1, 2017 to June 30, 2018, we received and completed analysis of 52 feed samples. Twenty-three of these samples were analyzed for protein, fat, moisture, fiber, select micronutrients and aflatoxins. 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 7 (30%). Specifically, 2 (8.7%) were deficient in protein; 3 (13.0%) were deficient in fat and 3 (13.0%) contained an excess of fiber. Of the samples analyzed for micronutrients, 5 (22%) were found to be unsatisfactory in one or more guaranteed nutrient value. Analytical findings are turned over to CT DoAg for regulatory response. Joint funding with the DoAg has been acquired from the

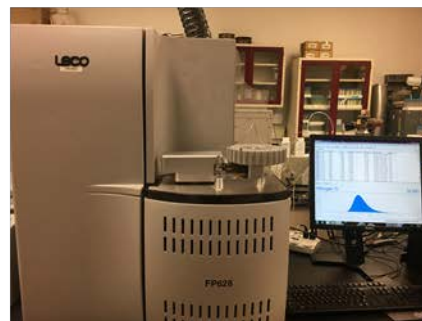


FDA to facilitate inclusion in the Animal Feed Regulatory Program Standards (AFRPS); this 5-year cooperative agreement has enabled the Department to bring aflatoxin analysis in animal feeds by liquid chromatography high resolution mass spectroscopy (LC-HRMS) under the scope of ISO accreditation effective February 2018. This reporting period, 29 samples were analyzed by methods for aflatoxin extraction and quantitation (by LC-HRMS) in corn-based feed as part of the AFRPS. All samples but one were officially logged out with no aflatoxins detected; the final sample had Aflatoxin B1 at 1.06  $\mu\text{g}/\text{Kg}$  (below the tolerance of 20  $\mu\text{g}/\text{Kg}$  total aflatoxin).



*b. Fertilizers:*

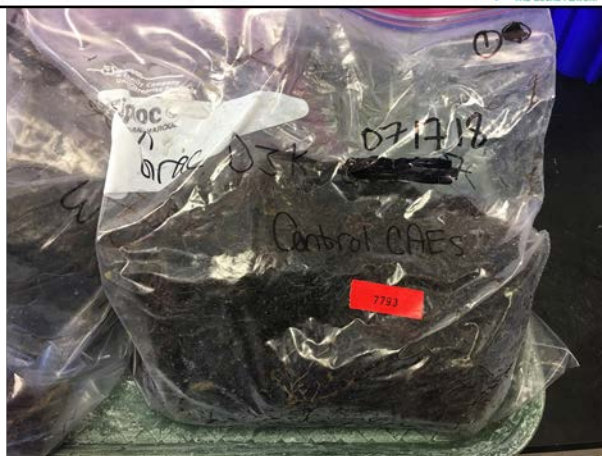
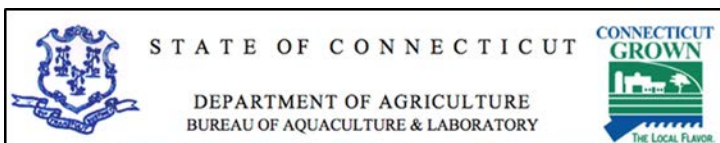
- **Analysts:** John Ranciato
- **Goal:** To assure products are in compliance with stated label guarantees.
- **Summary:** This was one of the primary analyses of the Station in 1875. Products from residential and commercial agricultural operations are collected by DoAg inspectors. Analytical results are reported to DoAg, who in turn reports findings to the product dealer and product manufacturer and takes regulatory response as needed.
- **Results:** From July 1, 2017 to June 30, 2018, we received and completed analysis of 41 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 26 (63%). 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 Ammirata, 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. The CAES Department of Analytical Chemistry conducts the chemical analysis; the microbial analysis happens at the Department of Public Health (DPH) Laboratory Environmental Microbiology Section. During the current reporting period, 31 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. 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 leads the regulatory response.

*a. Pesticide residues in food:*

- **Analysts:** Walter Krol, Brian Eitzer, Michael Ammirata, Terri Arsenault, and Kitty Prapayotin-Riveros
- **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](http://www.ct.gov/caes). From July 1, 2017 through June 30, 2018, a total of 111 samples of food were analyzed for pesticide residues. Of the 111 samples analyzed, 48 (43.2%) contained a total of 120 residues. Of these 48 samples, there was 1 sample that contained a total of 4 violative residues. There were 55 different pesticide active ingredients found at an average concentration of 0.452 µg/Kg, and the average number of pesticide residues



per sample containing residues was 2.4. During the same time frame, there were 21 fresh and processed food samples analyzed for total arsenic; none of these were found to be violative.

- With US FDA funding and support, has received and maintained 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, 2017 to June 30, 2018, 54 consumer complaint samples were submitted by CT DCP for analysis, including foreign material identification, fecal content determination, product adulteration or tampering, and off taste. 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 2 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:** Eleven alcoholic products were examined for authenticity; 5 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 Ammirata, Terri Arsenault



- **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, 2017 to June 30, 2018, 55 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. A number of samples were submitted due to downed telephone poles in residual areas stemming from the tornadoes in May 2018. The findings are reported to DEEP for assessment of continued regulatory compliance or to establish remediation criteria. 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 enzyme-linked immunosorbent assay (ELISA).

- **Summary:** From July 1, 2017 to June 30, 2018, 15 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, John Ranciato, 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 involving the analysis of 100 samples of imported spices, herbs, and flours;





results were reported to FDA through eLEXNET. Staff scientists are currently participating in an active surveillance assignment of rice-based baby foods within CT; five separate analytical platforms are being used to screen food for poisons, toxins, pesticides, heavy metals, and inorganic arsenic species. The Department participated in several FDA and USDA FSIS proficiency tests and challenge exercises. Dr. Christina Robb has continued to investigate methods related to the detection of the plant toxins ricin and abrin, including exploring potential use of LC-HRMS for proteomic analysis. 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, 2017 through June 30, 2018, Department staff analyzed several dozen samples for municipalities or other groups. We analyzed foods and other products for heavy metals at the request of the New Haven Health Department and the City of Stamford. In one lead poisoning investigation involving a child, submitted samples of turmeric from the child's house, along with comparison samples from a local retailer, were analyzed by FDA methods. We detected 0.5% lead and 0.1% chromium in the samples from the house; these levels are over one hundred thousand times higher than the background levels in the comparison samples.



**Impact:** The findings of highly toxic lead and chromium levels in samples of imported household spices assisted city inspectors 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:** Chuanxin Ma, Craig Musante, Roberto De La Torre-Roche, Nubia Zuverza-Mena, Jason C. White

• **Summary:** In conjunction with scientists in 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. This work is being done under 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, Brian Eitzer, Craig Musante, Michael Ammirata, Nubia Zuverza-Mena
- **Summary:** Thirty samples were analyzed during the reporting period as part of annual proficiency testing related to our FDA FERN work, FDA ISO Accreditation program (MFRPs), Animal Feed Regulatory Program (AFRPs), as well as performance evaluation samples for our polychlorinated biphenyl (PCB) regulatory program. 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 and heavy metals in food:***

- **Investigators:** Brian Eitzer, Terri Arsenault, Walter Krol, Christina Robb, Michael Ammirata, Craig Musante, John Ranciato, Jason C. White
- **Summary:** We continue to participate in or lead several FDA coordinated research projects. Staff used FDA methods and equipment as part of a First Responder Training Exercise run by the 14th Civil Support Team of the CT

National Guard and the FBI Weapons of Mass Destruction Directorate out of New Haven. The field training event involved an aircraft at a local airport with a suspected chemical weapon; liquid samples with suspected sodium azide were submitted to the laboratory. We used FDA FERN methods to quantify azide in the sample; accurate results were reported out 6 hours after sample receipt. 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 currently involved in the analysis of rice-based baby food for a range of contaminants, including inorganic arsenic species. We also achieved ISO Accreditation for two separate FDA programs; one focused on human food (MFRPS) and a second focused on animal feed (AFRPS). Lastly, we have initiated projects investigating the use of LC-HRMS to directly detect the plant proteins abrin and ricin in food. The overall goal of these projects is to develop robust and accurate methods that the FDA could deploy as part of large-scale surveillance programs.



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

**Project 2: *Nanoparticles in agricultural systems:***

- **Investigators:** Roberto De La Torre-Roche, Chuanxin Ma, Nubia Zuverza-Mena, Craig Musante, Jason C. White
- **Summary:** Nanomaterials (NM) have at least one dimension less than 100 nm (one billionth of a meter), and possess 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. Our work in this area is focused on two separate but related topics; the implications of nanomaterial presence (by accident or design) in agricultural systems and the use of nanomaterials as agricultural amendments to suppress plant disease. The first project is

focused on the fate of nanomaterials in agricultural systems. Although nanomaterial 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. Research in our laboratory has been focusing on defining the impact (physiological and molecular toxicity, accumulation) of NM 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 of these materials to alter the nutritional quality of exposed crops such as peanut. 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. 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, the 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, China Agricultural University, and Nanjing Agricultural University.



The second project is focused on the use of nanoscale micronutrients to sustainably suppress crop disease and increase yield. Much of this work is happening in conjunction with The Center for Sustainable Nanotechnology. Here, we have shown that nanoscale versions of micronutrients such as copper, silica, and sulfur are effective at promoting plant health and stimulating important plant defense pathways that lead to decreased pathogen infection by fungal diseases such as Fusarium and powdery mildew.

**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 under certain exposure scenarios, crop quality can be negatively impacted. In addition, co-exposure to a NM can significantly alter the fate and effects of other organic and elemental contaminants, including additional



nanomaterials. Alternatively, when used appropriately, nanoscale versions of select micronutrients can suppress crop disease and increase yield.

## **2. ENVIRONMENTAL MONITORING/REMEDATION**

### **Project 1: *Protecting pollinators with economically feasible and environmentally sound ornamental horticulture.***

•**Investigators:** Brian Eitzer, Kim Stoner (Department of Entomology), Richard Cowles (Valley Laboratory), Cristi Palmer (Rutgers University)

•**Summary:** We are participating in a multi-year multi-institution study to examine pesticide use in ornamental horticulture. One part of this large study is to understand the translocation of pesticides into the pollen and nectar of plants. This is being done by treating the plants with known amounts of five different pesticides and then analyzing the pollen and nectar from the plants for those pesticides. Sampling of these plant matrices is very laborious so that only very small amounts of sample can get collected. These small sample amounts then require instrumental methods with great sensitivity. Liquid chromatography coupled to mass spectrometry provides this sensitivity. We are currently analyzing the pollen and nectar taken from rhododendron plants during the first two years of this study.



•**Impact:** Knowledge of the translocation of pesticides to pollen and nectar 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 2: *Determining the effects of pesticide exposure on bumble bee microcolonies***

•**Investigators:** Brian Eitzer, Kim Stoner (Department of Entomology), David Lehman (EPA), Robert Koethe (EPA)

•**Summary:** While much has been learned about the effects of pesticides on honey bees, much less is known about their effects on bumble bees. This project is aimed at understanding some of those effects. Pollen is collected at ornamental nurseries and then has its pesticide levels determined using liquid chromatography/mass spectrometry (LC/MS) so that the baseline level of pesticides in the pollen is known. A portion of the pollen is also characterized by palynology so that the plants producing the pollen are also known. After characterization of pesticide content, additional pesticide is then added to the pollen at various dosage levels and then pollen is fed to bumble bee microcolonies. These colonies are then monitored for deleterious effects. After a set time period, the colonies are sacrificed and various compartments of the colony (queen, workers, drones, larva, eggs, nesting, honey pots, fecal material) are analyzed for the pesticide being studied. These data will then help us to understand how the pesticide has impacted these bumble bees.

•**Impact:** Knowledge of the effects of pesticides on bumble bees can help us to protect these important native 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](http://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 2017-2018 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 Information Office*

Dr. Gale E Ridge works in 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 cell phone and internet. Phone calls remain a primary citizen contact followed by emails.

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, 2017 and June 30, 2018 the insect information office handled 11,965 requests for information down from the 2017 record of 15,870 inquiries. The decline was because Gypsy moth, *Lymantria dispar* populations had collapsed. The outbreak was brought under control by the entomopathogenic fungus *Entomophaga maimaiga*. A cold wet spring in 2018 additionally assisted fungal inoculation of the caterpillars’ further suppressing populations. There still remained “hot spots” with high activity which prompted calls from affected citizens. Inquiries remained elevated into 2018, in part due to public concern about the insect and pesticide use against it. There were 983 specific calls about pesticides, many concerning treatment against the Gypsy moth.

There were 601 categories of inquiries including insects, arachnids, animal, pesticides, insect damage, general entomology, and horticulture. Delusional Infestation (DI) formerly Delusory Parasitosis (DP) cases continued to rise from 189 in 2016, 243 in 2017 to 300 in 2018. These are time consuming psychological cases that encompass multiple phone calls, emails, and visits which often involve medical professionals.

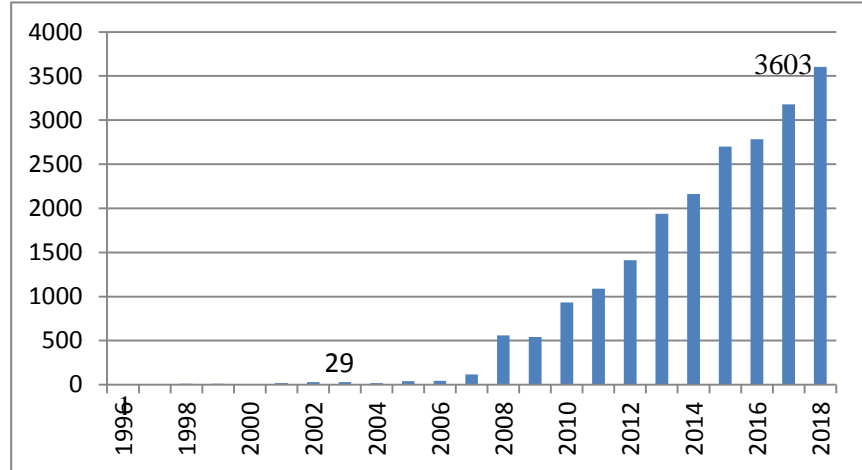


Table 1. Number of bed bug inquiries from FY 1996 to 2016

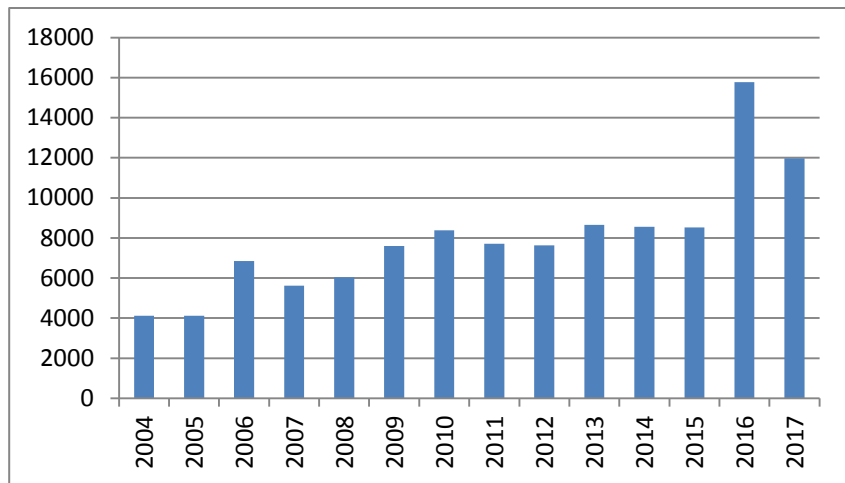


Table 2. Number of inquiries from FY 2004/2005 to FY\* 2017/2018.

Following a mild winter due to possible “climate change” tick populations, especially American dog ticks, *Dermacentor variabilis* remained high. Black legged tick, *Ixodes scapularis* populations were also high with the insect information office responding to numerous calls and visits during the spring of 2018. Many tick submissions for Lyme disease testing passed through the insect information office. Additionally, mistaken tick identifications from the public were forwarded to the office for a correction of identification. Woodland cockroach, *Parcoblatta pennsylvanica* populations increased; there was a brief period of high activity of the four-lined *Poecilocapsus lineatus* and tarnished *Lygus lineolaris* plant bugs, during early spring. Ant inquiries remained low. German cockroach inquiries increased indicating populations may be recovering from near extirpation in the early 2000s from the use of effective modern baits. During a warm February the brown marmorated stink bug, *Halyomorpha halys* inquiries increased as overwintering insects became active in buildings. The cottony scales were active especially cottony maple scale, *Pulvinaria innumerabilis* which was found on many shrubs and trees. The highest inquiry was human feeding bed bugs (3603) at 31% of total calls, followed in order by pesticides (987), and DI (300). Termite and fall webworm inquiries were up as well.

Inquiries were the second highest on record with 11,965 in 2018 and was higher than normal. This may be an artifact of continued public interest in the Gypsy moth and a continued rise in bed bug inquiries. Of these 53% were natural resources, 43% man and medical issues, 1% undetermined, and 3% food related. Dr. Ridge hosted a number of trainings on bed bugs including national Mattress Recycling Council trainings under the leadership of DEEP as part of a requirement written into the Connecticut mattress recycling law, Act 13-42.

The office continued to lead in public outreach building collaborative relationships and projects with local, state, and federal agencies, particularly health departments to better serve the needs of Connecticut citizens. During the 2017 to 2018 fiscal year, several exotic arthropods were identified by Dr. Ridge. Following is an account of these identifications. The Systematic Entomology Laboratory (SEL)-USDA confirmed identification of *Lyctus africanus* as a new state record July 3, 2017; Dr. Ridge identified a spider found in China Girl blue holly bought from the East Haven Home Depot by Lindsay Patrick (CAES) for display purposes as a brown widow spider, *Latrodectus geometricus*. Trace-back revealed the holly had been grown in Havana, Florida, shipped up to Clinton Nurseries, and then delivered to the East Haven Home Depot for sale July 3, 2017; she identified a male jumping bush cricket, *Orocharis saltator*, as a new state record September 20, 2017; an identification of the Legurian leafhopper, *Eupteryx decemnotata*, was confirmed, as the second interception of this insect (the first was in 2009) on September 27, 2017, as well as a new state record for citrus leafminer *Phyllocnistis citrella*, which was confirmed by the SEL-USDA; and Dr. Ridge received confirmation of her identification of a plant bug *Charagochilus longicornis* (Miridae) collected on September 21, 2017 from Logees Nursery, Danielson, in Windham County (December 12), a new North American record (this bug is a species found in Southeast Asia). Also in 2017, she identified a minute brown scavenger beetle, *Deinerella* sp. (Latridiidae), as a new state record; the skin beetle, *Trogoderma simplex*, as a new state record; a species of tree hopper, *Ophiderma trincta* Ball (Membracidae), as a new state record; and the Persimmon psyllid, *Trioza diospyri/Baeoalitrizus diosptri*, as a new state record.

**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 2018, 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 and tortricids in Christmas tree farms. Additional orchard and solanaceous 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 FPOSP also includes a biosurveillance program for exotic beetles related to the emerald ash borer using the native *Cerceris* wasp.

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

Jeffrey Fengler and Jane Canepa-Morrison observed 12 different butterfly species, 7 species of birds, and no other species around the garden at Plant Science Day on August 2, 2017.

<i>Butterflies &amp; Moths</i>	<i>Birds</i>	<i>Other</i>
Monarch	Bluejay	None noted
Spicebush Swallowtail	American Robin	
Cabbage White	American Goldfinch	
Painted Lady	European Starling	
Eastern Tiger Swallowtail	Eastern Bluebird	
Orange Sulphur	Downy Woodpecker	
Pipevine Swallowtail	Northern Mockingbird	
Peck's Skipper		
Tawny-edged Skipper		
Crossline Skipper		
Summer Azure		
Silver-spotted Skipper		

### **Sponsored Meetings and Conferences:**

Dr. Kirby Stafford and Dr. Goudarz Molaei organized a symposium “The Challenges of Tick-Borne Diseases” at the Annual Meeting Entomological Society of America held in Denver, CO, November 7, 2017. There were eight speakers and 76 attendees.

Dr. Kimberly Stoner organized a conference entitled “Pollinator Habitat in the Northeastern Landscapes: Pollinator Diversity, Crop Pollination, and Pesticide Exposure” held at the Eastern Branch meeting of the Entomological Society of America held in Annapolis, Maryland, on March 19, 2018. There were six speakers and 35 attendees.

## **RESEARCH ACTIVITIES**

### **Center for Vector Biology and Zoonotic Diseases**

Collaborative studies involving scientists and staff from the Departments of Entomology, Environmental Science and Forestry and Horticulture

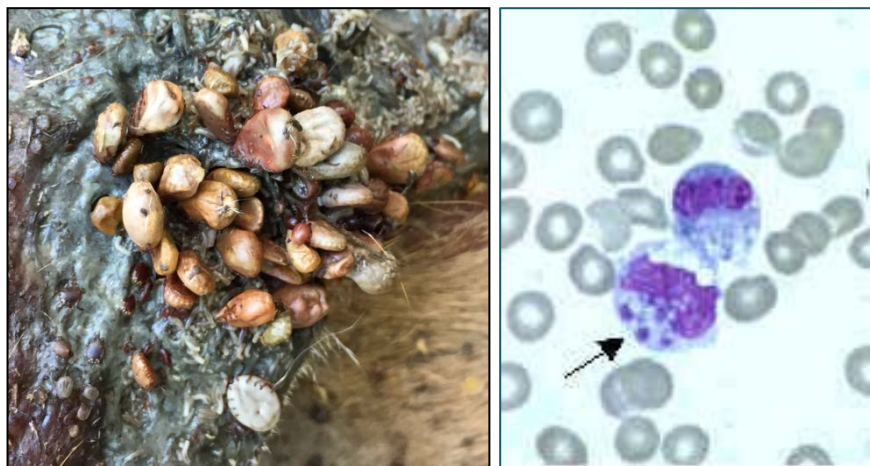
### Rodent-Targeted Vaccine Bait Study

U.S. Biologic, Inc. has developed a timed application system to disperse their Osp-A rodent targeted Lyme disease vaccine pelleted bait. Previously from 2014-2016, Dr. Kirby C. Stafford, Dr. Scott C. Williams and Dr. Megan Linske completed a Rhodamine-B marker bait consumption study and a study of the vaccine bait in Redding, CT. The Rhodamine dye is commonly used in wildlife studies as it can be detected on the animal or in the whiskers of the animal. In summer 2018, a bait consumption study using the new application system and Rhodamine-B treated bait pellets was initiated in forested plots in North Branford, CT.



### Lone Star Tick Control Project

The presence of an established lone star tick population in Norwalk first came to light as a result of a June, 2017, report from a South Norwalk resident about a deer that was acting strange. When a Connecticut Department of Energy and Environmental Protection (DEEP) Environmental Conservation (EnCon) arrived on scene at Manresa Island, the animal was deceased. But, the animal suffered from a severe infestation of ticks, which still completely covered its eyes, ears, head, and neck. Photographs were forwarded to Dr. Kirby Stafford, who examined the animal the following day and determine that it was covered by lone star ticks, *Amblyomma americanum*. Dr. Kirby Stafford, Dr. Scott Williams, and Dr. Megan Linske initiated a 4-poster study in 2018 for the control of the lone star tick population on the island in cooperation with staff from the Wildlife Division, DEEP. Four 4-posters were activated June 1, 2018. Deer have been tagged at the Manresa Island site by DEEP for an initial density estimate of 53.4 animals/km<sup>2</sup>, which is roughly comparable to deer densities of 44.4 to 63.7 deer/km<sup>2</sup> reported for other areas with high populations of *A. americanum*, such as Shelter Island, Long Island. A sample of 104 nymphs and 100 adults of *A. americanum* ticks collected July 2017 were tested by Drs. Sandor Karpathy and Christopher Paddock at the Centers for Disease Control and Prevention (CDC) in Atlanta, Georgia. The prevalence of Anaplasmataceae infections in host-seeking adult *A. americanum* was 48.0%, primarily *Ehrlichia chaffeensis*. Three of the adult *A. americanum* were positive for *E. ewingii*. The *Anaplasma phagocytophilum* detected in one male *A. americanum* was 100% identical to the sequence for AP-Variant 1 associated with white-tailed deer. Deer are reservoir hosts for the AP-Variant and *E.*



*chaffeensis*.



Adult female *A. americanum* (CDC), lone star ticks feeding on a deer (Stafford), and *Ehrlichia chaffeensis morulae* in cytoplasm of monocyte (white blood cell) (CDC).

### Pyrethroid Insecticide Spray Trial

A spray trial testing the effectiveness of a combination of the pyrethroid cyhalothrin (0.8 ounces/gallon) and the insect growth regulator (IGR) pyriproxyfen (1.0 ounces/gallon) for control of ticks under two application regimes was conducted by Drs. Kirby C. Stafford, Scott C. Williams and Megan Linske in 2017 with the assistance of Michael Short and Heidi Stuber. Applications were made by a standard truck tank sprayer (875 gal. capacity, 6-8 gal/1,000 ft<sup>2</sup>) or by a gasoline-powered low volume backpack mist blower (1 gal. capacity). Blacklegged ticks and American dog ticks were sampled on two occasions on transects of known length prior to treatment and 4 times post-treatment. The amount of active ingredient was the same for each application and only differed in water volume. Post-treatment, there was an average of 0.0 ticks/acre on properties that received the tank spray treatment (100% control), 10.2 ticks/acre with the ultra-low volume mist blower treatment (77% control), and 33.4 ticks/acre on the untreated properties. The spray tank treatment was most effective at killing ticks likely due to product volume (34.4 gallons per property). The mist blower treatment (1.5 gallons per property) was successful at killing ticks initially, but some ticks persisted post-treatment, likely due to smaller volume of product and less penetration of the leaf litter and vegetation. The study was repeated in the summer of 2018 using backpack mist blowers with a larger 3-gal capacity and output. Results are pending.



Application of pyrethroid acaricide by Michael Short, June 2018 (Stafford).



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

### Tick Overwintering Study

Overwintering survival of *I. scapularis* and *A. americanum* were investigated under varying conditions of leaf litter and snow cover by Dr. Kirby Stafford, Dr. Scott Williams, and Dr. Megan Linske with the assistance of

Heidi Stuber and Michael Short at CAES and Charles Lubelczyk and Margaret Welch at the Maine Medical Research Center Institute (MMRCI) over an initial 2-year period (winter 2015-2016 and 2016-2017), supported by the Northeast IPM Center. This project was continued for a third year with support from the Northeast Center of Excellence for Vector Biology in the winter of 2017-2018. 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 with temperature and humidity data loggers. In the first year of the study in Connecticut, 94% of the ticks survived the winter in the control pots (no leaf or snow removal). Survival of *I. scapularis* with either snow or leaf litter removed was virtually identical (85-86%). Significantly fewer nymphs survived with both leaf and snow removal, but survival was still a respectable 77%. By contrast in Maine, results were more variable, ranging from 3-23% survival with no notable trend. In the winter of 2016-2017, survival of *I. scapularis* nymphs and *A. americanum* adults was similar, ranging from 38-63% and 38-69%, respectively. By contrast in Maine, overwintering survival for *I. scapularis* was 14-56% with the highest survival with both snow and leaf litter present. Adult *A. americanum* survival in Maine was lower, 7-9%. In the third year of the study, the winter of 2017-2018, survival of *I. scapularis* nymphs and *A. americanum* adults in Connecticut was similar to the previous year, ranging 54-67% for *I. scapularis* and 50-69% for *A. americanum*. In Maine, survival of *I. scapularis* nymphs and *A. americanum* adults ranged 31-70% for *I. scapularis* and 11-81% for *A. americanum*, with the higher survival in both states again associated with the presence of leaf litter and/or snow. As *A. americanum* continue to survive the winter in these studies, this suggests further establishment in New England coastal areas is not only possible, but likely.

### **Integrated Tick Management (ITM)**

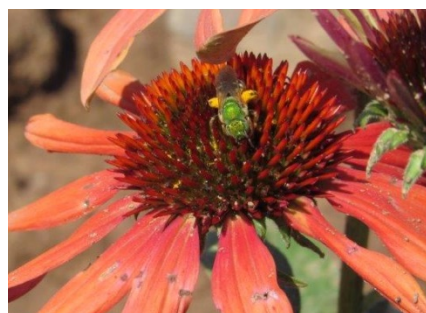
Lyme disease (LD) continues to be the most commonly reported vector-borne disease in the United States. According to the Centers for Disease Control and Prevention, it affected over 360,000 people in 2016. The blacklegged tick, *Ixodes scapularis*, is the vector for *Borrelia burgdorferi*, the causal agent for Lyme disease, and at least six other human pathogens. An integrated tick management project was initiated by Dr. Kirby C. Stafford, Dr. Scott C. Williams, Dr. Megan Linske, and Dr. Goudarz Molaei with the assistance of technicians Heidi Stuber and Michael Short in 2016-2017 in a cooperative agreement with Dr. Andrew Li at the USDA-Agricultural Research Service, which is funding the study. Conducted in several neighborhoods in Guilford, CT, baseline tick and mouse sampling was conducted the first year. Seven neighborhoods were selected throughout Guilford based on their layout and proximity to large (> 200 acres) pieces of Town- or Land Trust-owned open spaces, and 91 properties (21%) have agreed to participate with good distribution among all seven neighborhoods. The treatments in this ITM study consist of different combinations of untreated controls and homes treated with various 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*). Twelve ‘4-posters’ (1 per 50 acres) were deployed in October 2017 and maintained at one 600-acre park. Bait boxes were deployed and Met52 applied in June 2018. Host-seeking ticks are sampled by dragging the perimeter of each property biweekly May-August and white-footed mice (*Peromyscus leucopus*) are live-trapped using Sherman box traps with the assistance of seasonal resource assistants Sarah Hemstock and Jamie Cantoni. Each captured mouse is sedated, marked with a unique ear tag, processed for ticks, and a blood sample was taken for serological analysis.



The 4-poster (left), fipronil bait box (center), and application of the Met52 (right).

### Variation in Attraction to Pollinators Among Cultivated Varieties of Ornamental Plants

Recent research on the value of urban and suburban gardens for bees has demonstrated that gardens can be an important resource for honey bees as well as for a diversity of wild bees because gardeners, like bees, prefer to have a variety of flowering plants blooming across the entire growing season. Although ornamental plants can provide nectar and pollen resources for bees and other beneficial insects, pollinator value has not generally been a goal of ornamental plant breeding. Ornamental plants are more often selected for such traits as novel colors, more elaborate floral display (including double flowers), and longer flowering. Most ornamental plants are grown as “cultivars” – named cultivated varieties developed by plant breeders and maintained either by vegetative propagation or by controlled breeding of hybrids. Dr. Kimberly Stoner, assisted by Tracy Zarrillo and Morgan Lowry, is evaluating cultivars of five different ornamental plant genera to determine how pollinator visitation varies within each genus as well as across different genera. In 2017 and 2018, the team evaluated 5 cultivars in the genus *Sedum*, 6 cultivars of *Phlox*, 8 cultivars of *Echinacea*, 5 cultivars of *Celosia*, and 11 cultivars of *Zinnia*. In each case there were tremendous differences in cultivars within a genus, with the most attractive cultivar visited 13 X as often as the least attractive cultivar within the genus *Sedum*, a 12 X difference in *Phlox*, 5 X difference in *Echinacea*, 9.5 X difference in *Zinnia*, and 5 X difference in *Celosia*. Funding for this project was provided by a Specialty Crop Research Initiative grant from the National Institute of Food and Agriculture of the US Department of Agriculture.



Green sweat bee on Cheyenne Spirit (top) and 2017 summer assistants Sawyer Badey, James Durrell, and Damaris Chenoweth conducting bee counts.

## Detection of bronze birch borer and a visit from PREPSYS scientists



Dr. Hugh Evans, a Senior Project Leader in Wales of UK Forest Research and Dr. Gernot Hoch, Head of the Department of Forest Protection at the Austrian Research Centre for Forests examine a purple prism trap hung on a birch tree at Lockwood Farm in Hamden with Dr. Claire Rutledge.



Dr. David Williams, an entomologist with UK Forest Research, learns how to spot a *Cerceris fumipennis* nest in Monroe, CT.

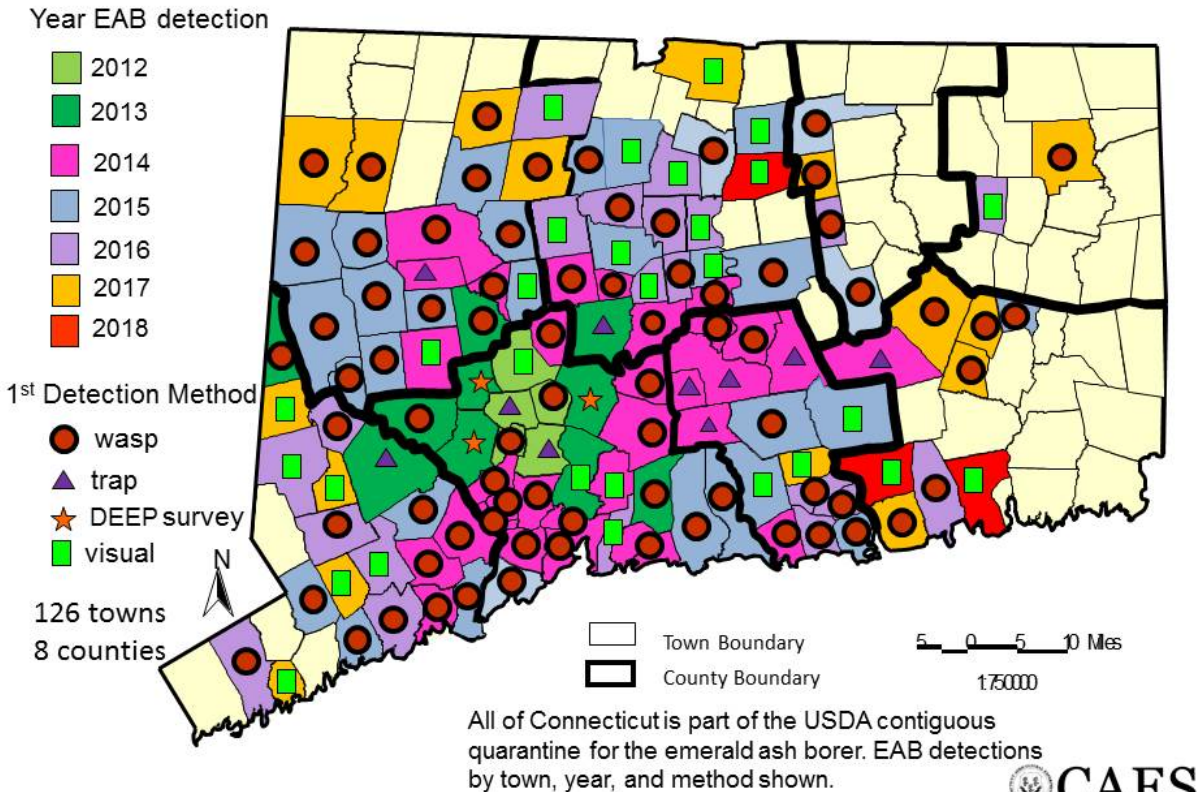
PREPSYS (Pest Risk Evaluation and Pest management SYStems). This multi partner project, headed by Forest Research UK, is focused on understanding how Europe can best prepare for, and manage if necessary, the risks and impacts of emerald ash borer (EAB) (*Agrilus planipennis*) and bronze birch borer (BBB) (*Agrilus anxius*). The group is funding research in my laboratory into adapting monitoring tools used for emerald ash borer for the detection of bronze birch borer. The bronze birch borer is native to North America, and non-North American species of birch have little-to-no resistance to the beetle. If bronze birch borer were to become established in Europe, it could have a devastating impact. We looked at the efficacy of purple prism traps and green multi-funnel traps, both commonly used in EAB surveys, for detecting BBB. Since BBB feeds on declining trees, we also compared trap catches on trees that had been girdled, with trees that were intact. In 2017, our results showed us that BBB prefers purple traps to green traps, and those hanging in girdled trees to that hanging in intact trees. A second season of experiments was begun in 2018 in collaboration with Dr. Peter Silk of Canada Forestry looking at the impact of lures with plant volatiles and a putative BBB pheromone on trap efficacy. On July 19-July 21, 2017, the Connecticut Agricultural Experiment Station hosted a visit from a group of scientists with PREPSYS. The scientists toured the station, discussed invasive insects with Dr. Theodore Andreadis and Dr. Charles Vossbrinck, visited experimental trapping sites, helped to deploy parasitoids for emerald ash borer, collected emerald ash borer frass samples for training Austrian beetle-sniffing dogs, and discussed trapping and management of emerald ash borer with Dr. Melody Keena and Dr. Therese Poland of U.S. Forest Service. They also had the opportunity to do some biosurveillance at a *Cerceris fumipennis* colony in Monroe CT, and see first-hand the wasps bring in both emerald ash borers and bronze birch borers.

## Biosurveillance for Exotic Buprestidae and the Wasp Watcher Program



The wasp watcher program was begun in the spring of 2010. *Cerceris fumipennis* is a native digging wasp that provisions its nest with adult Buprestidae, including emerald ash borer. It is used as a tool for

detecting and monitoring emerald ash borer and other invasive buprestid species by intercepting its prey as female wasps return to their nest. The wasp was responsible for the first detection of EAB in Connecticut, and remains our main tool for detecting and monitoring EAB in the state. We are in the 9<sup>th</sup> year of our Wasp Watcher program. Over the course of the program we have trained 135 watchers. In 2018, 31 watchers from previous years are signed-on, as well as 8 new watchers. Since 2010, Watchers have collected over 8,000 beetles and detected EAB in 42 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.



June 30, 2018

### Classical Biological Control of Emerald Ash Borer



Larvae of the endoparasitoid *Tetrastichus planipennisi* and the remains of an EAB larva. 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 12 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. We have been fortunate in finding in-state collaborators to aid in releases. DEEP has been generous in allowing us to release parasitoids in Connecticut Wildlife Management Areas and State

Parks. In 2016, we partnered with the Connecticut office of The Nature Conservancy, and they aided in releases at three sites along the Connecticut River and its tributaries. In 2017, we were given permission by the Aspetuck Land Trust to do releases at Trout Brook Preserve. In the spring of 2018, we entered a partnership with a large private farm in Kent to do releases there.

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 sites nearby looking for EAB larvae parasitized by *T. planipennisi*. We found them both at the initial release site, and at sites up to 2.5 m from the original site, strongly suggesting that the parasitoid has established in Connecticut, and is spreading. We 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. We were unable to detect *O. agrili* at either site, but we did confirm the continuing presence of *T. planipennisi* in Hamden. Further work on documenting the establishment of these parasitoids in Connecticut is in progress.

### 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 congeners. Recently published work suggested that green ash dosed with methyl jasmonate, a plant stress hormone, becomes more resistant to emerald ash borer. In summer of 2017, in collaboration with Dr. Adriana Arango

Velez, CAES, 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. The most notable response was the very low establishment rate of EAB larvae on ash that had been treated with MeJA compared to control trees. This promising result will be followed with field testing.



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

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

Southern Pine Beetle (SPB) *Dendroctonus frontalis* (Coleoptera: Curculionidae), has been a major pest of the timber industry in the south for years. It has been moving northwards from Honduras over the last 400 years. It was discovered in Long Island 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. It is still uncertain if SPB is overwintering in Connecticut, the majority of

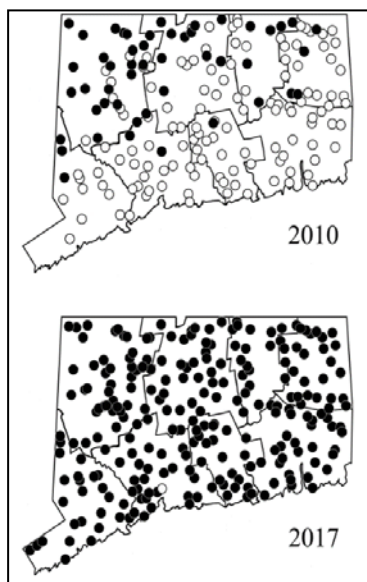


the very low numbers of beetles trapped since its discovery in the state have been in coastal towns. It is possible that beetles are being blown over from Long Island, NY where a major epidemic is occurring. This spring, we started working with Dr. Alicia Brays at Central Connecticut State University and her MS student Niklas Lowe to better understand the current status of SPB in Connecticut.

### Range Expansion of the Viburnum Leaf Beetle

The Eurasian viburnum leaf beetle (*Pyrrhalta viburni*) can injure and sometimes kill cultivated and wild species of viburnum in North America. Both larvae and adults injure plants by feeding upon the foliage. Dr. Chris Maier, assisted by Morgan Lowry and Tracy Zarrillo, examined the distribution of this insect in Connecticut in 2009–2010 and again in 2016–2017. In the first survey, they found that this invasive beetle was concentrated in the northern one-half of the state. The second survey revealed that the viburnum leaf beetle had spread throughout the state, being present at 247 of 248 (99.6%) sites sampled. Thus, susceptible species of viburnum are now at risk of injury throughout Connecticut.

### Hosts of the Lily Leaf Beetle



The lily leaf beetle (*Lilioceris lili*) feeds upon Asiatic, Oriental, and native lilies that grow in Connecticut. The larvae and the bright red adults of this European beetle eat the leaves and the flowers of lilies, often killing cultivated plants where beetle populations are high. In Connecticut, this invasive beetle prefers Asiatic lilies, but it has injured wild plants of Canada lily (*Lilium canadense*) and Turk’s-cap lily (*L. superbum*). In a field study, Dr. Maier and his assistants previously documented that the lily leaf beetle can severely reduce the growth of Canada lilies.

Over the past 2 years, Dr. Maier and his assistants have evaluated the potential impact of this foreign beetle on other liliaceous plants by caging beetles on wild plants. In 2017, he found that caged beetles would regularly eat the foliage of Indian cucumber (*Medeola virginiana*), Solomon seal (*Polygonatum pubescens*), and twisted stalk (*Streptopus lanceolatus*), but they could not successfully reproduce on these plants. In 2018, he collected eggs laid on Asiatic lilies and attached them to the leaves of caged plants of the wild native species that the adults ate. After the eggs hatched, larvae fed briefly on Indian cucumber, Solomon seal, and twisted stalk, but none survived. In addition, with the exception of native lilies, the beetle was not observed on 8 species of wild liliaceous plants that were examined every 2 weeks in May and June. Based on all of the feeding tests and surveys conducted during this project, native lilies are the only wild plants at risk of injury from this invasive beetle.

Known distribution of the viburnum leaf beetle in 2010 and 2017. Black circles show sites with the beetle; hollow ones show those without it.

### Longhorned Beetles of Connecticut

The larvae of most longhorned beetles, or Cerambycidae, bore into the wood of dead or dying trees and shrubs or occasionally into herbaceous plants. Pest species generally 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 to increase our understanding of species diversity,

distribution, and host use. 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.



Longhorned beetle (*Semanotus ligneus*) that bores into dead and dying cedars.

In 2017, Dr. Maier and his team completed a 16-year study of host use by northeastern longhorned beetles. They reared 58 species of Cerambycidae in the subfamilies Parandrinae, Prioninae, Lepturinae, Spondylidinae, and Cerambycinae. New hosts were discovered for 34 (58.6% of total) of the species. In all, they reared 1,892 adults from infested wood to document 170 host associations, including 87 (51.2% of total) new ones. The red-headed ash borer (*Neoclytus acuminatus*) had the broadest host range with 32 hosts, followed by the rustic oak borer (*Xylotrechus colonus*) with 13 hosts; the remaining 56 species developed in 7 or fewer hosts. Adults emerged from 62 woody species in 33 genera distributed in 20 plant families.

Over the past 11 years, Dr. Maier and his assistants have added new biological information to a database that now has over 18,000 entries, representing more than 23,000 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.

### Delayed Emergence of 17-Year Periodical Cicadas



Female periodical cicada laying eggs in an apple twig.

Dr. Maier has studied the distribution and emergence of periodical cicadas (*Magicicada* spp.) for the past 40 years. During that period, brood II of periodical cicadas had large emergences in 1979, 1996, and 2013. First in 1983, and then again 2000 and 2017, he noticed that a small number of periodical cicadas in this brood emerged 4 years late in the Hudson Valley of New York and in Connecticut. In June and July 2017, he measured the density of emergence holes at two sites with the highest density. The density of emergence holes was 0.1/meter<sup>2</sup> at the Mohonk Preserve in New Paltz, New York, and 0.06/meter<sup>2</sup> at Sleeping Giant State Park in Hamden. The estimated cicada density per hectare was 1,000 in New York and 600 in Hamden. At these population levels, the adult females cause no detectable damage when they lay their eggs in the twigs of trees.

In an attempt to determine if periodical cicadas in brood II could delay their emergence by 4 years, Dr. Maier and Tracy Zarrillo put cicada eggs on young apple trees at Lockwood Farm in 1996. A large number of cicadas emerged at this site in 2013, but only one emerged in 2017. Although the emergence was disappointingly low in 2017, it did show the periodical cicada can sometimes require 21 years to complete development.

## 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 nurseries were certified to conduct intra- and interstate business. There were 178 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.

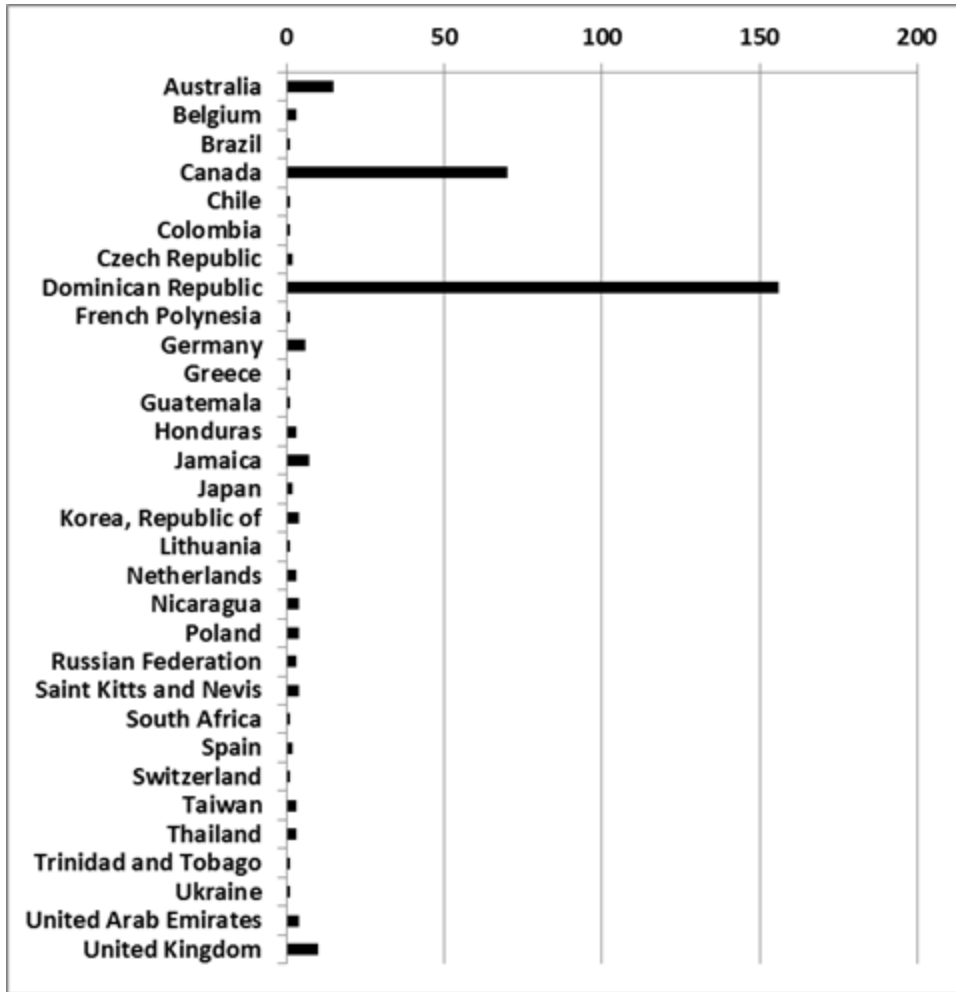
**Nursery Dealer Permits** Nursery dealer permits were issued to 92 firms.

**Phytosanitary Certificates** Three hundred twenty phytosanitary inspection certificates were issued covering the shipment of the following plant materials to 31 destinations outside the United States. One hundred fifty-six consignments were bound for the Dominican Republic (tobacco), seventy to Canada (ornamental plants), and fifteen to Australia (ground plant materials).

### Product Quantity

Apricot /walnut shells, mixed (ground, drums)	4
Apricot/vegetable ivory, mixed (ground, drums)	21
Bulbs & Tubers ( <i>Dahlia</i> & <i>Gladiolas</i> ) (# bags)	111
Bulbs & Tubers ( <i>Dahlia</i> & <i>Gladiolas</i> ) (kilos)	6
Chinese Tree Peony (plants)	47
Corms ( <i>Crocasmia</i> )	60
Greenhouse plants	
Plants	42
Nursery stock	
Bare root stock	8
Plants (balled and burlapped)	60,591
Perennials	
Bare root plants	987
Cuttings	400
Seeds (bags)	287
Seeds (kilos)	77
Tobacco	
Bales	75,667
Bundles	58,492
Cartons	1,175
Pounds	5,866
Vegetable ivory (ground, drums)	8
Walnut shells (bags)	128
Walnut shells (boxes)	30
Walnut shells (drums)	362

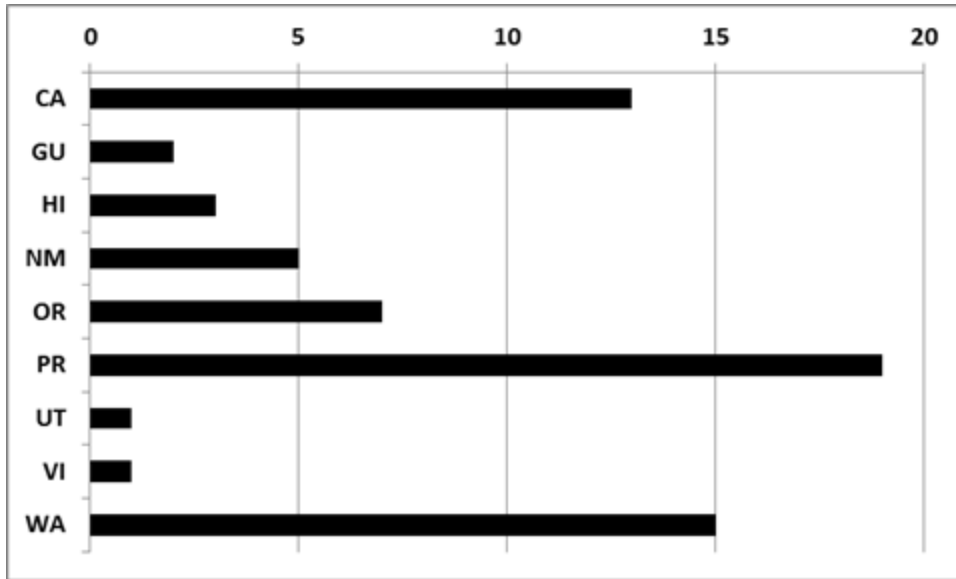
Destinations for out of country exports from CT are as follows.



Sixty-six 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 (9 listed destinations). Nineteen consignments were bound for Puerto Rico, fifteen to Washington, and thirteen to California.

<u>Product</u>	<u>Quantity</u>
Nursery stock (containers)	1,523
(bare root plants)	851
Greenhouse plants	1,522
Perennials	2,388
Seed (# Bags)	66

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



**Special Inspections** Three inspections were made for 21 individual plants to assist homeowners moving out of state.

**Permits to move live plant pests, noxious weeds, and soil** In 2017, there were seventy PPQ 526 Permits (Permit to move live plant pests, noxious weeds, and soil) approved in CT. There were five Controlled Import Permits issued. There were no new permits 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.

**Gypsy Moth** Due to drought conditions in spring and early summer of 2017, 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 1,175,004 acres, mostly in the eastern half of the state, which includes Middlesex, New London, Tolland, and Windham counties. In December 2017 through March 2018, 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 2018. Other locations had many dead egg masses, indicating that there was some mortality due to parasitoids.

**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 2017, 46 acres were affected by HWA, and 1,855 acres 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 10,318 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.

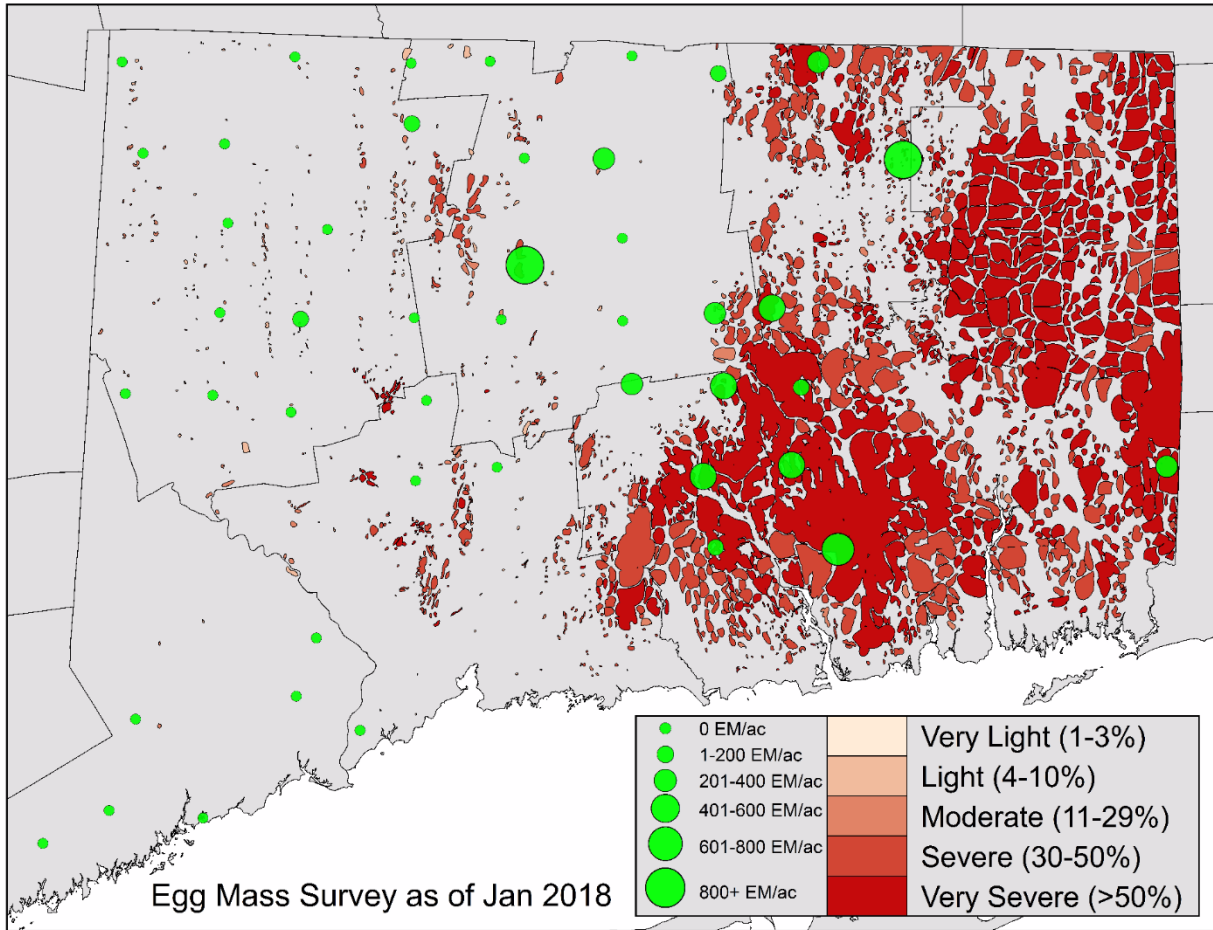
**Cynipid Gall Wasp** Cynipid gall wasp was detected on the Bluff Point Coastal Reserve in New London County and adjoining areas in the town of Stonington in late 2014. The infestation has not been delimited.

**Apiary Inspection** During the 2017 season Connecticut had over 642 registered beekeepers maintaining over 5,000 hives. In 2017, one thousand four hundred hives were inspected. Unofficial estimates indicate that over 5000 packages of Honey bees were imported into Connecticut for sales to new beekeepers and to replace losses. American foulbrood was detected in five 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. The USDA APHIS National Honey Bee survey for 2016 identified a varroa mite average of 3.95 per 100 bees for Connecticut beekeepers, second highest in the Northeast.

CT beekeepers continue to lose colonies overwinter in higher numbers; the Bee Informed Annual Loss report for CT in 2017 was 53.89 %; the winter loss was 49.83%. These losses are slightly lower 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 varroa destructor virus (VDV) were detected in Connecticut as part of the USDA Honey Bee Pests and Diseases Survey. Due to high winter losses in 2017, local beekeepers continued to replace losses with package bees from southern states. Despite these challenges, beekeeping interest is still strong with over 400 new beekeepers being trained this winter. There were one hundred sixty Apiary Certificates of Health issued. Four certificates were issued for export out of CT, and over one hundred certificates for interstate movement of honey bees.

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, but are under considerable stress from repeated drought and defoliation by gypsy moth.

Areas of forest damage mapped during aerial survey in 2017 are illustrated below with the 2017-2018 egg mass survey results.



## **Environmental Chemistry**

(Dr. Joseph Pignatello)

The Environmental Chemistry program has been involved in research topics dealing with the interactions of pollutants with environmental particles, the bioavailability of pollutants in environmental particles, pollution prevention and remediation, and natural chemical processes in the environment. It covers many types of pollutants, including industrial solvents and chemicals, fumigants, insecticides, herbicides, pharmaceutical compounds, personal care products, engineered nanomaterials, and greenhouse gases.

### **A. Interactions of Contaminants with Environmental Particles**

(Joseph Pignatello, Yi Yang, Santanu Bakshi, and numerous collaborators)

#### 1. Effects of thermal air oxidation on the surface and adsorptive properties of biochars.

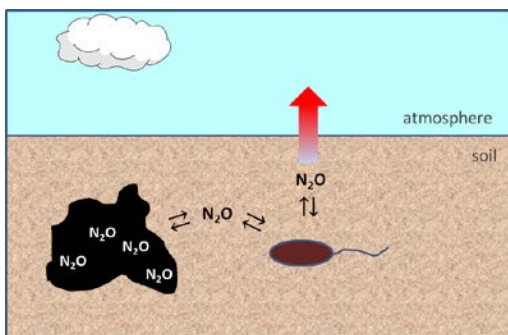
Biochar (BC) is the charcoal-like material remaining after heating (pyrolyzing) vegetative wastes in the absence of air. It has been studied for its beneficial effects on soil fertility and utility in pollutant remediation. In this study, we systematically investigated the effects of post-pyrolysis air oxidation (PPAO) on the properties of BCs made from wood or corn cobs at heat treatment temperatures (HTTs) of 300–700 °C under nitrogen. Including air during the pyrolysis step was found to result in BCs with a low surface area and underdeveloped pore structure. Substantial changes of BC were observed after PPAO, however. Well-carbonized BC samples made anoxically at relatively high HTTs (600 and 700 °C) and subsequently PPAO treated showed significant increases in N<sub>2</sub> BET surface area (SA) (up to 700 times), porosity below 6 nm pore width sizes (up to 95 times), and adsorptivity (up to 120 times) of neutral organic compounds including two triazine herbicides (atrazine and prometon) and one natural estrogen (estriol). Partially carbonized BC made at a lower HTT (300 or 400 °C) showed moderate increases in these properties after PPAO, but a large increase in the intensity of Fourier transform infrared spectroscopy bands corresponding to various oxygen-containing functional groups. Well-carbonized BC samples, on the other hand, were deficient in surface oxygen functionality even after PPAO treatment. Adsorption of the test organic compounds on BC generally trended with the SA when it was less than 300 m<sup>2</sup>/g, but SA was poorly predictive of adsorption when it was greater than 300 m<sup>2</sup>/g. Overall, the results suggest that thermal reactions between molecular oxygen and BC, 1) increase surface oxygen functionality more effectively for low-HTT than for the high-HTT BC samples; 2) increase SA and porosity (< 6.0 nm) especially for high-HTT BC samples; and 3) create new adsorption sites and/or relieve steric restriction of organic molecules to micropores, thereby enhancing the adsorptivity of BC. These results will prove useful, not only for understanding the fate of environmental BC, but also in devising strategies for improving the performance of biochar in practical applications. This work is published in Xiao et al., 2018.

#### 2. Adsorption and desorption of nitrous oxide on raw and thermally air-oxidized biochars.

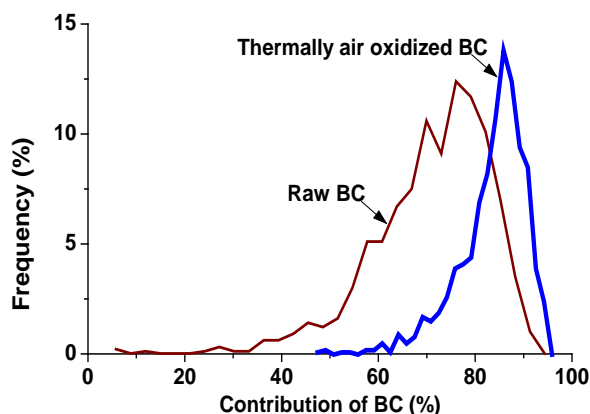
Nitrous oxide (N<sub>2</sub>O) is an important greenhouse gas—third behind carbon dioxide and methane—as well as perhaps the most important stratospheric ozone-depleting gas. About 60% of N<sub>2</sub>O emissions are natural and result primarily from enzymatic conversion of both ammonium and nitrate in soil and the oceans. Of the remainder, in the U.S. about 80% originate from agricultural activities mainly from fertilizer use. Addition of biochar to soil reportedly suppresses emissions of N<sub>2</sub>O, but the causes are unclear. Some studies report the effect is only temporary. To determine whether adsorption may play a role in the behavior of N<sub>2</sub>O, adsorption isotherms of N<sub>2</sub>O were constructed at 273 K on samples of anoxically-prepared wood-derived biochars (300 -700 °C) and on a subset of those biochars that were briefly reheated in air at 400 °C. Adsorption of N<sub>2</sub>O by the chars was greater and more reversible than by soils or



soil mineral phases. Adsorption by chars increased with initial pyrolysis temperature after post-pyrolysis air oxidation. The Langmuir maximum capacity correlates well with the CO<sub>2</sub>-determined surface area, but not N<sub>2</sub>-B.E.T.-determined surface area. At environmentally realistic partial pressures in soil, N<sub>2</sub>O adsorption correlates with CO<sub>2</sub> adsorption, and is found to predominate in the micropores (<1.5 nm), especially the ultramicropores (< 0.7 nm). Neither adsorption nor adsorption reversibility was affected by coating the char with soil organic matter extract. It is concluded that char added at levels above 1% in soil would act as a strong and reversible sink for N<sub>2</sub>O, and could be responsible for the temporary nature of emission suppression observed in some cases. This work is published in Xiao, Pignatello, and Gamiz, 2018.



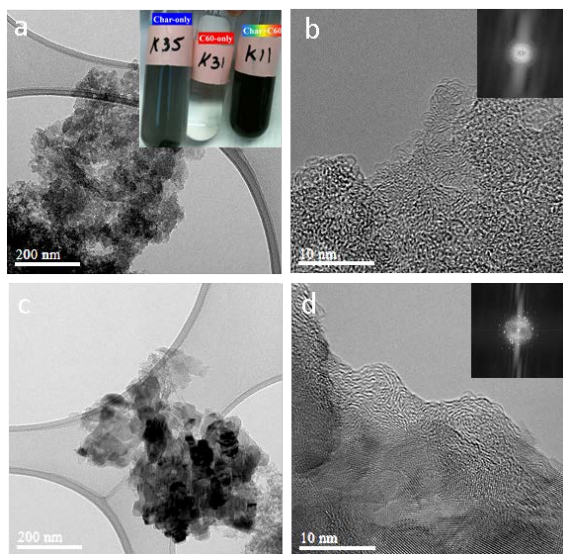
Cartoon showing partitioning of nitrous oxide between biochar, soil, soil microorganisms, and atmosphere.



Monte Carlo simulation of adsorption of N<sub>2</sub>O attributable to raw (M400) or 30-min air-oxidized (M400-30) char mixed in a hypothetical soil. Adsorption to the char, especially air oxidized char, dominates.

### 3. Structural transformation of char particles by C60 fullerene.

Pyrogenic carbon (char) is widespread in soil due to wildfires, soot deposition, and intentional amendment of pyrolyzed waste biomass (i.e., biochar). Interactions between engineered carbon nanoparticles and chars are unknown. This study first employed transmission electron microscopy (TEM) and X-ray diffraction (XRD) to interpret the superstructure composing fullerene (C60) nanoparticles prepared by prolonged stirring of commercial fullerite in water (nC60-stir). The nC60-stir was found to be a superstructure composed of face-centered cubic (fcc) close-packing of nearly-spherical C60 superatoms. The nC60-stir superstructure (≈100 nm) reproducibly disintegrated pecan shell biochar pellets (2 mm) made at 700 °C into a stable and homogeneous colloidal (<100 nm) aqueous suspension. The amorphous carbon structure of the biochar was preserved after the disintegration, which only occurred above the mass ratio of 30,000 biochar to nC60-stir. Favorable hydrophobic surface interactions between nC60-stir and 700 °C biochar likely disrupted van der Waals forces holding together the amorphous carbon units of biochar and C60 packing in the nC60 superstructure. This study appears in Uchimiya et al., 2017.



Transmission electron micrograph (TEM) images of a pecan shell char made at 700 °C and mixed with nC<sub>60</sub>-stir in water. a) Amorphous structure. b) Higher magnification of a). c) Crystalline structure. d) Higher magnification of c). The inset in a) shows the disintegration of 2-mm char pellets by nC<sub>60</sub>-stir after 3 d equilibration. The insets in b) and d) confirm the amorphous and crystalline nature of structures.

## B. Bioavailability of Contaminants in Environmental Particles

(Joseph Pignatello and numerous collaborators)

### 1. Bioaccumulation of cerium oxide nanoparticles by earthworms in biochar amended soil.

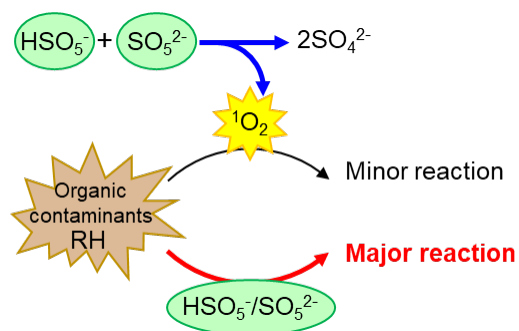
The interactions of nanoparticles (NPs) with biochar and soil components may substantially influence NP availability and toxicity to biota. In this study, earthworms (*Eisenia fetida*) were exposed for 28 days to a residential or agricultural soil amended with 0–2000 mg of CeO<sub>2</sub> NP/kg and with biochar (produced by the pyrolysis of pecan shells at 350 and 600 °C) at various application rates [0–5% (w/w)]. After 28 days, earthworms were depurated and analyzed for Ce content, moisture content, and lipid peroxidation. The results showed minimal toxicity to the worms; however, the pyrolysis temperature (350 or 600 °C) was the dominant factor, accounting for 94 and 84% of the variance for the moisture content and lipid peroxidation, respectively, in the exposed earthworms. For both soils with 1000 mg of CeO<sub>2</sub>/kg at 600 °C, biochar significantly decreased the accumulation of Ce in the worm tissues. Amendment with 350 °C biochar had mixed responses on Ce uptake. Analysis by micro X-ray fluorescence (μ-XRF) and micro X-ray absorption near edge structure (μ-XANES) was used to evaluate Ce localization, speciation, and persistence in CeO<sub>2</sub>- and biochar-exposed earthworms after depuration for 12, 48, and 72 h. Earthworms from the 500 mg of CeO<sub>2</sub>/kg and 0% biochar treatments eliminated most Ce after a 48 h depuration period. However, in the same treatment and with 5% BC-600 (biochar pyrolysis temperature of 600 °C), ingested biochar fragments (~50 μm) with Ce adsorbed to the surfaces were retained in the gut after 72 h. Additionally, Ce remained in earthworms from the 2000 mg of CeO<sub>2</sub>/kg and 5% biochar treatments after depuration for 48 h. Analysis by μ-XANES showed that, within the earthworm tissues, Ce remained predominantly as Ce<sup>4+</sup>, with only few regions (2–3 μm<sup>2</sup>) where it was found in the reduced form (Ce<sup>3+</sup>). The present findings highlight that soil and biochar properties have a significant influence in the internalization of CeO<sub>2</sub> NPs in earthworms; such interactions need to be considered when estimating NP fate and effects in the environment. These results appear in Servin et al., 2018.

## C. Pollution Prevention and Remediation

(Joseph Pignatello, Yi Yang, and numerous collaborators)

### 1. Oxidation of organic contaminants by unactivated peroxymonosulfate.

Removal of contaminants from drinking water sources and waters intended for reuse are critically needed. Peroxymonosulfate ( $\text{HSO}_5^-$ , PMS) is an optional bulk oxidant in advanced oxidation processes (AOPs) for treating wastewaters. Normally, PMS is activated by the input of energy or reducing agents to generate sulfate and/or hydroxyl radicals, which are highly reactive towards most organic compounds. This study shows that PMS without explicit activation undergoes direct reaction with a variety of compounds, including antibiotics, pharmaceuticals, phenolics, and commonly-used singlet oxygen ( $^1\text{O}_2$ ) traps and quenchers, specifically furfuryl alcohol (FFA), azide, and histidine. Reaction timeframes varied from minutes to a few hours at pH 9. Using a test compound with intermediate reactivity (FFA), electron paramagnetic resonance (EPR) spectroscopy and scavenging experiments ruled out sulfate and hydroxyl radicals. Although  $^1\text{O}_2$  was detected by EPR and is produced stoichiometrically through PMS self-decomposition,  $^1\text{O}_2$  plays only a minor role due to its efficient quenching by water, as confirmed by experiments manipulating  $^1\text{O}_2$  formation rate (addition of  $\text{H}_2\text{O}_2$ ) or lifetime (deuterium solvent isotope effect). Direct reactions with PMS are highly pH- and ionic strength-sensitive and can be accelerated by (bi)carbonate, borate, and pyrophosphate (although not phosphate) via non-radical pathways. The findings indicate that direct reaction with PMS may contribute to degradation pathways and must be considered in mechanistic and product investigations of AOPs and other applications. There are many literature reports attributing the unactivated reaction of PMS with organic compounds to  $^1\text{O}_2$ , a conclusion in light of our results may have to be reconsidered. Our results also signal caution to researchers when choosing buffers and  $^1\text{O}_2$  traps/quenchers for PMS or other reactions. This work appears in Yang et al., 2018.

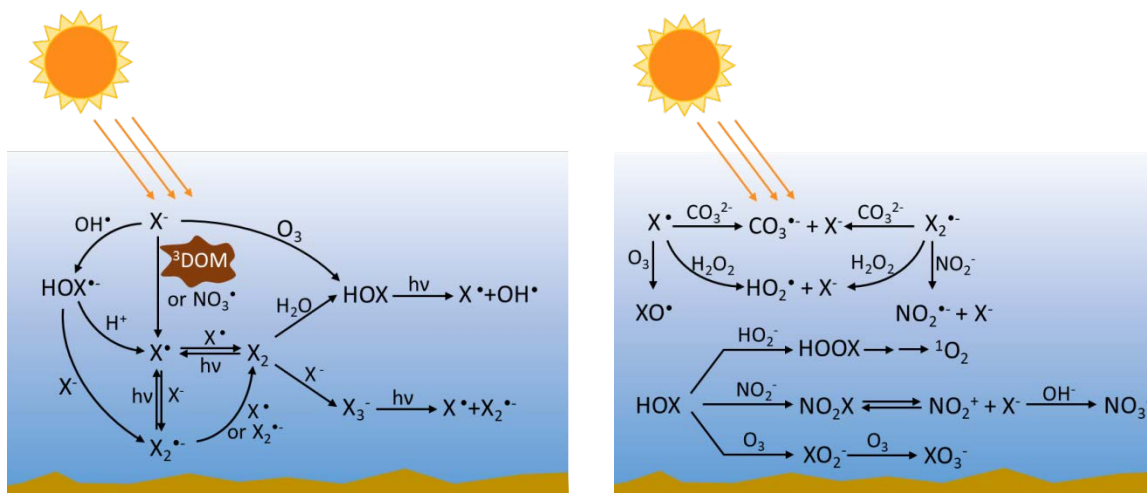


#### D. Chemistry of the Environment

(Joseph Pignatello and Yi Yang)

##### 1. Participation of the halogens in photochemical reactions in natural and treated waters.

Halide ions are ubiquitous in natural waters and wastewaters. Halogen plays an important and complex role in environmental photochemical processes and in reactions taking place during photochemical water treatment. Photolysis critically affects the global biogeochemical cycling of halogen. While inert to solar wavelengths, halides can be converted into radical and non-radical reactive halogen species (RHS) by sensitized photolysis and by reactions with secondary reactive oxygen species (ROS) produced through sunlight-initiated reactions in water and atmospheric aerosols, such as hydroxyl radical, ozone, and nitrate radical. In photochemical advanced oxidation processes for water treatment, RHS can be generated by UV photolysis and by reactions of halides with hydroxyl radicals, sulfate radicals, ozone, and other ROS. RHS are reactive toward organic compounds, and some reactions lead to incorporation of halogen into byproducts. Recent studies indicate that halides, or the RHS derived from them, affect the concentrations of photogenerated reactive oxygen species (ROS) and other reactive species; influence the photobleaching of dissolved natural organic matter (DOM); alter the rates and products of pollutant transformations; lead to covalent incorporation of halogen into small natural molecules, DOM, and pollutants; and give rise to certain halogen oxides of concern as water contaminants. This paper appears in Yang and Pignatello, 2018.



Generation (left) and reactions of (right) radical halogen species RHS in natural waters through the action of sunlight. Not shown are reactions of RHS with natural dissolved organic matter.

## Mosquito Program

### A. Mosquito Trapping and Testing Program

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

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



warn the public and guide the implementation of disease prevention and control measures. The CAES is responsible for conducting all mosquito trapping and testing activities.

In 2017, statewide mosquito trapping was conducted from June 5 through November 7. 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

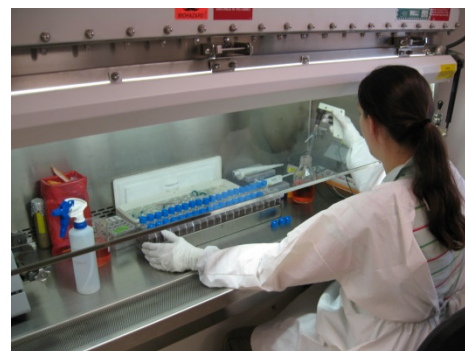
permanent fresh-water swamps (red maple/white cedar) and bogs, coastal salt marshes, horse stables, and swamp-forest border environs.

Mosquito trapping was conducted with CO<sub>2</sub> (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.

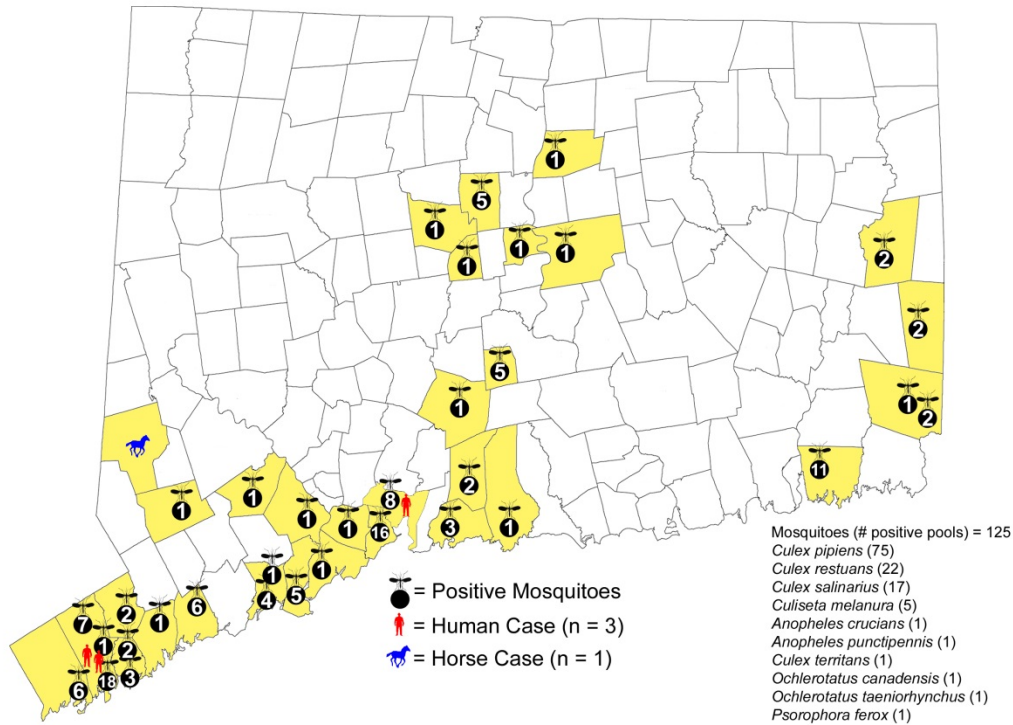
Aliquots of each mosquito pool were inoculated into Vero cell cultures for detection of West Nile virus (WNV), eastern equine encephalitis (EEE), and other mosquito-borne arboviruses of public health importance. Isolated viruses were identified by Real Time (TaqMan) reverse transcriptase polymerase chain 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.



During 2017, 195,543 mosquitoes (14,708 pools) representing 42 species were trapped and tested from 91 locations statewide between June 5 and November 7. A total of 125 isolations of WNV were made from 10 mosquito species: *Culex pipiens* =75, *Cx. restuans* = 22, *Cx. salinarius* = 17, *Culiseta melanura* = 5, *Anopheles crucians* = 1, *An. punctipennis* = 1, *Cx. territans* = 1, *Ochlerotatus canadensis* = 1, *Oc. taeniorhynchus* = 1, and *Psorophora ferox* = 1 collected at 30 sites in 26 towns in six counties. As in prior years, the majority of WNV activity was detected in densely populated urban and suburban regions in southwestern (Fairfield and New Haven counties) and central (Hartford County) Connecticut. The first positive mosquitoes were collected on June 29, and the last on October 5. Three human cases of WN virus-associated illness which have been locally acquired (encephalitis/meningitis n=2, and WN fever = 1) were reported. Dates of onset of symptoms were from August 22 to August 28. Human cases were temporally and spatially consistent with WN virus isolations from mosquito pools. A single horse case of WN virus infection occurred in Fairfield County with date of onset on October 23. There were six isolations of EEE virus from mosquitoes collected in New London and Windham counties and no human or equine cases were reported. Other viruses isolated from mosquito pools include: Jamestown Canyon virus (N= 25), Cache Valley virus (N=12), Potosi virus (N=128), Highlands J (N=9), and Flanders virus (N=1). All arbovirus and mosquito trapping data has been reported on the CAES/CT Mosquito Management website, the CDC via ArboNet and MosquitoNet, and to the Department of Public Health for dissemination.



## 2017 West Nile Virus Activity



**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 to 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 our understanding of the ecology of mosquitoes and mosquito-borne viruses. Additional studies on the role of different mosquito species to serve as vectors of viral pathogens may be used to target anti-vector interventions more effectively.

### B. Population Genetics of Mosquitoes and Epidemiology of Mosquito-borne Viral Diseases

#### 1. Wetland characteristics linked to broad-scale patterns in *Culiseta melanura* abundance and eastern equine encephalitis virus infection

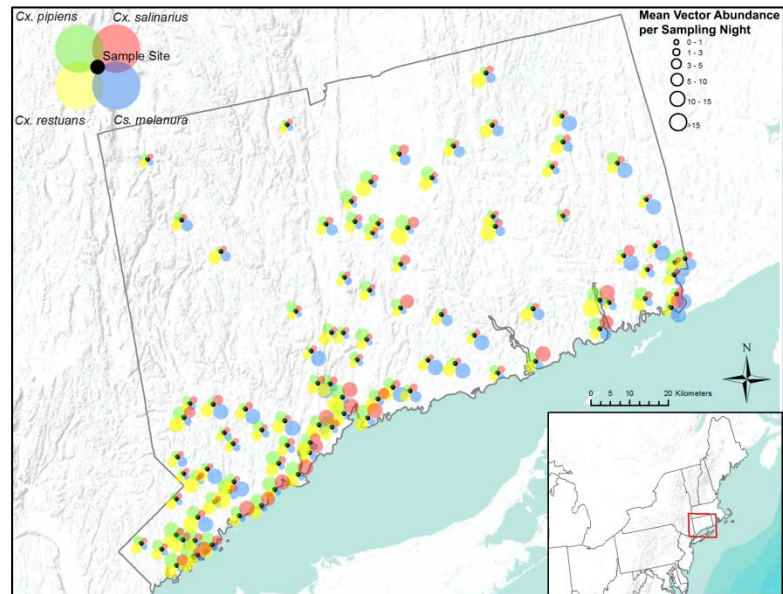
(Philip M. Armstrong and Theodore G. Andreadis in collaboration with Nicholas K. Skaff and Kendra S. Cheruveli)

Eastern equine encephalitis virus (EEEV) is an expanding mosquito-borne threat to humans and domestic animal populations in the northeastern United States. Outbreaks of EEEV are challenging to predict due to spatial and temporal uncertainty in the abundance and viral infection of *Cs. melanura*, the principal enzootic vector. EEEV activity may be closely linked to wetlands because they provide essential habitat for mosquito vectors and avian reservoir hosts. However, wetlands are not homogeneous and can vary by vegetation, connectivity, size, and inundation patterns. Wetlands may also have different effects on EEEV transmission depending on the assessed spatial scale. Accordingly, we investigated associations between

wetland characteristics and *Cs. melanura* abundance and infection with EEEV at multiple spatial scales in Connecticut, USA.

Our findings indicate that wetland vegetative characteristics have strong associations with *Cs. melanura* abundance. Deciduous and evergreen forested wetlands were associated with higher *Cs. melanura* abundance, likely because these wetlands provide suitable subterranean habitat for *Cs. melanura* development. In contrast, *Cs. melanura* abundance was negatively associated with emergent and scrub/shrub wetlands, and wetland connectivity to streams. These relationships were generally strongest at broad spatial scales. Additionally, the relationships between wetland characteristics and EEEV infection in *Cs. melanura* were generally weak.

However, *Cs. melanura* abundance was strongly associated with EEEV infection, suggesting that wetland-associated changes in abundance may be indirectly linked to EEEV infection in *Cs. melanura*. Finally, we found that wet hydrological conditions during the transmission season and during the fall/winter preceding the transmission season were associated with higher *Cs. melanura* abundance and EEEV infection, indicating that wet conditions are favorable for EEEV transmission.

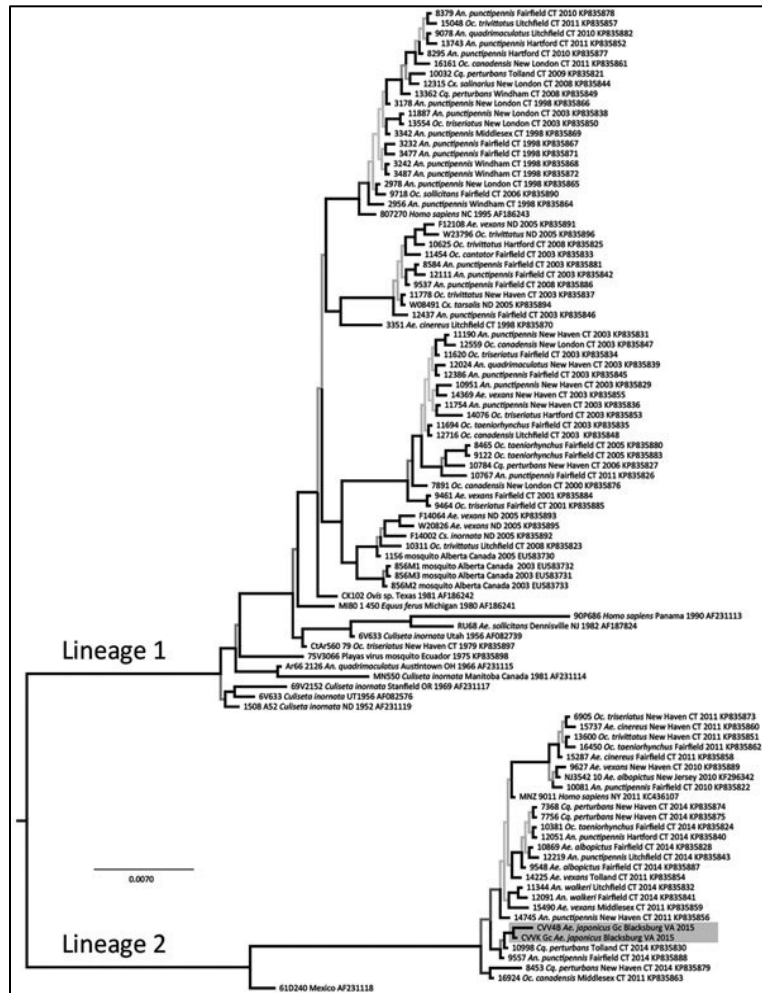


**Impact:** These results expand the broad-scale understanding of the effects of wetlands on EEEV transmission and help to reduce the spatial and temporal uncertainty associated with EEEV outbreaks. Such an understanding will help us anticipate future disease outbreaks and focus resources for vector control and surveillance more effectively.

## 2. Cache Valley Virus in *Aedes japonicus* Mosquitoes, Appalachian Region, United States

(Philip M. Armstrong in collaboration with Fan Yang, Kevin Chan, Paul E. Marek, Pengcheng Liu, Jacob E. Bova, Joshua N. Bernick, Benjamin E. McMillan, Benjamin G. Weidlich, Sally L. Paulson)

Cache Valley virus (CVV) is widespread throughout North and Central America and infects many species of domestic ungulates (sheep and cattle), but white-tailed deer are a likely reservoir. *Anopheles quadrimaculatus* and *Anopheles punctipennis* mosquitoes appear to play important roles in its transmission cycle in eastern U.S. CVV infection is common in sheep triggering spontaneous abortion, stillbirth and congenital defects (Edwards 1994). The virus is neuro-invasive in humans and there have been 3 confirmed human cases, with a single mortality in the U.S (Nguyen, Zhao et al. 2013). Medical laboratories rarely test for CVV, belying its true incidence and impact on human health, but serological studies have reported high infection rates ( $\leq 18\%$ ) in endemic areas.



In this study, we report the discovery of CVV from the invasive mosquito, *Aedes japonicus*, from Blacksburg, Virginia, USA. The virus was genetically most similar to strains previously isolated in the northeastern U.S. To determine the vector competence of local mosquitoes for CVV, a laboratory strain was established from uninfected *Ae. japonicus*. Week-old female mosquitoes were offered an infectious blood meal (IBM) in a membrane feeder. After a 14-day incubation, CVV was present in 41% of mosquito abdomens, 38% of legs and wings, and 28% of saliva samples.

**Impact:** This study shows the first occurrence of CVV in Appalachia and demonstrate that the invasive mosquito species *Ae. japonicus* is a competent vector of the virus. *Aedes japonicus* readily feeds on humans and large animals such as white-tailed deer. Consequently, it is probable that this species may help contribute to local transmission of CVV.

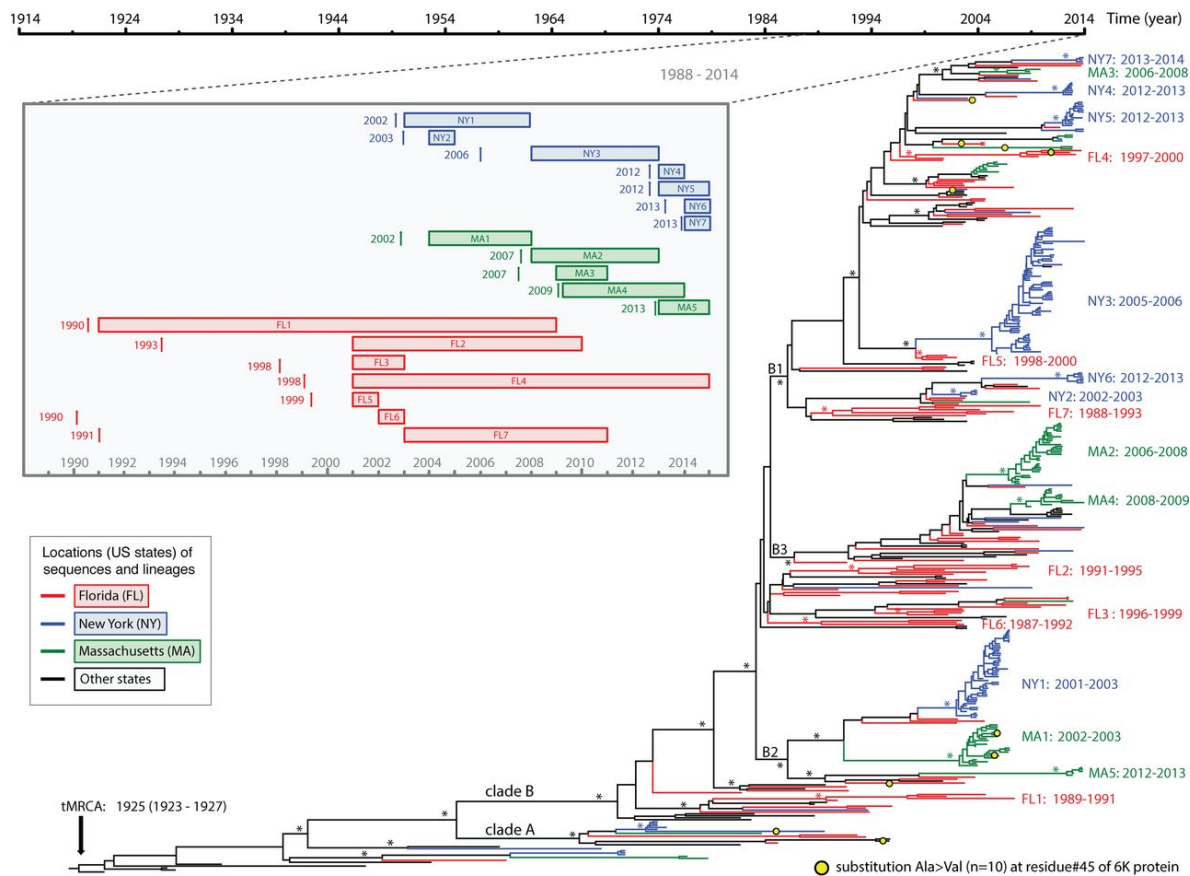
Phylogeny of Cache Valley virus isolates collected in



3. Large scale complete genome sequencing and phylodynamic analysis of eastern equine encephalitis virus reveal source-sink transmission dynamics in the United States.

(Philip M. Armstrong and Theodore G. Andreadis in collaboration with Yi Tan, Tommy Tsan-Yuk Lam, Lea A. Heberlein-Larson, Sandra C. Smole, Albert J. Auguste, Scott Hennigan, Rebecca A. Halpin, Nadia Fedorova, Vinita Puri, Timothy B. Stockwell, Robert B. Tesh, Edward C. Holmes, Scott C. Weaver, Thomas R. Unnasch, Alexander T. Ciota, Laura D. Kramer, Suman R. Das)

Eastern equine encephalitis virus (EEEV) has a high case-fatality rate in horses and humans, and causes sporadic outbreaks in the United States. Florida has been hypothesized to be the source of EEEV epidemics for the northeastern U.S. because of its year-round EEEV activity compared to the observed seasonal activity observed in temperate northeastern states. However, there has been insufficient viral genome sequence data to test this hypothesis in a phylogenetic framework. To this end, we performed high-throughput next-generation sequencing to determine the complete genome sequences of 433 EEEV strains collected within the U.S. from 1934 to 2014. These data substantially increased the size of publicly available EEEV sequences and allowed high-resolution phylodynamic analyses. Phylogenetic analysis suggested EEEV evolves relatively slowly and that transmission is enzootic in Florida, which is characterized by extensive genetic diversity and long-term local persistence. In contrast, EEEV in New York, Connecticut, and Massachusetts was characterized by lower genetic diversity, multiple introductions, and shorter local persistence, although overwintering was observed. Our phylogeographic analysis also supported a source-sink model in which Florida is the major source of EEEV compared to the other localities sampled. In sum, this study revealed the complex epidemiological dynamics of EEEV in different geographic regions in the U.S., which may provide general insights into the evolution and transmission of other avian mosquito-borne viruses in this region.



**Impact:** Our data enabled us to address the long-standing hypothesis that Florida is the ultimate source of EEEV epidemics in northeastern U.S. Such information could be used to improve surveillance and intervention strategies against the virus.

#### 4. Vector-Host Interactions of the Asian Tiger Mosquito, *Aedes albopictus*, The Potential Vector of Zika and other Arboviruses

(Dr. Olivia Harriott and Dr. Goudarz Molaei)

The Asian tiger mosquito, *Aedes albopictus*, garnered international attention in 2015 after the emergence and rapid spread of Zika virus in Brazil and other countries in Central and South America, the Caribbean, and in the state of Florida. This mosquito species has been expanding beyond its native boundaries in Africa and Asia into temperate zones in North America and Europe, heightening concern about possible human health implications. *Aedes albopictus* has been implicated in outbreaks of Dengue and Chikungunya viruses in several countries in Europe and Asia, prompting public health agencies in the United States to closely monitor local populations of this mosquito species. Connecticut is among 40 states where established populations of *Ae. albopictus* have been reported. As mosquito-borne disease agents are transmitted primarily during blood feeding, knowledge of vector feeding patterns and blood meal sources can aid in assessing the role of mosquitoes and their host species in disease transmission, maintenance, and amplification. We are investigating blood-feeding behavior of *Ae. albopictus* collected from mid-Atlantic regions of the U.S., using molecular methods. Of the blood meals analyzed to date, over 98% were from mammalian, and occasionally reptilian, hosts. These findings are consistent with reported feeding tendencies ascribed to this mosquito species.

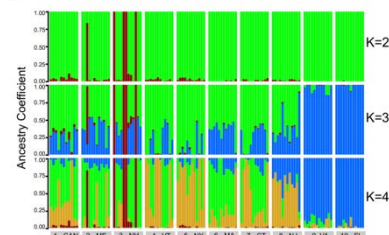
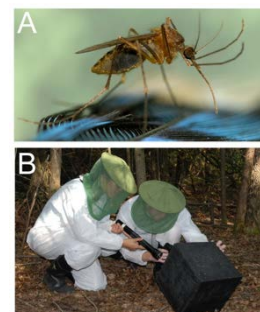


**Impact:** Detailed knowledge of the vector-host interactions of mosquito populations in nature is essential for evaluating their vectorial capacity and for assessing the role of individual vertebrates as reservoir hosts involved in the maintenance and amplification of zoonotic agents of human diseases. Our study will clarify the host associations of *Ae. albopictus* in mid-Atlantic region of the U.S., identify vector host preferences as the most important transmission parameter, and determine the risk of human infection with Zika and other arboviruses likely transmitted by this important mosquito species.

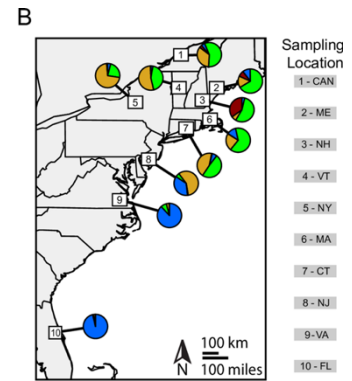
#### 5. Population Genomics of *Culiseta melanura*, the Principal Vector of Eastern Equine Encephalitis Virus in the United States

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

Eastern Equine Encephalitis (EEE) (Togaviridae, Alphavirus) is a highly pathogenic mosquito-borne arbovirus that circulates in an enzootic cycle involving *Culiseta melanura* mosquitoes and wild Passeriformes birds in freshwater swamp habitats. Recently, the northeastern United States has experienced an intensification of virus activity with increased human involvement and northward expansion into new regions. In addition to its principal role in enzootic transmission of EEE virus among avian hosts, recent studies on the blood-feeding behavior of *Cs. melanura* throughout its geographic range suggest that this mosquito may be also be involved in epizootic/epidemic transmission to equines and humans in certain locales. Variations in blood feeding behavior may be a function of host availability, environmental factors, and/or underlying genetic differences among regional populations. Despite the importance of *Cs. melanura* in transmission and maintenance of EEE virus, the genetics of this species



remains largely unexplored. To investigate the occurrence of genetic variation in *Cs. melanura*, the genome of this mosquito vector was sequenced resulting in a draft genome assembly of 1.28 gigabases with a contig N50 of 93.36 kilobases. Populations of *Cs. melanura* from 10 EEE virus foci in the eastern North America were genotyped with double-digest RAD-seq. Following alignment of reads to the reference genome, variant calling, and filtering, 40,384 SNPs were retained for downstream analyses. Subsequent analyses revealed genetic differentiation between northern and southern populations of this mosquito species. Moreover, limited fine-scale population structure was detected throughout northeastern North America, suggesting local differentiation of populations but also a history of ancestral polymorphism or contemporary gene flow. Additionally, a genetically distinct cluster was identified predominantly at two northern sites.



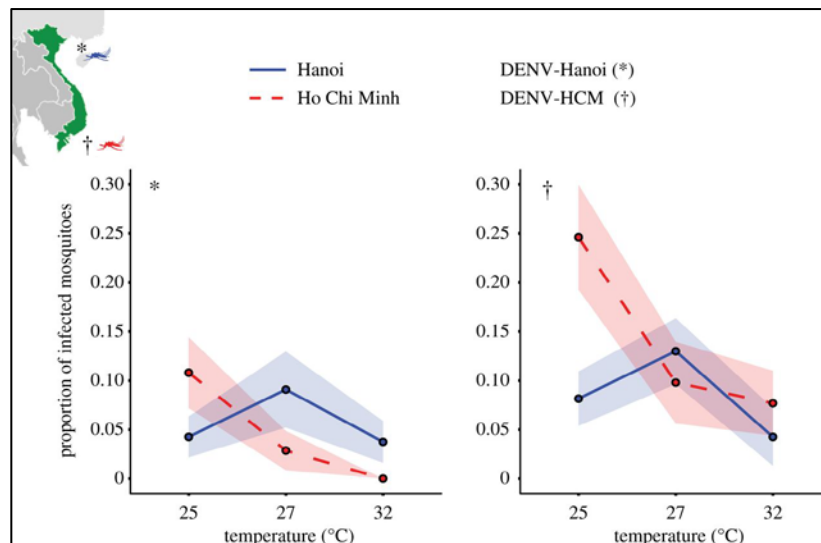
**Impact:** This study elucidates the first evidence of fine-scale population structure in *Cs. melanura* throughout its eastern range and detects evidence of gene flow between populations in northeastern North America. This investigation provides the groundwork for examining the consequences of genetic variations in the populations of this mosquito species that could influence vector-host interactions and the risk of human and equine infection with EEE virus.

### C. Virus-Vector Interactions

#### 1. Infection rate of *Aedes aegypti* mosquitoes with dengue virus depends on the interaction between temperature and mosquito genotype

(Philip M. Armstrong with Andrea Gloria-Soria, Jeffery R. Powell, and Paul E. Turner)

Dengue fever is the most prevalent arthropod-transmitted viral disease worldwide, with endemic transmission restricted to tropical and subtropical regions of different temperature profiles. Temperature is epidemiologically relevant because it affects dengue infection rates in *Aedes aegypti* mosquitoes, the major vector of the dengue virus (DENV). *Aedes aegypti* populations are also known to vary in competence for different DENV genotypes. We assessed the effects of mosquito and virus genotype on DENV infection in the context of temperature by challenging *Ae. aegypti* from two locations in Vietnam, which differ in temperature regimes, with two isolates of DENV-2 collected from the same two localities,



followed by incubation at 25, 27 or 32°C for 10 days. Genotyping of the mosquito populations and virus isolates confirmed that each group was genetically distinct. Extrinsic incubation temperature (EIT) and DENV-2 genotype had a direct effect on the infection rate, consistent with previous studies. However, our results show that the EIT impacts the infection rate differently in each mosquito population, indicating a genotype by environment interaction. These results suggest that the magnitude of DENV epidemics may not only depend

on the virus and mosquito genotypes present, but also on how they interact with local temperature. This information should be considered when estimating vector competence of local and introduced mosquito populations during disease risk evaluation.

**Impacts:** Dengue incidence is expected to increase over the next decades as exotic *Ae. aegypti* populations and DENV genotypes are introduced to new areas through human migration and trade, and as *Ae. aegypti* expands its geographical distribution in response to global temperature increases that facilitate year-round survival at northern (colder) latitudes. Studies of vector competence for arboviruses are usually performed at a standard 28°C temperature. Our results suggest that accurate vector competence assessments of these populations should incorporate the local temperature. Our data suggest that introduction of vectors from warmer to cooler areas can result in higher infection rates than in their native range depending on the virus genotype. Changes in local temperature patterns resulting from climate change will thus have a positive or negative impact on the epidemiology of arbovirus transmission based on the introduced vector and pathogen.

## 2. The Role of RNA Interference in Arbovirus Diversification

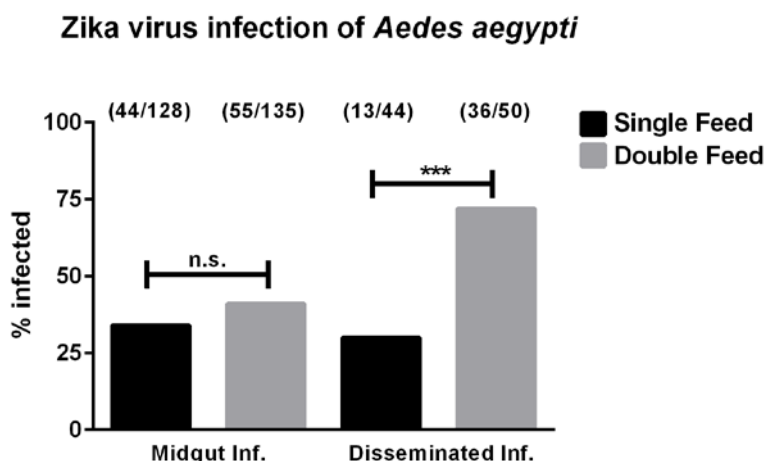
(Dr. Doug Brackney, Dr. Phil Armstrong)

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. Our previous studies have demonstrated that the innate immune pathway of arthropods, RNA interference (RNAi), serves as one of these micro-evolutionary forces and can directly impact the diversity of virus populations. However, because of other forces such as genetic drift and genetic bottlenecks it is unclear the true role of RNAi in arbovirus diversification. We are currently performing a series of experiments to address this specifically. Using viruses which over-express RNAi agonists, we will be able to quantify RNAi-mediated diversification. In addition to the canonical RNAi pathway, recent work has demonstrated that arbovirus sequences can be integrated into the mosquito genome and that these sequences can serve as templates for RNAi-mediated targeting of viral genomes. Our work will be to further quantify the contributions of this non-canonical RNAi based defense mechanism in virus diversification. Ultimately this line of research will provide mechanistic insights into arbovirus evolution and epidemic potential.

## 3. 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

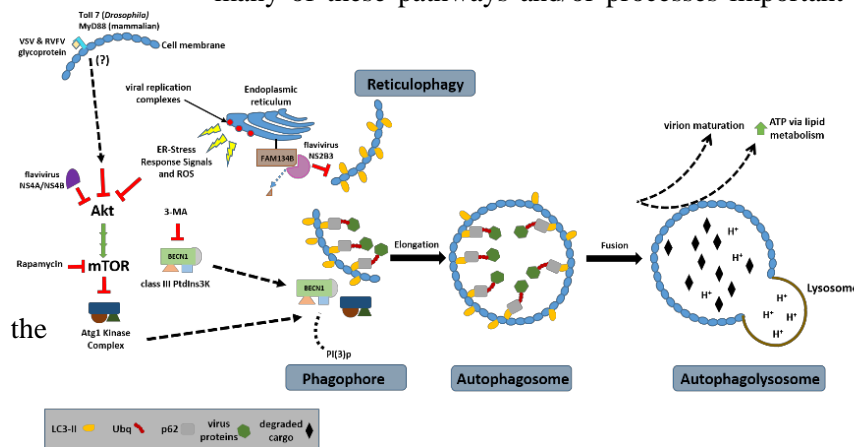


constitutes a continued and significant public health threat. Determining the relative risk for transmission is typically assessed in the laboratory by performing vector competence studies. Vector competence is the ability of an arthropod vector (e.g. mosquitoes) to become infected with a pathogen, permit 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 hemolymph (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.

#### 4. 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 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.

### D. Mosquito Biological Control

#### Life cycle investigations on a microsporidian pathogen of the mosquito, *Aedes communis* (Dr. Theodore Andreadis, Michael Thomas, and John Shepard)



A multi-year study was conducted to examine the natural ecology of the microsporidium *Amblyospora khaliulini* and more fully characterize parasite development and histopathology in all stages of its primary mosquito host, *Aedes communis* and intermediate copepod host, *Acanthocyclops vernalis* with redescription of the species. *A. khaliulini* exhibits polymorphic development, produces three morphologically and functionally distinct spores, and is both horizontally and vertically transmitted. Development in *A. vernalis* is restricted to females, occurs within the ovaries and results in death of the host. Development is haplophasic with division by

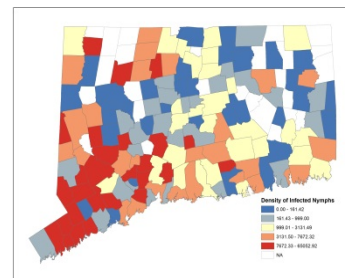
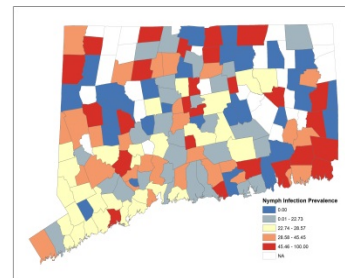
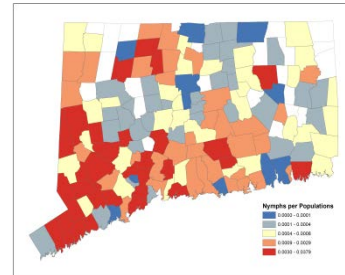
binary and multiple fission producing rosette-shaped sporogonial plasmodia and conical uninucleate spores that are orally infectious to *Ae. communis* larvae. Both sexes are equally susceptible and infections are confined to testes in males and ovaries in females. Initial stages of development include uninucleate schizonts that undergo karyokinesis forming diplokaryotic meronts that divide repeatedly by binary fission. Sporogony occurs in both host sexes, but sporogenesis does not progress normally in adult males and elliptical, thin walled binucleate spores that function in vertical transmission of the microsporidium via infection of the ovaries and eggs are formed in adult females only. Development of vertically acquired infections in larval *Ae. communis* hosts occurs within fat body tissue, leads to the production of meiospores in male hosts only and results in death during the 4<sup>th</sup> larval stadium. Initial development is characterized by merogonial multiplication of diplokarya by synchronous binary division producing additional diplokarya. The cessation of merogony and the onset of sporogony are characterized by the simultaneous secretion of a sporophorous vesicle and meiotic division of diplokarya resulting in the formation of octonucleate sporonts that undergo cytokinesis and sporogenesis to form eight uninucleate, broadly ovoid meiospores enclosed within a sporophorous vesicle. The natural prevalence of patent vertically acquired fat body infections in field populations of *Ae. communis* ranged from 1.6% to 3.6%. Yearly infection rates in *A. vernalis* copepods ranged from 57.1% to 15.0%. Prevalence rates of horizontally acquired infections in emerging adult *Ae. communis* ranged from 69.0% to 11.9% in males and 50.0% to 16.4% in females.

## Tick Management and Epidemiology of Tick-borne Diseases

### A. Spatiotemporal Modeling of Human Lyme Disease and Tick Distributions in Connecticut

(Dr. Goudarz Molaei, Dr. Eliza Little, Dr. John Anderson, Dr. Kirby Stafford III)

Lyme disease is the most prevalent arthropod-associated disease in the United States with an estimated 330,000 human cases occurring annually. *Ixodes scapularis*, commonly referred to as the blacklegged tick or deer tick, is the primary vector of the Lyme disease spirochete, *Borrelia burgdorferi*, in the eastern United States. Connecticut has had pervasive populations of *I. scapularis* in all of its eight counties since 1996, and remains as an endemic region for Lyme disease. In addition to data for reported Lyme disease cases from the Connecticut Department of Public Health (CDPH), the Tick Testing Laboratory at the Connecticut Agricultural Experiment Station (CAES-TTL) has generated data annually since 1996 for human-biting *I. scapularis* ticks submitted by the public for screening of infection with *B. burgdorferi*. Tick-based passive surveillance data was used to generate estimates of nymphal tick submission rates, *B. burgdorferi* infection prevalence in engorged nymphs, and abundance of submitted infected nymphs. These risk measures were calculated for each year at two spatial scales in Connecticut: town (n=169) and county (n=8). Due to changes over time in Lyme disease case reporting practices, calculation of corresponding town and county level Lyme disease incidence was restricted to an 11-year period from 2007 to 2017. Spatiotemporal patterns in tick-based measures and Lyme disease incidence were assessed with generalized linear and spatial models, and data from 2007 to 2017 were used in generalized linear mixed effect models, together with land cover and household income data, to examine the association between tick-based risk estimates and Lyme disease incidence. Between 2007 and 2017, the CAES-TTL received 26,116 *I. scapularis* tick submissions and the CDPH reported 23,423 Lyme disease cases. Nymphal tick submission rates, nymphal infection prevalence, the abundance of submitted infected nymphs and Lyme disease incidence all decreased over time during this 11-year period. Nymphal tick submission rates, abundance of submitted infected nymphs, and Lyme disease incidence were spatially clustered while nymphal infection prevalence was not. We found positive relationships between nymphal tick submission rate or abundance of submitted infected nymphs and Lyme disease incidence at both town and county spatial scales but not for nymphal infection prevalence. When also considering landscape and socioeconomic factors, the best fitting tested model to predict Lyme disease incidence revealed a positive association with the abundance of submitted infected nymphs and a negative association with the percent of developed land at the county scale. We further assessed the model by comparing predicted and observed Lyme disease cases using spearman's correlation and through leave-one-out temporal and spatial cross validation. We conclude that data from passive surveillance, relying on tick submissions from the public, were strongly predictive of Lyme disease incidence in Connecticut ( $\rho=0.945$ ). Tick-based passive surveillance methods may be particularly useful in settings where Lyme disease case reporting practices change substantially over time.



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**Impact:** We find a strong relationship between nymphal submission rates and the abundance of submitted infected nymphs with Lyme disease incidence at the town and county level. This finding underscores the relevance of using passive surveillance based on ticks recovered from humans, and guides in the complex decision making processes concerning prevention and treatment of tick-associated diseases.

## B. Evaluation of Temperature-dependent Physiological Parameters Associated with Disease Transmission in Blacklegged Tick

(Dr. Goudarz Molaei, Dr. Kirby C. Stafford III)

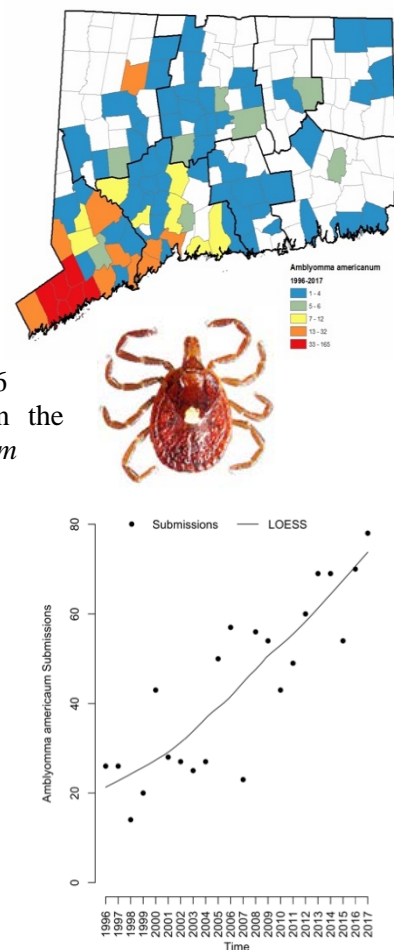
Climate models predict that the environment will warm in the tick geographic ranges. Historical data on tick dispersal patterns has been incorporated into recently developed computer-based models to predict how this warming climate will alter the biogeography of this arthropod vector. However, conspicuously 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.

### C. Distribution and Establishment of the Lone Star Tick, *Amblyomma americanum* (L.) (Acari: Ixodidae), in Connecticut and Implications for Range Expansion and Public Health

(Dr. Kirby C. Stafford III, Dr. Goudarz Molaei, Dr. Eliza A. H. Little, Dr. Christopher D. Paddock, Dr. Sandor E. Karpathy, Mr. Andrew M. Labonte)

In the United States, the lone star tick, *Amblyomma americanum* (L.), is an aggressive southeastern species whose range has reportedly been steadily expanding northward. The number of *A. americanum* specimens submitted to the Tick Testing Laboratory (TTL) at the Connecticut Agricultural Experiment Station (CAES) increased by 58% from the period of 1996-2006 (n = 488) to 2007-2017 (n = 773), mainly from Fairfield County in the southwestern corner of the state. The greatest numbers of *A. americanum* submissions to the CAES-TTL were from the City of Norwalk and a few adjacent municipalities. We also report the discovery of a large infestation of adult and nymphal lone star ticks detected on a dead male white-tailed deer, *Odocoileus virginianus* (Zimmerman), on Manresa Island, Norwalk, in June 2017, indicating a long established, undetected population. A sample of nymphal and adult host-seeking *A. americanum* collected July 2017 from Manresa Island were tested and a proportion were positive for *Ehrlichia chaffeensis*, *E. ewingii*, and *Anaplasma phagocytophilum*. The *A. americanum* tick and its associated disease pathogens are expected to become an increasing public health concern in southern New England.

**Impact:** As *A. americanum* expands its established range into new regions and more ticks are found on humans seasonally in areas beyond established populations, it is expected that this species and associated pathogens will become an increasing medical and veterinary concern in southern New England.

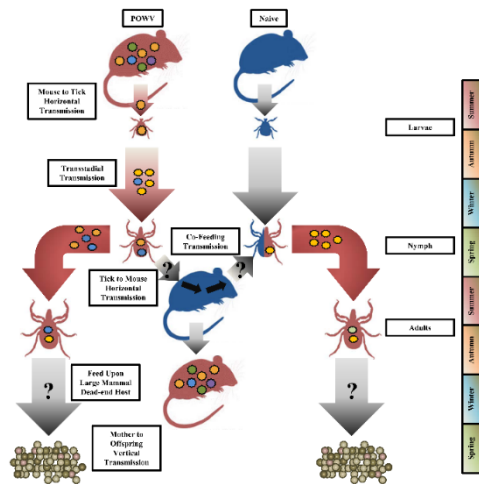


### D. Virus-Vector Interactions: Deer Tick Virus Population Dynamics during Infection of *Ixodes Scapularis* Ticks



(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.

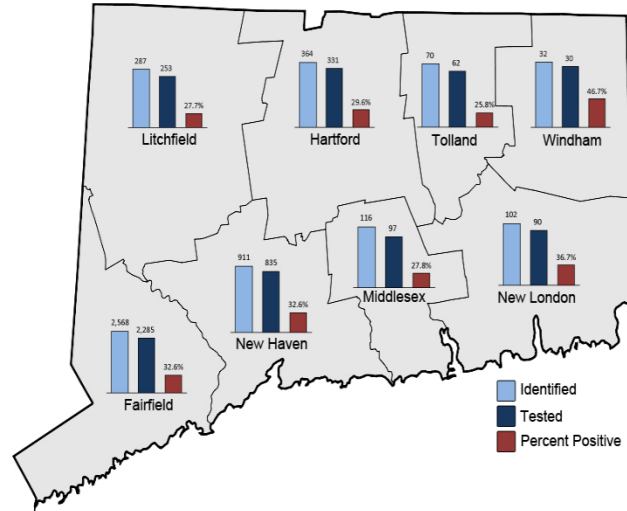
### E. Tick Testing Program for Lyme and Allied Diseases

(Dr. Goudarz Molaei assisted by Alex Diaz, Mallery Breban, Dasha Pokutnaya, Nicholas DeVito, Victoria Dahm, Doug Voung)

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 2017, 2,022 LD cases were reported in Connecticut with an incidence rate of 56.6. In recent years, 95% of reported LD cases in the United States were reported from 14 states, including Connecticut.



The CAES Tick Testing Program was established in 1990. Each year, an average of 3,000 ticks are submitted for testing. However, in recent years, the number of submissions has substantially increased. In 2017, the CAES Tick Testing Laboratory received greater than 5,700 ticks. In the past, testing was limited to *B. 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. A total of 5,577 ticks submitted by Connecticut residents, health departments and/or physicians' offices, of which 4,458 were identified as *I. scapularis*. Of 3,989 engorged nymph and adult *I. scapularis* examined, 32% tested positive for LD; 6% for babesiosis; and 7% for anaplasmosis.

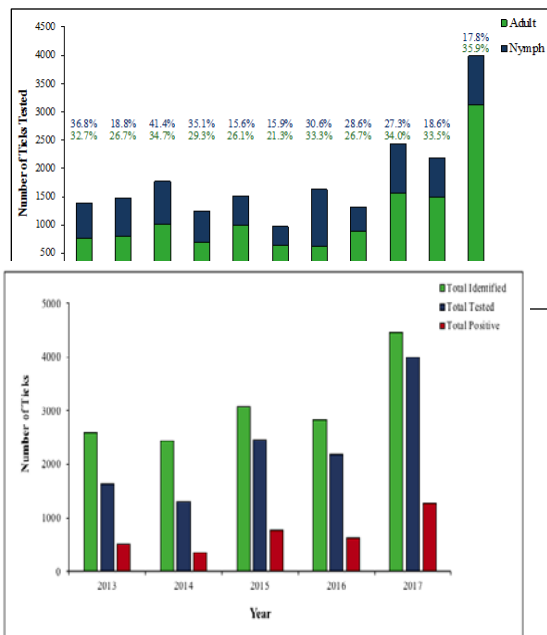


Number of Ticks Submitted, Number of *I. scapularis* Tested, and Percentage Positive for *B. burgdorferi* in 8 CT counties, 2017

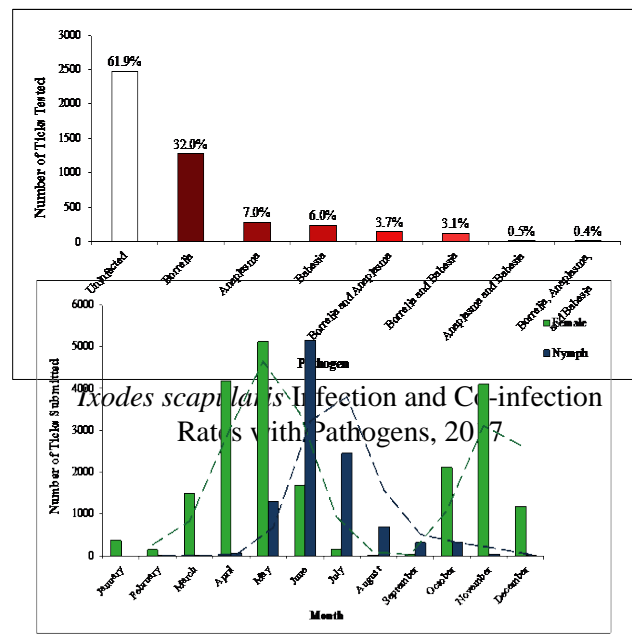
**Impact:** As a passive surveillance, testing human-biting ticks provides important spatial and temporal information on infection rate and the risk of human infection with important tick-borne pathogens including, *Borrelia burgdorferi*, *Anaplasma phagocytophilum*, and *Babesia microti*, the causative agents of Lyme disease, human granulocytic anaplasmosis, and babesiosis, respectively, in Connecticut. Tick testing results generated by this passive surveillance, in conjunction with other lines of evidence, can also be used to make the important decision as to whether treatment is required.

## Environmental Microbiology

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



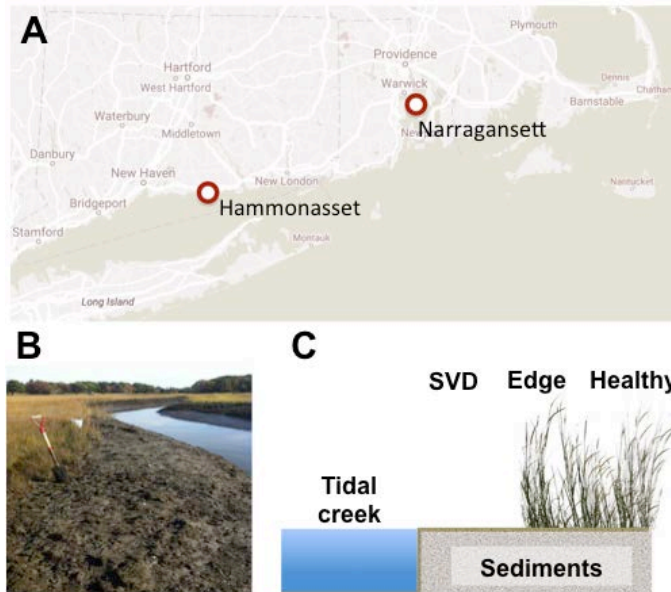
Number of Ticks Received, Tested, and Positive for *Borrelia burgdorferi*, 2013-2017



Temporal Pattern of Nymph and Adult *Ixodes scapularis* Infection and Coinfection Rates with Pathogens, 2017

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<sub>2</sub> 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.

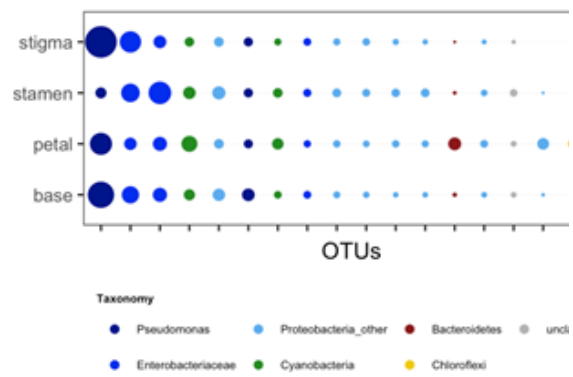


**Fig. 1.** SVD affected sites in CT. A). Map of the two field sites being studied. B). Site of SVD at Hammonasset State Park. C). SVD develops as patches of unvegetated soils along tidal creeks, leading to distinct zones of vegetation status.

More recently SVD has also developed at sites at Narragansett Bay in Rhode Island (Figure 1A). We are currently comparing and contrasting the sediment microbial communities between these two sites to characterize how SVD affects carbon cycling, microbial community composition, and biogeochemistry between two sites that differ in geography and the time since SVD development.

**B. 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 pear. Despite the tremendous damage posed by fire blight, the control options for organic growers are extremely limited. Further, the removal of antibiotics from the list of organic control options by the National Organic Standards Board in 2014, put organic growers at significant risk for control failures. As the pathogens enter the plant through open flowers, we are characterizing and screening the natural microbiome of apple blossoms to identify potential natural biocontrol



**Fig. 2.** Bacterial species identified on apple flowers and their abundance. Each point represents a bacterial species identified on different flower parts (colored by the phylum to which they belong) the size of the point represents the abundance of each species on that part.

agents that could be employed in organic agriculture.

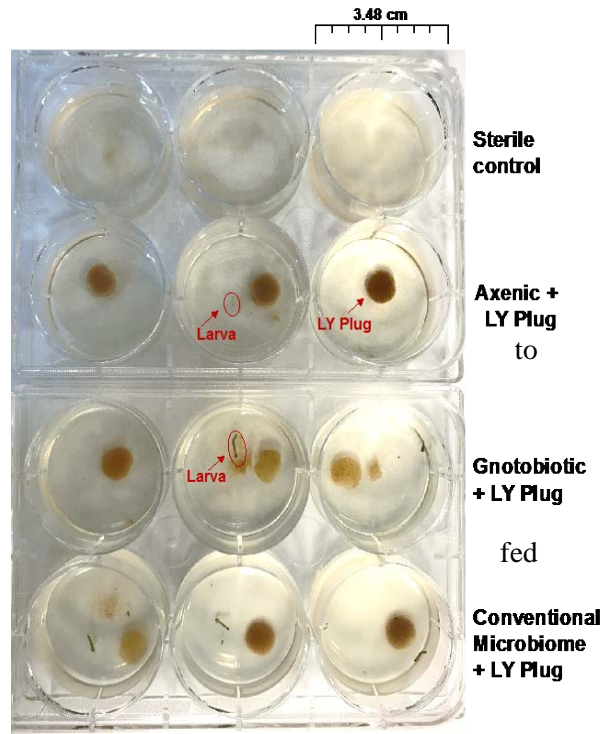
Our initial work has been to characterize how the apple flower microbiome varies with flower anatomy and apple cultivar. Overall, different flower parts harbor a similar microbial community (Figure 2). Similarly, apple cultivar was not associated with flowers harboring different bacteria. Taken together, these data suggest that the apple flower is colonized by a relatively small set of bacteria that are well adapted to life on a flower. We are currently isolating members of this community in pure culture and screening them for their potential to control fire blight.

### C. Mosquito Microbiota: Transitioning the Microbiome into a Controllable Variable

(Dr. Doug Brackney, Dr. Blaire Steven)

The presence of a host associated microbiota or the “microbiome” (the collection of bacteria living on or in animals) is a commonality shared among most, if not 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 to role of microorganisms in mosquito biology. However, without the ability to manipulate the microbiome it is not possible perform mechanistic experiments. We have recently developed methods to rear mosquitoes in the complete absence of living bacteria, also called an axenic state (Figure 3).

In the sterile controls the larvae do not develop, but when on a high nutrient diet embedded inside an agar plug, axenic larvae grow. However, their development is delayed in comparison to gnotobiotic mosquitoes (colonized by a single bacterial species) or mosquitoes reared with a conventional microbiome. These experiments for the first time allow the microbiome to become an aspect of mosquito biology that can be controlled and manipulated in a variety of experiments.



**Fig. 3.** Growth and development of axenic mosquitoes. Sterile control mosquitoes do not develop. Axenic mosquitoes show slower development than gnotobiotic (colonized by *E. coli*) or mosquitoes with their normal microbiome.

## Evolutionary Microbiology

### A. Ecological Genomics of the Microsporidia

(Dr. Charles Vossbrinck)

Recent advances in genomics and related technologies are giving scientists unprecedented abilities to solve problems in the biological world. We are using computational chemistry to look at protein structures (superoxide dismutase) of microsporidial parasites to learn how they protect themselves from the destructive effects, such as mutation and degradation, by oxygen radicals. We are now extending this research to other components of microsporidial cells.

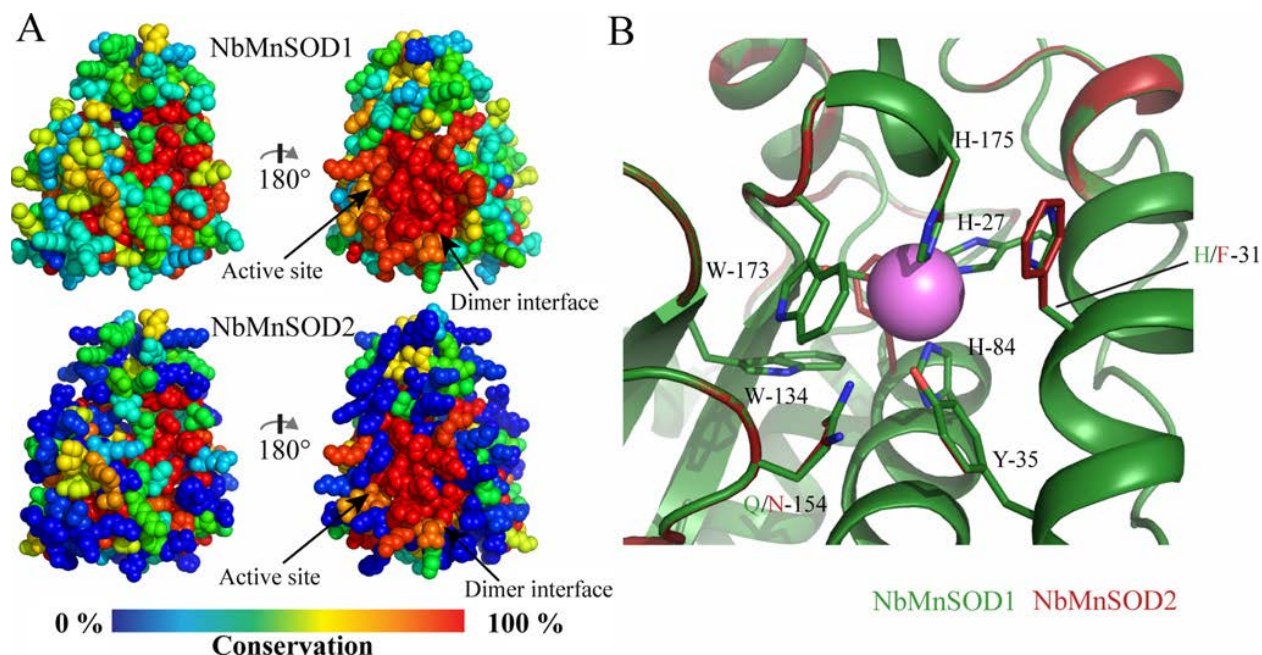
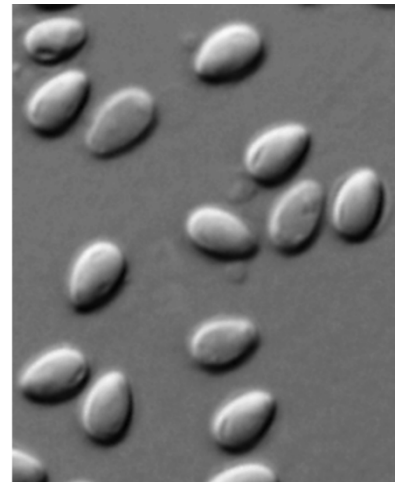
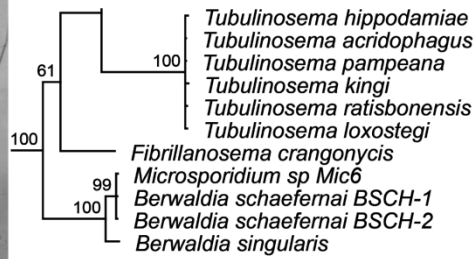


Figure above. Homology modeling of NbMnSOD1 and NbMnSOD2 (A) Homology model of NbMnSOD1 (top) and NbMnSOD2 (bottom). Both models were prepared using the Phyre homology modeling server and are based on PDB entry 4YIO. Both protein models were visualized by Homolmapper and Pymol. Only the monomer is shown in spheres representation and colored according to conservation from not conserved (dark blue) to conserved (red). (B) Active site comparison of the homology model of NbMnSOD1 (green) and NbMnSOD2 (red). Cartoon representation with active site residues shown as sticks. The ion (Mn) at the active site is shown as a purple sphere.

## B. Identifying New Species of Microsporidia

(Dr. Charles Vossbrinck)

Microsporidia are single-celled parasites that can be found living inside (infecting) members of essentially all animal species. Our goal is to describe new species of microsporidia from a variety of animal species (insects, crustaceans, etc.) and to determine their phylogenetic placement with other microsporidia species. Through the use of traditional methods such as light and electron microscopy combined with modern methods of DNA and phylogenetic analysis we are uncovering new species of microsporidia that infect aquatic organisms such as Daphnia.



At left we see *Daphnia pulex*, right is a light microscope image of the spores infecting this species (*Berwaldia singularis*) and center is a phylogenetic analysis of several species of spores that infect *Daphnia*.

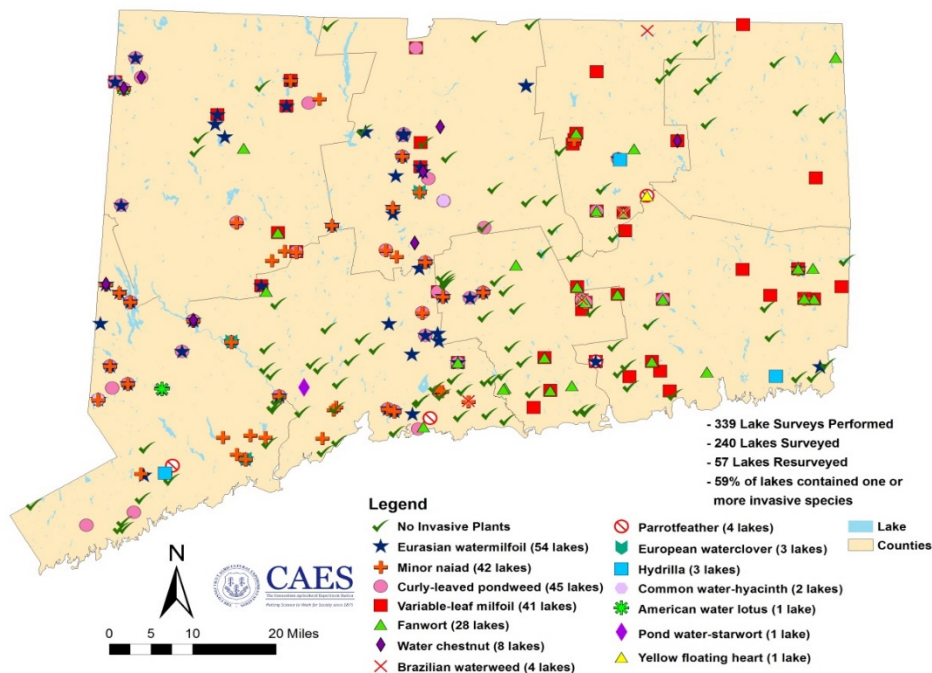
## Invasive Aquatic Plant Program

(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

Locations of Invasive Plants Found by CAES IAPP 2004-2017



Locations of invasive plants in Connecticut's lakes and ponds as found in CAES IAPP surveys from 2004-2017.

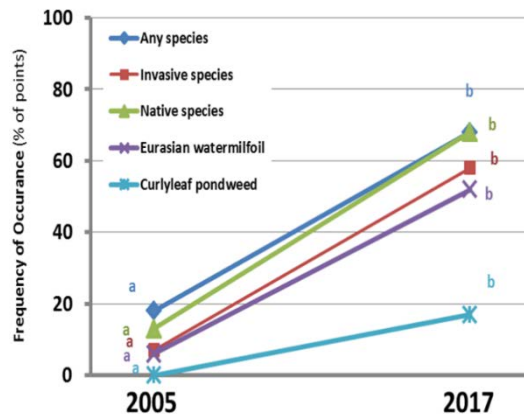
Since 2004, the Connecticut Agricultural Experiment Station Invasive Aquatic Plant Program (CAES IAPP) has completed aquatic vegetation surveys of 230 Connecticut lakes and ponds. A total of 56 waterbodies have been resurveyed to determine how invasive plants are changing the quality of lakes over time. In fiscal year 2017-2018, Gregory Bugbee and staff mapped the aquatic vegetation in three new and 12 previously surveyed waterbodies. 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. 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 plant species.

CAES IAPP Surveys Performed in 2017			
Number	Lake Name	Town	Acres
1	Beseck Lake	Middlefield	116
2	Candlewood Lake	Sherman	5400
3	Chordas Pond	Shelton	2.5
4	Fence Rock	Guilford	16.9
5	Lake Forest	Bridgeport	66
6	Lake Housatonic	Derby	347
7	Lake Lillinonah	Newtown	1547
8	Lake Phipps	West Haven	26
9	Lake Zoar	Newtown	920
10	Pachaug Pond	Griswold	817
11	Private Pond, Stonington	Stonington	0.04
12	Squantz Pond	New Fairfield	266
13	Taunton Lake	Newtown	124
14	West Shore Pond	West Haven	0.75

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. 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.



Surveying aquatic vegetation in Taunton Lake, Newtown.



Change in aquatic vegetation in Lake Housatonic from 2005-2017.

We surveyed Lake Housatonic in 2005 and again in 2017 to document changes in aquatic vegetation over time. Lake Housatonic is immediately downstream from Lake Zoar and we now have updated surveys of all lakes formed by the damming the Housatonic River beginning with Lake Candlewood. Our surveys found a significant increase in both invasive and native species over the twelve-year period. This provided stakeholders with the detailed information needed to begin management in 2018.

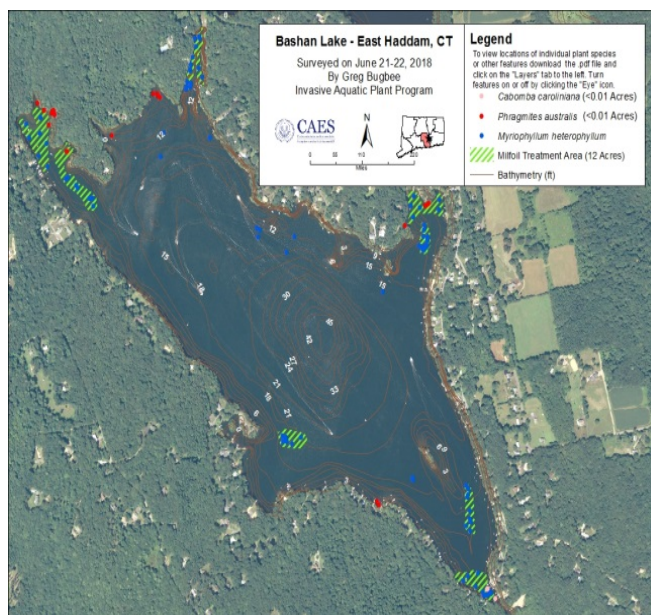
## B. Control Technologies

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.

### 1. Herbicides.

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

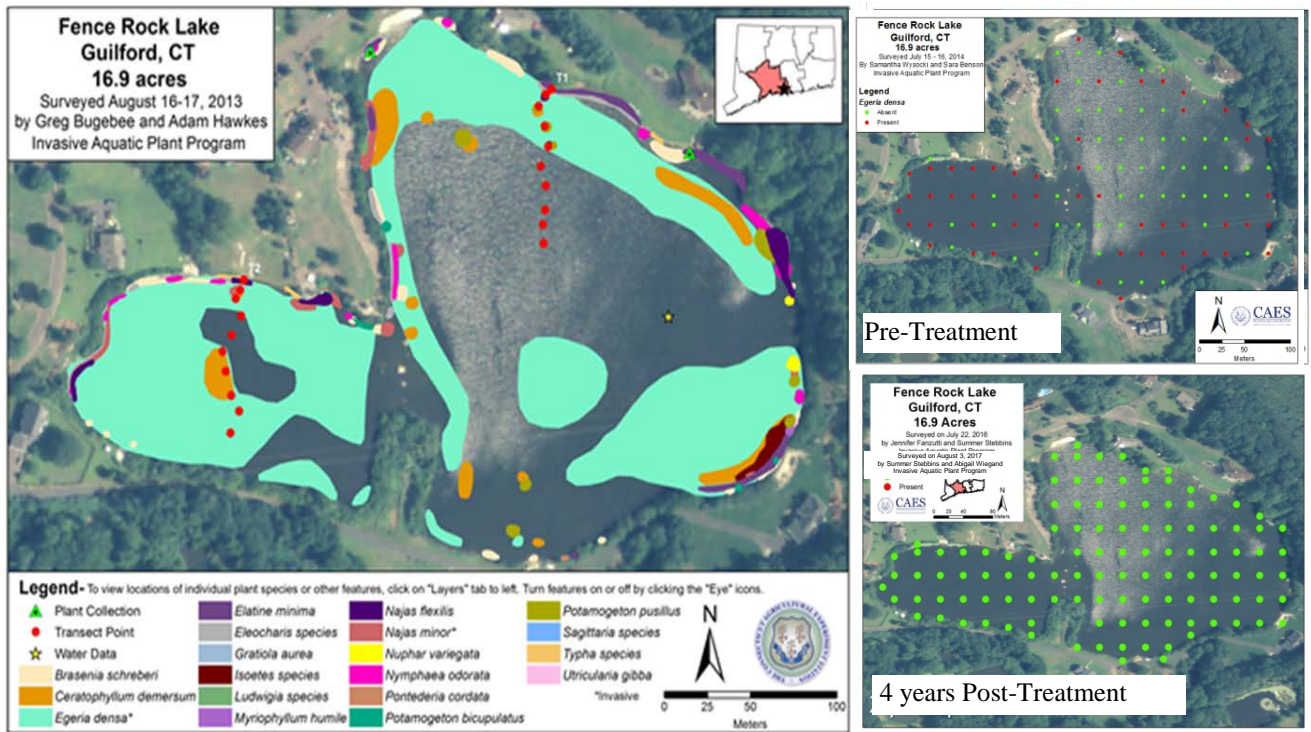
*Bashan Lake – East Haddam, CT.* We are in the 17<sup>th</sup> year of research involving the use of spot applications of the herbicide 2,4-D to control variable watermilfoil in Bashan Lake. We had largely restored the lake to preinfestation conditions prior to lowering the lake for dam repairs in 2014. Surveys of Bashan Lake in 2016 and 2017 found a regrowth of variable watermilfoil and a number of areas where phragmites (*Phragmites australis*) had become established. With support from the Bashan Lake Association (BLA) and the Town of East Haddam, CAES IAPP performed a targeted herbicide application of the phragmites and variable watermilfoil in late September. Our 2018 survey found little phragmites but the variable watermilfoil seemed nearly untouched. CAES is procuring the necessary CT DEEP permits to treat the variable watermilfoil this September with an experimental product that claims to be both effective and environmentally benign.



Locations of phragmites and variable watermilfoil in Bashan Lake in 2018.

*Fence Rock Lake - Guilford, CT.* CAES IAPP discovered Brazilian waterweed in Fence Rock Lake in 2009 and has since documented its yearly expansion. Because this is the first documented case of a 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) pyrazinedium dibromide) in the summer of 2014. The herbicide was applied by bottom injection to the shoreline areas of the lake in July 2014. A pretreatment survey on over 100 georeferenced points found 59 points were occupied by Brazilian waterweed. Although a survey one year later found only one point with the plant, another treatment was performed to increase the chances of long term control. We resurveyed the lake in July 2016 and 2017 without finding a trace Brazilian waterweed. We believe we have completely eliminated the plant without harm to the native plant community.





Brazilian waterweed in Fence Rock Lake in 2013, pretreatment 2014, and three years post treatment in 2017).

## 2. Winter water level drawdown and grass carp.

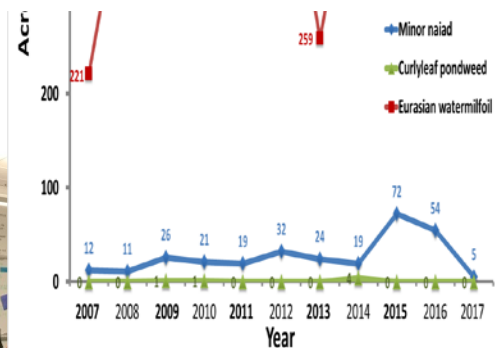
*Candlewood Lake - Brookfield, New Fairfield, New Milford, Sherman, CT.* Lake Candlewood’s aquatic plant community is dominated by Eurasian watermilfoil. Winter water level drawdown is used to manage this invasive aquatic plant. Using state-of-the-art global positioning systems, we have documented the 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 milfoil shows a negative relationship to drawdown depth. In 2015 and 2017, a total of nearly 10,000 sterile grass carp were introduced into the lake. These fish eat aquatic vegetation and we are determining 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 Quonnapaug, Guilford and Bashan Lake, East Haddam.* 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 Quonnapaug’s public beach for the third straight year. The beach has had an increasing problem with Eurasian watermilfoil and fanwort (*Cabomba caroliniana*). We placed the benthic barriers in early April and removed them prior to the opening of the beach on Memorial Day weekend. The results are promising with little vegetative regrowth throughout the summer. In 2018, we are testing the use of benthic barriers to control a pioneer infestation of fanwort in Bashan Lake. Further tests are needed to determine why these barriers provide impressive weed control even when they are used for short periods of time.



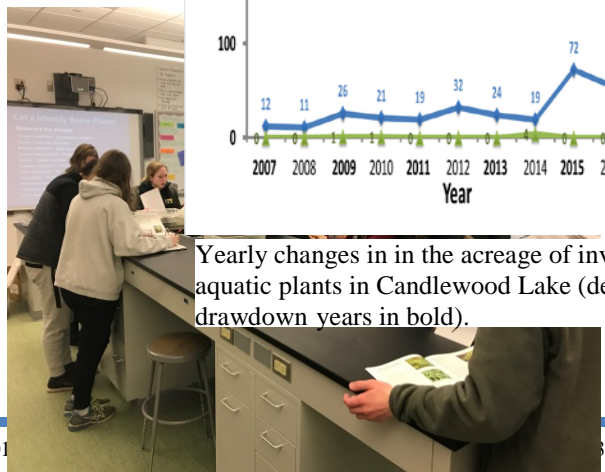
Benthic barrier installed over pioneer infestation of fanwort Bashan Lake, East Haddam.



Yearly changes in in the acreage of invasive aquatic plants in Candlewood Lake (deep drawdown years in bold).

### C. Outreach.

We strive to disseminate all information from our program to the public in a timely fashion and educate stakeholders in the identification,



Invasive aquatic plant workshop at the 2018 high school Envirothon.

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 8) on the identification of invasive aquatic plants. We also have given 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>).

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 provided for citizens of Connecticut. At the laboratory in New Haven, 6,457 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.



## DEPARTMENT OF FORESTRY AND HORTICULTURE

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

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.

### **Forest Rehabilitation Study**

(Dr. Jeffrey R. Ward assisted by Mr. Joseph P. Barsky)

Poorly stocked stands are a common problem across a broad geographical range - occupying more than 200,000 acres in Connecticut, 660,000 acres in southern New England, and 32 million acres of upland oak forests in the eastern United States. In addition, there are another 57 million acres with medium stocking that are potentially one high-grade harvest away from becoming poorly stocked. Poorly stocked stands have too few trees to fully utilize available growing space; resulting in low productivity, including carbon sequestration, compared with fully stocked stands. Poorly stocked oak forests generally have trees of less desired species with lower quality stems and irregular stand structures that are logistically difficult to manage.

Poorly stocked stands rarely develop on publicly managed lands and other professionally managed forests except following severe weather, repeated defoliations, or wildfire. While the majority of family forests (small, privately owned forests) are held for non-financial amenities such as scenic beauty or protecting nature, there is a much higher risk of poorly stocked stands developing on family forests as the majority have not received professional consultation. Most of the poorly stocked stands were created by high-grading or repeated diameter limit harvests which emphasize maximizing immediate economic return with no consideration of future stand growth and value.

Returning poorly stocked stands to their economic and ecosystem services potential will require innovative rehabilitation practices that are at least cost-neutral. While there are suggested guidelines for rehabilitating poorly stocked stands, research has been limited to studies in southern pine and hardwoods in Arkansas and mixed conifer/hardwood stands in central Maine. Suggested approaches have focused on stand level treatments, i.e., having a single prescription for an area of several acres or larger. This one-prescription fits all approach, unless the stand is uncharacteristically homogeneous for a poorly stocked stand, will result in inappropriate treatment for some of the stand and will likely be unacceptable to many landowners with less than one hundred acres.



High-grading results in poorly stocked forest stands with a mosaic of conditions such as this forest in Goshen.

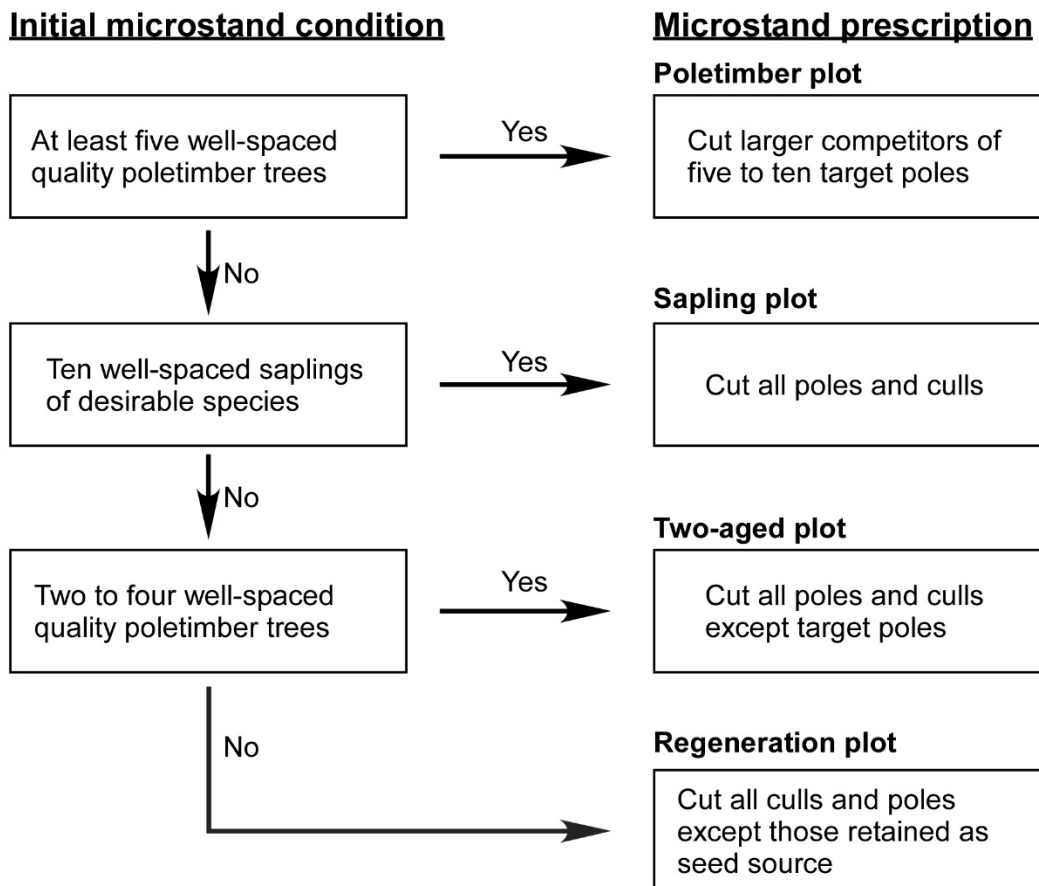
An alternative approach originally developed for northern hardwoods in Quebec is to recognize that poorly stocked forests are a conglomerate of stand types at the microstand scale (~0.1 ac) and to assign unique treatments to each microstand type. In 2012, Dr. Ward initiated research at five study areas in Connecticut to examine rehabilitation of poorly stocked stands. Rather than a single prescription for the entire stand, we used a prescription decision tree developed in consultation with CT DEEP foresters to assign treatments at the microstand scale to account for the irregular, spatially patchy structure typical of high-graded stands. The treatment prescriptions incorporated earlier research showing that crop tree release can greatly increase diameter growth and survival, together with timber stand improvement, for the several microstand types commonly found in poorly stocked stands: poletimber (5.0-10.9 inch diameters), two-aged, sapling (0.8-4.9 inch diameters), or regeneration. The goal was to determine whether this approach could be implemented on family forests, whose owners could accomplish much of the treatments by harvesting firewood and, in some cases, removing cull trees and release a limited number of saplings.

Study areas were established in collaboration with Town of Guilford, Rebekah's Hill Flora and Fauna Preservation Society (Goshen), Weantinoge Heritage Land Trust (New Milford), the White Memorial Foundation (Litchfield), and the Winchester Land Trust. Study areas had nine to twenty-eight 0.1 acre plots arranged in 3x3 contiguous blocks to form a square. After initial measurements were completed, each plot was evaluated and categorized as one of four microstand classes based on initial conditions: poletimber, two-aged, sapling, or regeneration. Poletimber plots had at least five well-spaced acceptable

growing stocking (AGS) poletimber trees– equivalent to a minimum of 50 trees per acre. Two-aged plots had two to four well-spaced AGS poletimber trees. Sapling plots had at least ten well-spaced saplings of desirable species (e.g., oak, white pine) with good form. The last microstand class, regeneration, did not have sufficient sapling or poles to create a fully-stocked future stand. Plots were then randomly designated as either control (no management) or treated (active management) with two treated plots for every control.

Unacceptable growing stock (UGS) basal area growth was 60% greater than for AGS on both poletimber and two-aged plots during the four years after initial treatment. In sharp contrast, basal area growth of AGS was more than double that of UGS on treated plots. In general, AGS basal area growth was constant for a given microstand class regardless of treatment, while UGS basal area growth was reduced following treatments that removed a large proportion of UGS stems. Plots that had some residual basal area showed a dramatic shift in allocation of basal area growth from predominately on UGS stems on untreated plots to predominately on AGS stems on treated plots. Crop tree release on treated plots increased 4-year diameter growth of sapling and pole crop trees, doubling growth of upland oaks.

**Impact:** Our research indicates that a microstand approach has potential to increase stand value and growth and is economically feasible where a commercial biomass market exists or for landowners cutting their own firewood. Family forest owners can bring their poorly stocked woodlots up to their full productive capacity. This project emphasized treatment options that could be implemented by non-professionals with minimal training to increase the likelihood of widespread adaption by landowners without a professional forestry background. A very modest gain of 5% productivity across the three million acres of poorly stocked oak forests would be equivalent to adding 150,000 acres of productive



forest and would have the additional benefit of increasing value added by concentrating growth of trees of higher quality species with superior stems.

Microstand prescription decision tree for poorly stocked hardwood stands in Connecticut

### **Old-Series study – 90 years of natural change**

(Dr. Jeffrey R. Ward assisted by Mr. Joseph P. Barsky)

Ultimately, forest stand dynamics is the aggregate of growth and demise of many individual trees. Understanding the relative importance and interaction of habitat, climate, disturbance, and neighborhood density on individual tree development requires a large, long-term data set of geo-referred trees. The Old-Series tracts provide a unique opportunity to understand the mechanisms of forest stand dynamics by analyzing the recruitment, growth, movement among canopy strata, and mortality of mapped trees that have been monitored over a ninety-year span.

During the summer of 2007 Dr. Ward with the assistance of a volunteer field crew completed the ninth inventory of these plots established in 1926-27. The location, species, diameter, and crown classes of all woody stems  $\geq 1.2$  cm dbh (diameter at 1.4 m) were recorded on 5.3 ha of strip transects. The data base of all nine inventories now includes 48,232 stems. Woody vegetation with diameters smaller than 1.2 cm are being inventoried using 1/1000 ha circular plots located at 128 foot intervals along the transects. The regeneration survey is the fifth since the initial inventory in 1977.



2017 field crew (Paul Bryant, Rebecca Harris, Sarah Sullivan, Jant Bryant)

Originally established to study the relationship between species and soil characteristics; these plots have chronicled slow, inexorable natural dynamics of Connecticut's second-growth forests. The four plots were established in stands typical of Connecticut's forests, i.e., stands which originated around the turn of the century, partly on land abandoned from agriculture and partly on land repeatedly cut for timber or fuelwood. The Old-Series long-term study plots are invaluable because they have allowed us to observe the gradual segregation of species along soil moisture gradients and to evaluate canopy stratification models. In addition, thirty years after the study was started, there was an unanticipated twenty-year period of repeated defoliations by a non-native insect - gypsy moth. Subsequent establishment of a viral and a

fungal pathogen stopped defoliation for thirty years. Because defoliation levels were mapped and differed among the tracts, we were able to develop species-specific quantitative models correlating metrics of individual tree vigor to mortality susceptibility. In addition, we compared how stand dynamics and recovery differed by defoliation intensity during the first decades after defoliation ceased. With several years of recent dry springs, gypsy again became a significant defoliator in 2017. We will now be able to compare the effects of defoliations in 60-80-year-old stands (earlier defoliations) with those in 120-year-old stands (current defoliations).

Prior to completing an analysis, we are adding data from the original 1926-1957 paper strip maps. The new information includes many shrub species not previously included in the database along with tree diameters in 1932 and whether or not stems were part of a sprout clump.



J.P. Barsky working with the original 1926, 1937, and 1957 paper strip maps

### **Deer Herbivory Exclosure Study**

(Drs. Scott C. Williams and Megan Linske assisted by Mr. Michael R. Short)

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. Williams and Linske are collecting vegetation data within deer exclosures and adjacent control plots in collaboration with the Metropolitan District Commission (MDC) and the Wildlife Division of the Connecticut Department of Energy and Environmental Protection (DEEP). Deer exclosures prevent deer from accessing vegetation within. Growth rates and species diversity of enclosed vegetation are compared with that of an adjacent control plot, where deer have access to vegetation. Plots have been sampled for woody and herbaceous plants for the past several years. 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 2018. Results from this study will reveal plant species composition and growth rates in the absence of browsing deer.





Staff from the Wildlife Division of CT DEEP and Drs. Williams and Linske erecting a deer enclosure in a recent clearcut, Barkhamsted, CT.

**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. CT DEEP and MDC are using these data to scientifically justify and document the results of their deer management program to limit overbrowsing of vegetation by white-tailed deer to insure forest regeneration to protect the drinking water supply of greater Hartford. 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.

### **New Crops Program**

(Dr. Abigail A. Maynard)

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 114 farmers' markets in 2017, attended by over 400 farmers compared to 87 markets in 2007, a 31% 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.

**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 2017, Dr. Abigail A. 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 (7.0 lbs/plant) compared to bare soil plots (4.0 lbs/plant). By growing sweet potatoes on black plastic instead of on bare soil, the grower can produce almost 44,000 more pounds/acre. At a retail price of \$0.99/lb, the grower can gross over \$43,000 per acre by utilizing black plastic. Hilled plots averaged 5.4 lbs/plant compared to 5.6 lbs/plant from flat soil plots. The long-term benefits of growing sweet potatoes include additional revenue for farmers and providing a product that has growing consumer demand. In addition, there may be health benefits for those who consume sweet potatoes. About 43% of vegetable growers in Connecticut grow sweet potatoes.

**Okra Trials:** Okra is grown for its long pointed seed pods, which are used in gumbos and soups. It is best picked when the pods are young and immature or about 2-4 inches long. It is considered a delicacy in the southern United States particularly when breaded with corn meal and deep fried. It is in the same family as cotton, hollyhocks, and hibiscus which make it a nice ornamental plant as well. Okra plants are extremely drought resistant which make a popular vegetable in countries with difficult growing conditions. It grows best in hot weather with warm soils so that yields are usually increased when grown with black plastic mulch in the Northeast. In 2017, 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, Zarah (49 pods/plant), Silver Queen (48 pods/plant), and Emerald Green (45 pods/plant) had the greatest yields. Yields from the black plastic amended plots averaged 87% greater when compared to plots with no plastic. Cultivar selection and cultural conditions

can dramatically increase yields and grower profits. By growing the cultivar Zarah (49 pods/plant) instead of the cultivar Red Burgundy (36 pods/plant), the grower can produce 13 more pods/plant or almost 126,000 more pods/acre. At a retail price of \$2.99/12 pods (6 oz), the grower can gross over \$31,000 more per acre by growing Zarah. In addition, by growing the crop on black plastic instead of bare soil, the grower can produce an average of 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 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 temperatures ranges of 45-75°F with the highest yields at 60-65°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 2017, 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:** Jade Cross E (3.6 lbs./plant) averaged the greatest yields followed by Dagan (3.0 lb/plant), Corbus (2.9 lb/plant), and Dimitri (2.9 lb/plant). Cultivar selection can dramatically increase yields and grower profits. By growing the cultivar Jade Cross E (3.6 lbs/plant) instead of the cultivar Lee (2.0 lb/plant), the grower can produce over 15,000 more pounds per acre of Brussels sprouts. At a retail price of 5.28/lb, the grower can gross almost \$82,000 more per acre by growing Jade Cross E. 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.

**Butternut Squash Trials:** Winter squash varieties such as butternut, buttercup, acorn, and Hubbard have long been favorite fall crops for vegetable growers who operate roadside stands and attend farmers' markets. An Experiment Station survey of vegetable growers found that 93% grow winter squash with butternut squash the most popular. Consumers often purchase by the bushel because they store well and can be eaten well into the winter months. Most squash varieties are long-vined and discourage home growers with limited space. New cultivars have been developed that produce fruit on shorter vines, allowing closer spacing. In 2017, Dr. Maynard evaluated the yield and quality of 5 semi bush butternut squash varieties and 5 traditional long vined varieties at Lockwood Farm and Windsor.

**Impact:** Ultra (long-vined) averaged the greatest yields (21.6 lb/plant) followed by Atlas (semi bush) (15.2 lb/plant). Cultivar selection can dramatically increase yields and grower profits. By growing the cultivar Ultra (21.6 lb/plant) instead of another long-vined cultivar Quantum (11.4 lb/plant), the grower can produce almost 99,000 more pounds per acre of butternut squash. At a retail price of \$0.59/pound, the grower can gross over \$58,000 more per acre by growing Ultra. For semi bush varieties, by growing Atlas (15.2 lb/plant) instead of Butternut 1744 (6.8 lb/plant), the grower can produce over 81,000 more pounds per acre of butternut squash. At a retail price of \$0.59/pound, the grower can gross almost \$48,000 more per acre by growing Atlas. The long-term benefits of growing butternut squash include providing a product that has growing consumer demand and additional revenue for growers who attend farmers'

markets or have their own roadside stands. Butternut squash is an especially important product for growers in the fall after a frost when other vegetables are not available.

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

**Impact:** Thus far, the cultivars Rebecca's Gold and Overleese have averaged the greatest yields (67 and 48 fruit/tree, respectively) with Sunflower producing the largest fruit (7.6 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 unique product and revenue for growers.

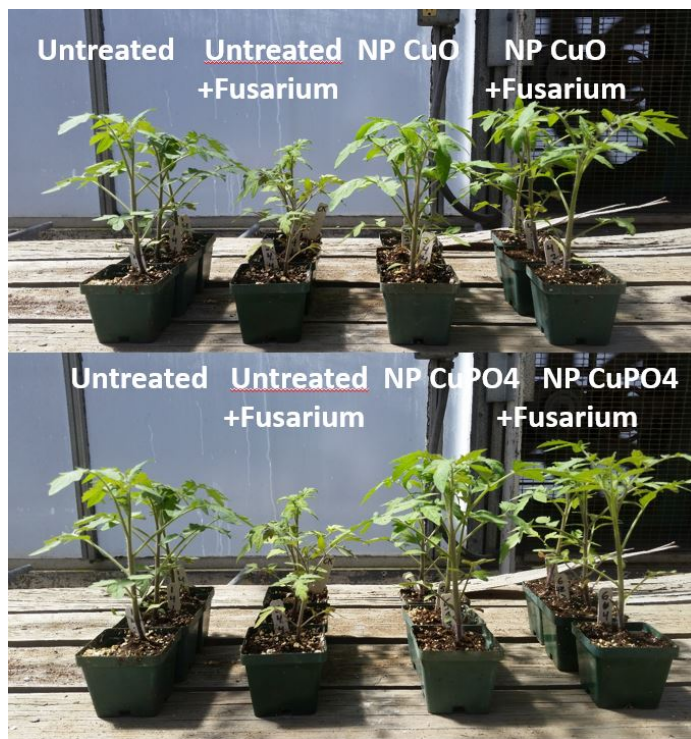
### Sheet Composting of Oak and Maple Leaves

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 1994-2016 and incorporated into the soil by rototilling. In 2017, the greatest cabbage yields were from plots amended with oak leaves (3.3 lb/plant) followed by plots amended with maple leaves (3.2 lb/plant) and the unamended control plots (3.0 lb/plant). For peppers, the greatest yields were from plots amended with maple leaves (4.7 lb/plant) compared to 4.6 lb/plant from the unamended control plots and 4.3 lb/plant from plots amended with oak leaves. For onions, plots amended with maple leaves averaged the greatest yields (7.4 lb/10 ft row) followed by plots amended with oak leaves (7.2 lb/10 ft row) and the unamended control plots (6.6 lb/10 ft row). Average yields of 12 different vegetable crops over 23 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.

### Using Nanoparticles to Enhance Plant Health



**Figure 1.** Tomato plants exposed to NP of CuO (Upper) or CuPO<sub>4</sub> (Lower) and inoculated with the Fusarium wilt fungus or left untreated.

Nanoparticles (NP) of metalloid and metallic oxides (< 100 nm) have great potential in agriculture as a means to deliver essential micronutrients like B, Cu, Mn, and Zn along with beneficial elements like Si. These elements important roles in activating enzyme systems important in host defense and form dismutase enzymes that detoxify free radicals. Since 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. Drs. Elmer has conducted greenhouse and field trials on many vegetable and ornamental plants. While NP performance varied across all studies, we observed that NP of CuO and CuPO<sub>4</sub> enhance plant health and suppressed disease more consistently than other NP.

Transcriptomics of tomato roots treated with NP of Cu have revealed a gradual uploading of host defense genes (Figure 1). Field experiments were conducted in the 2016-2018 field season where the individual and combined effects of NP of

CuO, MnO, and ZnO were examined for their on yield of eggplant in soil infested with *Verticillium dahliae*. We discovered that NP of CuO and MnO alone along with all the combination of all three improved yield and growth performance.

**Impact:** These studies reveal that application of NPs of micronutrients offer an improve delivery system for these crucial element to susceptible tissues. Nanoparticles may be the new weapon in plant disease management.

### Winegrapes in Connecticut

In cooperative involvement with the “NE-1720, Multi-state evaluation of winegrape cultivars 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. This year three more cold-hardy hybrid cultivars (Itasca, Aromella, and Briana) have been planted at the three CAES research farms. The performance of the 15 cultivars at these three locations will provide information on the effect of climate variation on growth, yield, and disease susceptibility.





**Figure 2.** 3D-sonic anemometers measure wind data in a Pinot Gris vineyard at Lockwood Farm.

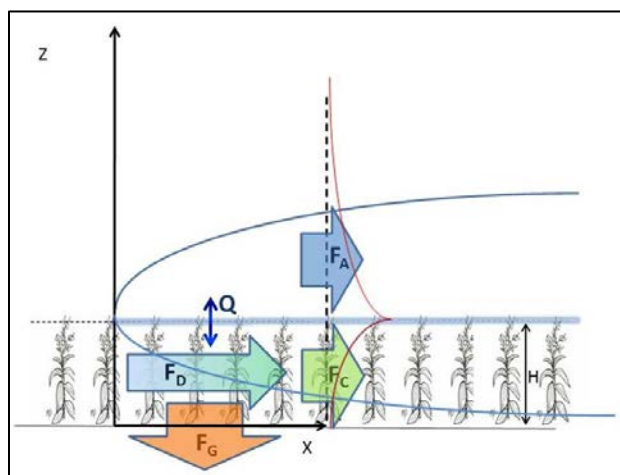
Dr. Ferrandino is continuing his work on 3D Lagrangian Stochastic Simulation for turbulent flows in hedgerow canopies in collaboration with Dr. D. E. Aylor. These simulations are programmed in Microsoft Visual Studio. The verification of such models requires direct measurement of turbulent wind statistics.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

Since 2009, Dr. Ferrandino has maintained three remote sensing weather stations located on the CAES research farms (Hamden, CT; Windsor, CT; Griswold, CT). Weather data from the three CAES experimental 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. On-site weather station data are used to calculate disease risk assessments, which are delivered to the winegrowers on a weekly basis.

**Impact:** The planting of a vineyard requires a large investment (\$4,500/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. Improved models of spore dispersal enable better predictions of the spread of disease. 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.

### Analytical Epidemiology

Dr. Ferrandino is examining model solutions to the advective-diffusion equation which describe the



dispersal of airborne particles near the edge of a field. Most previous work has concentrated on steady state dispersal over a very large area. However, the importance of transient solutions at the edge of a field or between two different fields is not well studied. This involves a detailed description of the relative flux of particles to the ground, foliage and downwind targets. When used to describe pollen dispersal, this is important in the quantification of outcrossing, particularly in the generation of GMO (Genetically Modified Organism) seed stock. When applied to aerosol droplets of pesticide or herbicide the model will predict the expected spray drift dose.

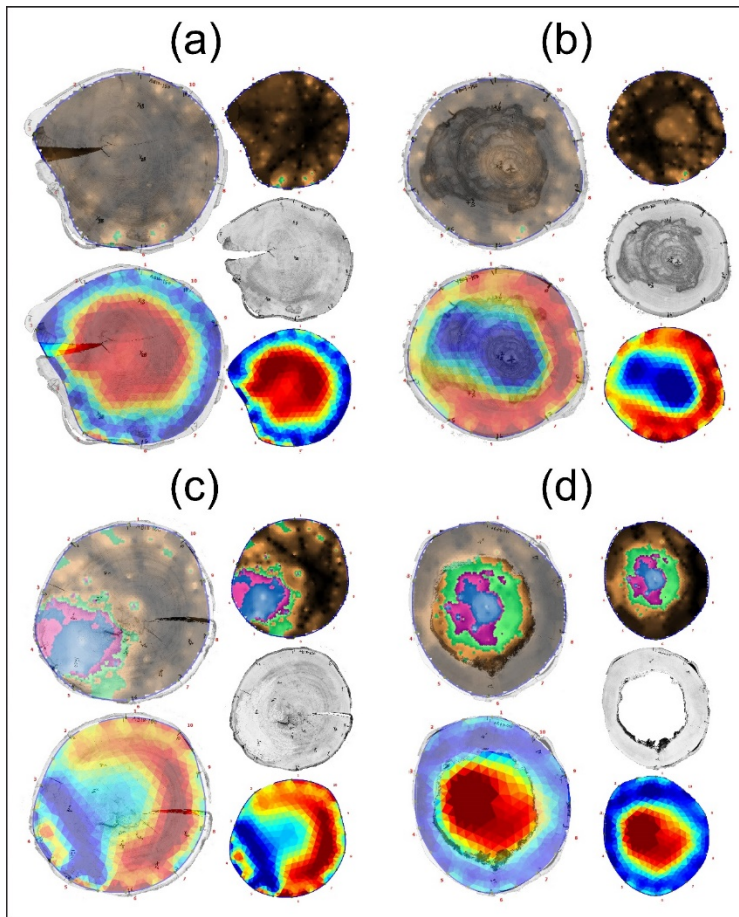
**Figure 3.** An illustrated model showing advective-diffusion that occurs near the edge of a field.

**Impact:**

To maintain seed purity in plant breeding programs, or in seed production fields, or in commercial grain production fields it is important to limit as much as possible cross fertilization between plots or fields of maize (or other grasses) of different types (cultivars). Thus, border strips of isolating foliage are used to genetically isolate different fields. The necessary width of these strips depends on a thorough knowledge of the transport processes between fields.

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

Dr. Marra’s National Science Foundation funded project resulted in the development and validation of a novel and unprecedented methodology, using sonic and electrical-resistance tomography (SoT and ERT), for nondestructive quantification of sequestered structural carbon (C) present in living trees. Most importantly, the methodology derives its accuracy by using tomography to account for the role of internal decay in releasing C back to the atmosphere. An additional benefit of the project was the validation of the accuracy with which SoT and ERT permit qualitative assessment of the internal condition of trees, as shown in the Decision Rules Table (Table 1) and Figure 4, which will be of benefit to the tree-care industry. A manuscript describing this work has been submitted by invitation for publication in the Environmental Research Letters’ “Special Focus” issue, “Focus on Carbon Monitoring Systems Research and Applications.”



**Figure 4:** Stem-disk SoT and ERT tomograms and photographs corresponding to each of four decay categories, according to Table 1. (a) Category A: No Decay; (b) Category B: Incipient Decay; (c) Category C: Active Decay; (d) Category D: Cavity. The five images within each set are, clockwise from top right: SoT tomogram—stem-disk photograph—ERT tomogram—ERT tomogram with photograph overlay—SoT tomogram with photograph overlay.

**Table 1: Decision Rules for predicting internal condition based on tomographic data**

Decay Category	SoT		ERT		Predicted Internal Condition
	color	density	color	moisture	
A	brown	maximum	red	none	No decay
B	brown	maximum	non-red	present	Incipient decay
C	non-brown	reduced	non-red	present	Active decay
D	non-brown	reduced	red	none	Cavity

**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.

While this project is still underway, to date Drs. Marra and Brazee have performed tomographic scans on 201 elms in Connecticut, Massachusetts, New York City (Governors Island), and the National Mall of Washington, D.C. Of these, 96 trees have been receiving fungicide injections, and 115 have not. The elms



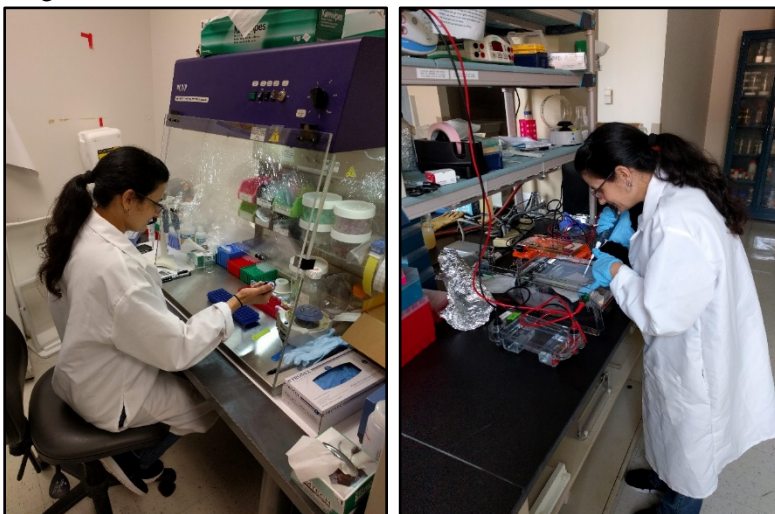
of the National Mall are of particular significance to this study because fungicide injections have not been used; the National Park Service has instead opted for scouting, pruning, and, in cases of severe infection, replacement. Preliminary results show only a small difference in the incidence of decay 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.

### ***Genetic Variation and Dispersal Dynamics in *Fusarium palustre*, associated with Sudden Vegetation Dieback in salt marshes of eastern United States***

With assistance from a M.S. student at Southern Connecticut State University, Alysha Auslender, Dr. Marra continues to pursue his research on *Fusarium palustre*, a fungal pathogen of *Spartina alterniflora* that was described by Drs. Marra and Elmer. Because of the unique nature of *F. palustre* distribution (i.e., in isolated patches in discontinuous salt marshes), Dr. Marra is interested in testing hypotheses about the introduction and spread of the pathogen, and relatedness among populations. A key component of wetland dieback syndrome, *F. palustre* has been shown by Dr. Marra to have a surprisingly high degree of genetic diversity both within and among populations sampled from various marshes ranging from Louisiana to Maine. In addition to constructing molecular phylogenies using DNA sequences from three genes, Dr. Marra has used Amplified Fragment Length Polymorphisms (AFLP) in a preliminary study to show a significant amount of genetic variability among a group of approximately 100 *F. palustre* isolates North America as well as several from China.

The genetic diversity in *F. palustre* demonstrated via AFLP analysis warranted the development of a more robust set of genetic markers for purposes of studying the epidemiology of this fungus. To that end, Dr. Marra and Ms. Auslender have generated a whole-genome sequence for the fungus's type specimen, CaesSaCT2, through the facilities at the Yale Center for Genome Analysis. The genome is currently being used to screen for candidate microsatellite loci. Primers designed around these loci are being tested for length polymorphisms against a screening population of 32 isolates representing the currently known distribution of the fungus.



**Figure 5:** Ms. Alysha Auslender, Master’s student from Southern Connecticut State University, testing *Fusarium palustre* isolates for microsatellite locus polymorphisms.

**Impact:** The appearance of SVD in multiple marshes over large areas makes it of considerable ecological and societal importance. Our findings will provide insight into the critical factors associated with the distribution of *F. palustre* in SVD sites and lay an understanding for how genetic exchange may operate in this fungus.

### **Neonectria Canker caused by *Neonectria ditissima***

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 principle 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). All observations of selfing were confirmed through the use of AFLPs.

With the assistance during June and July of 2018 of a USDA Plant Health Fellow, Dr. Marra is in the process of analyzing the genetic relatedness of *N. ditissima* isolates sampled from cankers vertically distributed on each of four black birch trees (Figure 6), which were felled in June 2018. To date, 12 isolates have been successfully isolated and taken to pure culture from these cankers. Once pure cultures for all 28 cankers have been obtained, they will be genotyped using Dr. Marra’s microsatellite markers. These microsatellite data will then be used to test the hypothesis that genotypes from the same tree are more closely related than those among trees.

**Figure 6:** Black birch (*Betula lenta*), with multiple *Neonectria ditissima* cankers distributed along stem. Because cankers typically only form on stems younger than ~15 years of age, lower cankers were likely initiated many years before those higher up the stem.



**Figure 7:** The USDA Plant Health Fellow, Melvin Mercado-Ayala, an undergraduate student from the University of Puerto Rico, received training in nearly all aspects of forest pathology and fungal genetics, from field sampling, to isolating pure cultures of *N. ditissima* from field samples, to DNA extractions and PCR-amplifying microsatellite loci.

**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.

### **Can nanoparticles be effective for treatment of vascular wilt diseases of trees?**

Great promise has been shown in the use of nanoparticles for delivery of metallic oxides and other compounds to crop plants to enhance growth and protect against disease. However, this technology has yet to be used in the treatment of tree diseases. The current treatment for Dutch Elm Disease (DED), a deadly vascular wilt caused by the fungus, *Ophiostoma novo-ulmi*, involves the prophylactic injection of fungicide (usually tebuconazole) into trees every 1-3 years. Although *O. novo-ulmi* is highly sensitive to copper, phytotoxicity issues have precluded its use in conventional treatments such as sprays. However, phytotoxicity has not been an issue when copper has been delivered via nanoparticle formulations for treatment in other pathosystems. Dr. Marra has planted an orchard of 50 American elms (*Ulmus americana*) and 50 sugar maples (*Acer saccharum*) at the CAES Lockwood Farm in Hamden, CT, which will be used in experiments testing the efficacy of prophylactic injections of copper and other metal-oxide

nanoparticle formulations for both DED and sapstreak of sugar maples caused by the vascular wilt fungus, *Ceratocystis virescens*.



**Figure 8:** Fifty sugar maples (*Acer saccharum*) and fifty elms (*Ulmus americana*) interplanted in checkerboard arrangement in November 2017 at Lockwood Farm in Hamden, CT. The trees, started from wild-collected seed, are enclosed within “tree tubes,” which protect from harsh winter weather as well as from deer, and bark-chewing rabbits and rodents.

**Impact:** Both Sapstreak and Dutch Elm disease cost millions every year. Once trees are infected, there is little effective management strategy. Nanoparticles may offer a new method for distributing antimicrobials through the vasculature of the tree.

#### ***Erwinia amylovora* and nucleobase transport**

Dr. Schultes is studying *Erwinia amylovora*, the causal agent of a devastating disease of apples and pears called fire blight. Fire blight causes large losses in apple and pear production and is a major disease for commercial farmers. 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. Dr. Schultes objectives are: 1) to determine 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. We have also generated specific gene deletion-insertion mutations in the *E. amylovora* genes encoding for the guanine-hypoxanthine, adenine and uracil transporters. These mutant *E. amylovora* lines were compared with wild type *E. amylovora* line Ea1189 in immature pear pathogenicity tests and determined that there is no difference in disease establishment of pathogenicity.

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

#### **Investigating the role of the *Xanthomonas* effector AvrRxol1 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 plant cells during infection to suppress immunity, and that this likely works by changing the oxidative environment inside the cell rather than through toxicity. In the past year, in collaboration with Dr. Christina Robb, Dr. Triplett began studies toward the long-term goal of determining how the toxin is recognized by certain plant resistance genes.

**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 how this new type of bacterial toxin is recognized 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, along with Dr. Teja Shidore, have continued identifying the roles of numerous different toxin-antitoxin systems in bacterial plant disease. Genomic analysis was continued, which has helped us understand the potential roles of these mysterious genes in different pathogen strategies. This year Dr. Shidore characterized the role of six TA systems in the fire blight pathogen *Erwinia amylovora*, a significant disease in Connecticut orchards, and showed that one system was required for persistence of *E. amylovora* to the antibiotic spray streptomycin. All six systems suppressed the virulence capabilities of *E. amylovora* in some way, suggesting novel roles for these systems in regulation of virulence.

**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 improved survival.

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

In the past two years Dr. Lindsay Triplett along with collaborators at Yale, Colorado State, and Cornell University discovered and mapped the genetic location of a new type of broad-spectrum resistance gene in rice. Candidate genes were identified and candidate interactors were found. This year, we performed genome sequencing of the rice variety with the trait and assessment of other varieties, revealing possible features that are essential for resistance. We also discovered that a tomato resistance gene can recognize the same pathogen trigger as the rice gene, and have identified new minimal requirements in this molecular pattern. We are working on confirming the gene’s identity and determining how it detects the target protein from pathogens.

**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.

### **Nanoparticle effects on Chrysanthemum Wilt: An approach to incorporate undergraduate training into original field research**

Dr. Lindsay Triplett and collaborators at Southern Connecticut State University completed the first year of a USDA-funded project to train the next generation of the agricultural workforce through undergraduate research experiences. As part of this project, ten undergraduate students participated in a group research project aimed at determining the effect of nanoparticle treatments on a fungal wilt disease of Chrysanthemums. Students participated in plot design, planting, disease inoculation, taking three types of plant health measurement, and analyzing data. The first year yielded publishable data indicating that nanoparticle treatments significantly affected Chrysanthemum growth and disease development. The project was prepared along with Dr. Wade Elmer and maintained by Mr. Peter Thiel and farm Staff.



**Figure 9** USDA funded interns preparing soil for chrysanthemum – nanoparticle research at the Lockwood farm.

**Impact:** Chrysanthemum wilt is a significant problem of Chrysanthemum, which represents a \$124 million market in the United States. The disease can be lethal and is currently only treated with fungicide drenches. Nanoparticles may represent a better alternative for control of root diseases. Second,

although field research skills are strongly needed on the job market, there are currently extremely few opportunities nationwide for meaningful undergraduate training in agricultural field research. This project will expose 30 undergraduate students to participation in a complete field project, and will generate pedagogical resources used to increase opportunities for future students.

### **Fire Blight Pathogen *Erwinia amylovora* Transmission in North America and Europe**

*Erwinia amylovora* is the causal agent of fire blight, one of the most devastating diseases of apple and pear. *Erwinia amylovora* is thought to have originated in North America and has now spread to at least 50 countries worldwide. An understanding of the diversity of the pathogen population and the transmission to different geographical regions is important for the future mitigation of this disease. In this research, Dr. Zeng performed an expanded comparative genomic study of the Spiraeoideae-infecting (SI) *E. amylovora* population in North America and Europe. We discovered that, although still highly homogeneous, the genetic diversity of 30 *E. amylovora* genomes examined was about 30 times higher than previously determined. These isolates belong to four distinct clades, three of which display geographical clustering and one of which contains strains from various geographical locations ('Widely Prevalent' clade). Furthermore, we revealed that strains from the Widely Prevalent clade displayed a higher level of recombination with strains from a clade strictly from the eastern USA, which suggests that the Widely Prevalent clade probably originated from the eastern USA before it spread to other locations. Finally, we detected variations in virulence in the SI *E. amylovora* strains on immature pear, and identified the genetic basis of one of the low-virulence strains as being caused by a single nucleotide polymorphism in *hfq*, a gene encoding an important virulence regulator.

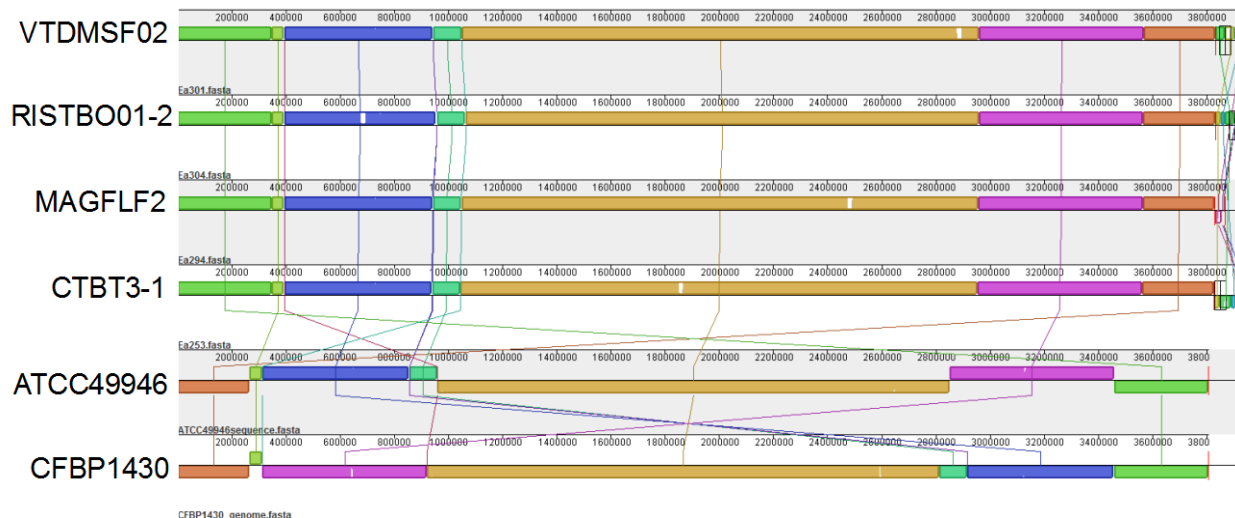


Figure 10. Genome comparison of *Erwinia amylovora* isolates from North America (top five genomes) and Europe (bottom genome).

**Impact:** Our results provide insights into the population structure, distribution and evolution of SI *E. amylovora* in North America and Europe. It provides indication that transporting plant materials may facilitate the transmission of plant diseases.

### Using a Genome-Based PCR Primer Prediction Pipeline to Develop Molecular Diagnostics for the Turfgrass Pathogen *Acidovorax avenae*

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, employed a novel alignment-free primer prediction pipeline to design diagnostic primers for turfgrass pathogenic *A. avenae* using 15 draft genomes of closely related target and non-target *Acidovorax* as input. Twenty candidate primer sets specific to turfgrass pathogenic *A. avenae* were designed. The specificity and sensitivity of these primer sets were validated via a traditional PCR and a real-time PCR assay. Primer sets 0017 and 0019 coupled with an internal oligo probe showed optimal sensitivity and specificity when evaluated with the target pathogen, closely related bacterial species and microorganisms that inhabit the same host and soil environment. Finally, the accuracy of the newly developed real-time PCR assay was evaluated to detect BED pathogens from BED symptomatic and asymptomatic turfgrass samples. The diagnostic results produced by the real-time PCR assay were consistent with results of a cultural-based method. This assay will allow quicker and more effective detection of the BED pathogen thus potentially reducing misdiagnoses and unnecessary usage of fungicides.

**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. The diagnostic assay developed can provide rapid and accurate response regarding this disease on golf courses.

### The Influence of Flower Anatomy and Apple Cultivar on the Apple Flower Phytobiome.

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, stigmas, stamens, receptacles, and petals were dissected from flowers, and the microbiome of each structure was characterized. Each flower part harbored a largely overlapping set of bacterial taxa, predominantly within the groups *Pseudomonas* and *Enterobacteriaceae*. However, the structure of the communities differed. The stigmas showed a high dominance of a small number of operational taxonomic units (OTUs; 97% sequence identity) whereas OTUs on petals were more even in relative abundance. Results from the OTU analysis of phytobiomes from stigmas from three apple cultivars, Braeburn, MacIntosh, and Sunrise, indicated cultivar did not significantly influence community structure. Correlation analysis of bacterial taxa in the apple phytobiome found a negative correlation between *Pseudomonas* and *Enterobacteriaceae*, suggesting a potential niche exclusion relationship between these taxa. In this respect, the phytobiome of the apple flower is relatively simple but different flower parts, particularly the stigma, enrich the relative abundance of specific bacterial populations. Correlations in the community structure point to potential antagonistic relationships, which could be used to manipulate the structure of the microbiome for biocontrol of pathogens or other orchard management strategies.

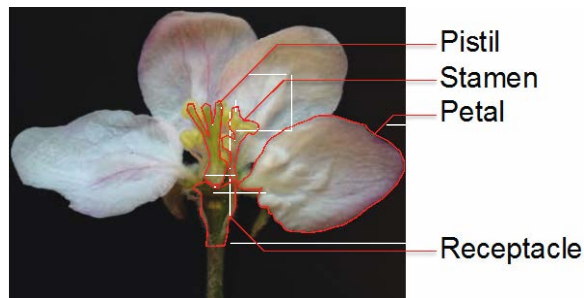


Figure 11. Anatomy of apple flower investigated in the microbiome study.

**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 single 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. *Dickeya dadantii* is a bacterial plant pathogen that causes soft rot disease on a wide range of host plants. The type III secretion system (T3SS) is an important virulence factor in *D. dadantii*. Expression of the T3SS is induced in the plant apoplast or in *hrp*-inducing minimal medium (*hrp*-MM), and is repressed in nutrient-

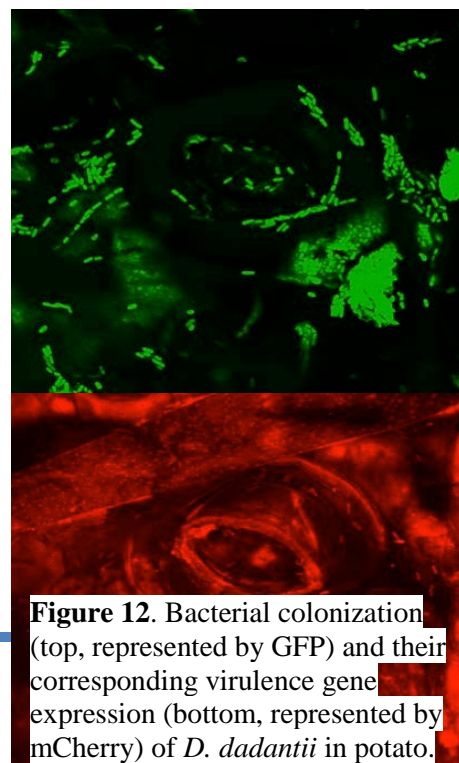


Figure 12. Bacterial colonization (top, represented by GFP) and their corresponding virulence gene expression (bottom, represented by mCherry) of *D. dadantii* in potato.



rich media. Despite the understanding of induction conditions, how individual cells in a clonal bacterial population respond to these conditions and modulate T3SS expression is not well understood. In our previous study, we reported that in a clonal population, only a small proportion of bacteria highly expressed T3SS genes while the majority of the population did not express T3SS genes under hrp-MM condition. In this study, we developed a method that enabled *in situ* observation and quantification of gene expression in single bacterial cells *in planta*. Using this technique, we observed that the expression of the T3SS genes *hrpA* and *hrpN* is restricted to a small proportion of *D. dadantii* cells during the infection of potato. We also report that the expression of T3SS genes is higher at early stages of infection compared to later stages. This expression modulation is achieved through adjusting the ratio of T3SS<sup>ON</sup> and T3SS<sup>OFF</sup> cells and the expression intensity of T3SS<sup>ON</sup> cells. Our findings not only shed light into how bacteria use a bi-stable gene expression manner to modulate an important virulence factor, but also provide a useful tool to study gene expression in individual bacterial cells *in planta*.

**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 diagnosed a wide range of fungal, bacterial, viral, nematode, and abiotic diseases on trees, shrubs, flowers, lawn grasses, fruits, and vegetables during the year 2017-2018. The drought stress during the growing season past several years and dramatic fluctuating of winter temperatures resulted in severe winter injury and diebacks of woody ornamentals in 2018. Cool and wet spring weather conditions favored for many fungal and bacterial diseases on trees, shrubs, herbaceous ornamentals, fruits, and vegetables in the year 2017-2018.

### **Ornamentals:**

Root rot diseases were major problems on annual and perennial flowers in greenhouse and nursery production and landscapes, such as Pythium root rot on impatiens, calibrachoa, poinsettia, chrysanthemum, and geranium; Thielaviopsis root rot on calibrachoa and verbena. Volutella blight of pachysandra remained a major problem in ground cover ornamentals because of drought stress during the summer and wet spring weather. Powdery mildew and Botrytis blight were problematic on peony. Botrytis blight was also found on rosemary. Alternaria leaf spot was found on zinnia.

Significant diebacks and browning of needles on Eastern red cedar were noticed statewide, which might be attributed by drought stress and mild/extreme cold winter temperatures in past few years. In several Christmas tree farms, severe wilting and diebacks of new growth were observed, but the causing agents this phenomenon haven't been confirmed. 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. Fabrella needle cast of hemlock was found in a landscape. Boxwood blight was continuously problematic in both landscapes and nurseries. Thirty-five boxwood blight incidences were confirmed in landscapes between August and October in 2017. Boxwood blight was also confirmed in a commercial nursery in the spring of 2018. Winter injury, Volutella canker and Macrophoma leaf spot were major contributors of severe diebacks of boxwood in landscapes. Gymnosporangium rust diseases were prevalent on apple, pear, quince, serviceberry, hawthorn, and cedar.

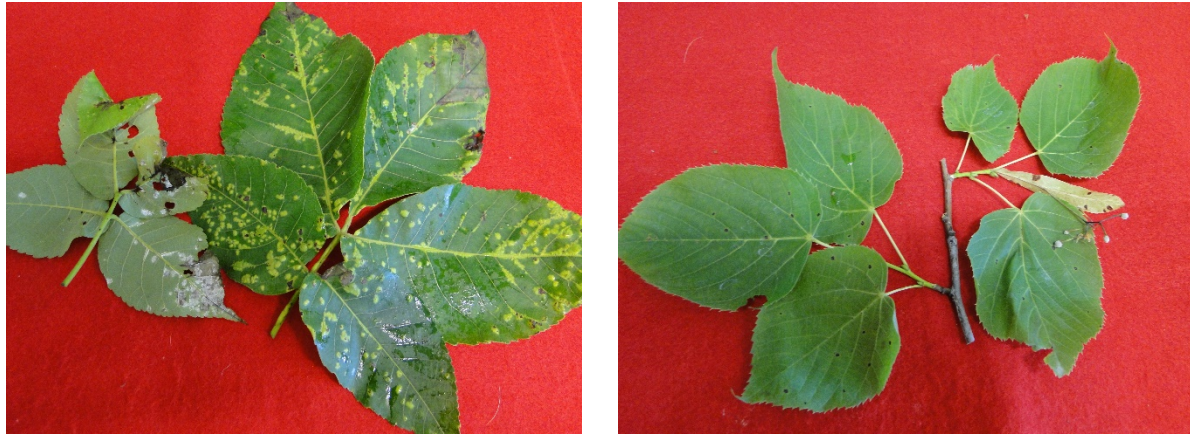
Many fungal canker diseases were found on woody ornamentals, such as *Phomopsis* canker on Japanese maple, holly, and yew; *Botryosphaeria* canker on hornbeam, Leyland cypress, cherry, and willow; *Sieridium* canker on Leyland cypress. *Botryosphaeria* canker was also identified on arcuba. Uncommon foliar diseases were identified this year, which includes *Phyllosticta* leaf spot of azalea, downy spot of hickory, and *Cercospora* leaf spot of linden tree.



**Figure 13.** Browning of eastern red cedar needles (left) and Fabrella needle cast of hemlock (right).



**Figure 14.** *Botryosphaeria* canker of arcuba (Left); *Phyllosticta* leaf spot of azalea (Right).



**Figure 15.** Downy spot of hickory (Left); Cercospora leaf spot of linden tree (Right).

Vegetables:

Septoria leaf spot remained the most common disease problem of tomato. Stemphylium gray leaf spot was found in field- and greenhouse-grown tomato plants. Early blight, Verticillium/and Fusarium wilt, leaf mold, catface, and blossom-end rot were common diseases in garden- and field-grown tomatoes. Bacterial pith necrosis and Botrytis ghost spot were found in several commercial production tomato fields and greenhouses, respectively. On peppers, bacterial leaf spot and Phytophthora blight were problematic. Powdery mildew, anthracnose, and downy mildew were major disease problems on cucurbit crops. Verticillium wilt and Phomopsis blight were found on eggplant. Basil downy mildew was found in late summer. White rot and anthracnose were two major diseases on garlic. Pythium root rot was an emerging disease of hydroponic-grown lettuce.



**Figure 16.** Marssonina leaf spot of apple (Left); Black rot of grape (Right).

Fruit:

Cedar-apple rust, scab, frog-eye leaf spot, and black rot were prevalent on apple trees. Marssonina leaf spot of apple was found in an orchard 2017. On pear trees, rust and Fabraea leaf spot were found. Leaf curl and brown rot continued to be major diseases on peach. Brown rot and winter injury caused significant tip diebacks on cherry and plum trees. Rust was frequently detected on fig trees. Severe epidemics of black rot resulted in significant yield losses of grapes in home gardens and commercial fields. Powdery mildew, downy mildew, and anthracnose remained common problems on grapevines. Botrytis blight, Phomopsis canker, Botryosphaeria canker, and mummy berry were major diseases on blueberry. Botrytis blight was also found on raspberry.

### Turf:

Widespread of dollar spot of lawn grass was reported, which might be contributed by wet and humid weather conditions in the summer of 2018. 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.



**Figure 17.** Alternaria leaf spot of zinnia (Left); Dollar spot of lawn grass (Right)

### Weeds:

Poison ivy and oriental bittersweet remained significant problems 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. Other common weeds were Asiatic dayflower, Japanese knotweed, Virginia creeper, horsetail, garlic mustard, mugwort, nightshade, pigweed, spurge, stilt grass, and sumac.

**Impact:** Information of disease survey 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 grass seeds are collected by inspectors from the Bureau of Regulation and Inspection of the Connecticut Department of Agriculture and submitted to The Connecticut Agricultural Experiment Station, an official seed testing laboratory for Connecticut, for seed purity and germination tests. In 2018, a total of 321 seed samples including 210 vegetable, 15 lawn grass, and 6 crop seed samples were submitted to Dr. Li for testing. Germination and purity analyses have been

performed by complying with Connecticut Seed Law Regulations and the Federal Seed Act and by following strict protocols designated by the Association of Official Seed Analysts. As of the date of this report, tests for 210 of the 321 vegetable samples, 12 of 15 grass samples, and all 6 crop samples were completed. The final result will be analyzed and the report will be submitted to the CT Department of Agriculture and published in the Station website.

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

### **Samples for Analytical Chemistry and the Connecticut Department of Consumer Protection**

During the year, Dr. Li examined 24 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 answered 4,093 inquiries about plant and plant health from Connecticut citizens. The majority of inquiries were on ornamentals, trees, and shrubs (69%), Inquiries about food crops (13%) and turf grasses (4%), were also well represented. A moderate percentage of inquiries fell into the miscellaneous category (14%), which included identification of various plants and weeds, mushroom identification for health officials, and information about pesticides and their relationships to health and environmental concerns. The majority of inquiries were from Connecticut homeowners (56%). The inquiries from commercial growers and plant care professionals (38%) were increased 4% this year. Six percent of inquiries were from cooperative extension, health, news, municipals, garden clubs, and other organizations. A further breakdown of inquiries showed that 27% of the questions came in by phone, 18% came in by mail, 16% came as email, and 39% were brought in person. A total of 1,954 physical samples were examined by Dr. Li and the other 2,139 inquiries were handled through phone calls, emails, and visitor's inquiries without samples. Dr. Li responded 1,575 inquiries via letters and email messages with attached files of fact sheets, which was 54% higher than that in last year.

## 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 municipalities, state agencies, and students.

### Activities on the Farm

There were a total of 50 experimental plots at the Windsor research farm during the past year. Four Windsor-based scientists had 38 of these plots; five New Haven-based scientists were using 12 plots. Additional plots were maintained by the Farm Manager as rotation crops or for seed collection. Valley Laboratory scientists also conducted experiments in many plots off site, such as in growers' fields, the Lockwood and Griswold farms and in State forests. Valley Laboratory Farm Manager James Preste kept the farm and equipment ready and in excellent shape. He expertly maintained the many field plots and addressed the specific needs of each scientist. He and his summer research assistants did an outstanding job maintaining the extensive ornamental garden in cooperation with the Connecticut Nursery and Landscape Association. Mr. Preste and Dr. LaMondia coordinated the Valley Laboratory effort to comply with EPA Worker Protection Standards for Agricultural Pesticides and organized and conducted safety and pesticide training sessions for the staff.

## RESEARCH ACTIVITIES

### Hemlock Woolly Adelgid Research

Biological control using imported predators of *Adelges tsugae*, the hemlock woolly adelgid (HWA) is a major long-term national strategy for reducing the impact and spread of this damaging and invasive insect which threatens the entire range of eastern and Carolina hemlocks. *Sasajiscymnus tsugae* (Coleoptera:Coccinellidae), originating from Honshu, Japan, discovered and studied at the CAES, is one of the first biological control agents released for HWA management in the US and the only major species released in Connecticut. From 1995-2007 >176,000 *S. tsugae* were mass reared and released in 26 state forest and parks, municipal, water company and private forest sites throughout Connecticut. Encouraging results of hemlock recovery from HWA damage in Connecticut were recorded from 2005-2009 in >75% of sites with *S. tsugae* releases. The overall goals of this project are to integrate established and new approaches, into (1) an overall current assessment of the health of forest hemlocks in Connecticut, 30 years after the arrival of HWA, and (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 ability for 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.

Assessments of the field efficacy of *S. tsugae* as a biological control agent documented many advantageous attributes for a second year in 2017. *S. tsugae* males and females are effective HWA predators under variable ambient environmental conditions, feeding on HWA from late spring through fall. Following continuous HWA predation in summer 2016, one of the hottest summers on record, female and male *S. tsugae* again fed weekly on HWA stages continuously from late June to October 2017

during field experiments conducted at the Valley Laboratory, Windsor. July and August 2017 were on average 5°F cooler than in 2016, which prolonged the duration of the HWA summer progrediens generation. Correspondingly, females had a longer oviposition season in synchrony with the developing progrediens generation. Adult females and males both fed on an average of 62-98 progrediens nymphs and adults over a 3-week period while larvae also feed on the same, further increasing predatory impact on the second HWA progrediens generation. Adults also uniquely feed continuously through the hot summer but do not oviposit on dormant HWA N1 settlers of the subsequent sistens generation. During the cooler summer of 2017, *S. tsugae* females and males consumed >1000 – 1100 HWA sistens N1 each from July to late October, rates which were comparable to that in 2016. During a warmer than normal (by 6°F) October in 2017, several females oviposited on developing sistens nymphs, although the eggs did not survive a sudden deep freeze in mid-November when overnight temperatures reached 19 °F at Windsor. Adult *S. tsugae* survived the cold snap well. However, if fall temperatures continue to trend warmer without abrupt freezes, *S. tsugae* may be able to complete another generation in milder areas. These field experiments document that *S. tsugae* is able to survive the variable, increasingly hot and humid summers and fall, adapting to the changing climate in Connecticut. Furthermore, *S. tsugae* is commercially reared and available to the public for biological control and should be released to control HWA in spring especially after mild winters. In some protected areas near the coast, *S. tsugae* could also be released strategically in low numbers to target HWA survivors after extreme winters which can significantly kill off large numbers of HWA.

**Impact:** *S. tsugae* is a commercially available biological control that can survive Connecticut climate conditions and aid in hemlock wooly adelgid control.

### **HWA Winter Mortality in 2018**

The winter of 2017-2018 started with one of the coldest 2 weeks in late December into early January with devastating wind chills of -10 to -30°F in the first week of January 2018. Winter sampling and counts of HWA mortality from 16 sites throughout Connecticut were conducted in February and March and the results showed that there was high HWA mortality throughout most of the state but not of the magnitude of 2015 and 2016. Mean HWA winter mortality throughout the state was 88.4%. In the Northwest (climate division 1), normally the coldest region of the state, minimum daily temperatures plunged to -8 and -10°F but HWA mortality was variable as HWA may be showing greater cold tolerance in some areas such as Norfolk. Mean HWA winter mortality in Division 1 was 84.7%. In the Central region of the state (climate division 2), HWA mortality was the highest, at 91.5%, with the highest mortalities in the north. Minimum daily temperatures ranged from -7 to -16°F (near the northeastern MA border). In areas near the coast (climate division 3), HWA winter mortality was reduced in 2018 with a mean of 88.5%. Minimum daily temperatures ranged widely from -2°F in Bridgeport, -6°F in interior Bridgeport to -11°F in Stamford. Minimum temperature in New Haven was 0°F.

**Impact:** HWA winter mortality can be predicted based on temperature and climate division and may preclude the need for management.

### **Releases of *S. tsugae* in 2018**

In response to the public interest in potential biological control with *S. tsugae*, a small release of the predator was implemented at the end of May 2018 in cooperation with the Board of Edgerton Park Conservancy, and the City of New Haven Department of Parks, Recreation and Trees, as an experiment. Edgerton Park Conservancy, a historic and beautiful New Haven public park, has stunning vistas and garden landscapes which provide a peaceful retreat and is located near the CAES. Hemlocks there have been treated twice annually with horticultural oil sprays for HWA and elongate hemlock scale control. Although these treatments are very effective in killing these hemlock pests, complete coverage is unfeasible and occasionally a few adelgids survive the sprays. It is hoped that these ladybeetle predators will survive and establish to control HWA refugia at Edgerton Park.



George Jones, Jenny Byers and Diane Holsenbeck, Edgerton Park Conservancy Board members, releasing *Sasajiscymnus tsugae* at Edgerton Park



The extended extreme drought of 2015-2017 lasted 22 months in Coastal climatic division 3, 18 months in Central climatic division 2 and 11 months in Northwestern climatic division 1, as determined by the Northeast Regional Climate Center at Cornell University. The extended drought in Connecticut officially ended in April 2017 and heavy rains and cool temperatures in spring and early summer had favored dramatic hemlock refoliation and recovery statewide during the summer of 2017. 15 *S. tsugae* release sites were revisited to assess hemlock crown health ratings one year later post drought in early spring 2018 at 15 of Connecticut's older *S. tsugae* release sites. The increased precipitation had triggered tremendous reflush of new growth in hemlocks at almost all sites visited in the summer of 2017, somewhat counteracting needle loss due to drought impacts in many areas. Even in poor sites, individual trees showed very good recovery:





Steep Rock Association, Washington Sep 2016.....May 2017



May 2018

However, extreme wind chills of -20 to -30 F in early January 2018, exacerbated by delayed impacts from the extreme drought, may have resulted in dramatic unexpected needle loss in some release sites, especially in parts of the central and the northeast part of CT. These effects of extreme winter desiccation have not been recorded by this researcher before.



By the banks of the Salmon River 2018



Mashamoquet Brook State Park, Pomfret May 2017...and May 2018



Mashamoquet Brook State Park, Pomfret May 2017...and May 2018

2016 hemlock health assessments had shown that hemlocks in some marginal release sites exhibited heavy decline on northeast and northeast ridges, due to heavy EHS infestations, in either single or joint infestations with HWA, exacerbated by native hemlock borer attacks. In 2016 ratings, a third of sites had heavy hemlock borer outbreaks on rocky ridgetops with thin soils but no significant new tree mortality was recorded in 2017 season assessments. It is possible resumption of rains allowed adjacent hemlocks to resist further borer attack. HWA levels continued to be significantly depressed in many sites due to another severe winter in 2018.

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 resulting in extreme decline of stressed hemlocks although also resulting in a drop in EHS levels in some sites.

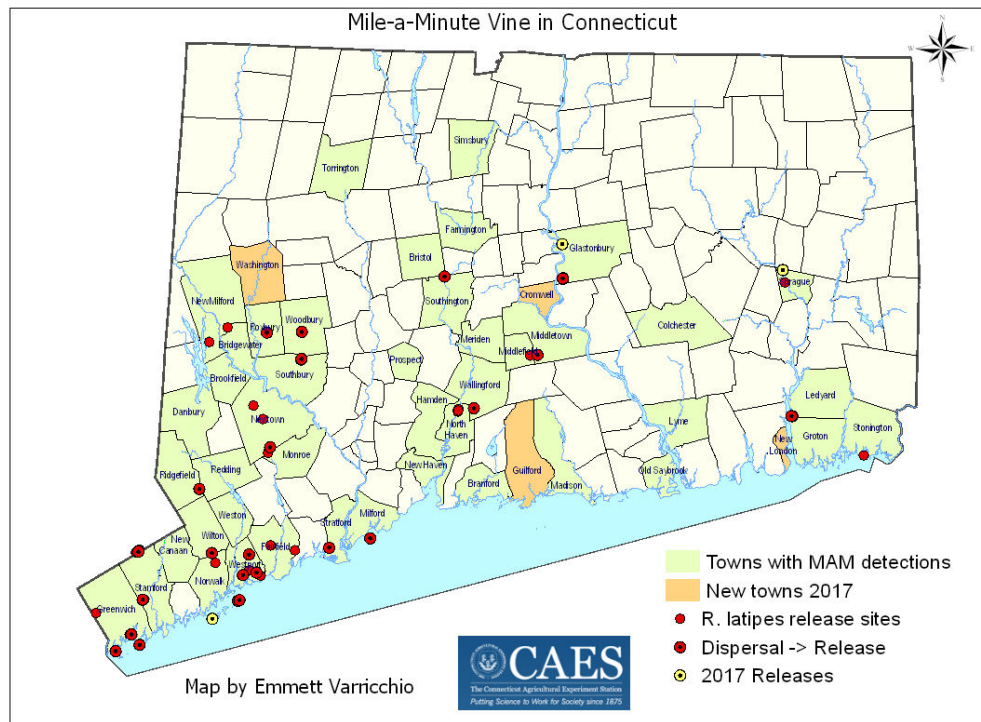


Hemlock mortality due to hemlock borer infestations in northern Connecticut

### **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. As of June 2018, 49 towns in Connecticut have confirmed reports of MAM, with Chester and East Lyme as the latest towns confirmed in 2018 (<https://mam.uconn.edu/distribution/>). Several towns 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. 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 collaborated on the releases and monitoring of all the release sites since 2009. Emmett Varricchio, summer research assistant at the Valley Laboratory, continued a third season in 2017, with GIS mapping of MAM and weevil dispersal, assisting in the release of weevils and conducting extensive scouting for MAM spread and weevil dispersal.

Releases of *R. latipes* began in 2009 in Connecticut, and to date, 55,624 weevils have been released in 25 towns as of June 2018. In June 2018, 2,000 weevils were released at 2 new sites: a school playing field in the town of Washington and at a private property in the town of Westport. Weevils were also added to a 2017 island site, Sheffield Island, part of the Stewart B. McKinney National Wildlife Refuge, with the assistance and cooperation of Wildlife Biologist Kris Vagos and NWR interns, and Charles Baker, USDA APHIS PPQ. This project has documented the continued successful establishment and wide spread of this phytophagous insect species in southern New England.



Donna Ellis, Charles Baker, with Jeff Hammond, Town of Washington Parks and Recreation, and daughter, releasing weevils at the Lower Shepaug playing fields.



Kris Vagos, US Fish and Wildlife, Stewart B. McKinney Wildlife Refuge, with Charles Baker (APHIS PPQ) and NWR summer interns, releasing weevils on Sheffield Island, Norwalk, June 2018



Emmett Varricchio, CAES Windsor, recording data at a MAM weevil release site in 2017



Adult weevil, *Rhinoncomimus latipes* on MAM

Forty-nine CT towns were recorded with confirmed reports of MAM to date in June 2018 (<https://mam.uconn.edu/distribution/>) with weevils released in 25 towns to date. Monitoring in 2017 showed the weevils' continued presence at all sites, very late maturation of fruit, reduction of MAM at some sites. For the third successive year, intensive scouting in adjacent areas, open space, town and state lands around release sites have shown little or no spread of MAM. Weevils have overwintered successfully again in Connecticut following successive severe winters in 2018. Weevils have now survived severe flooding, drought, storms, variable winters, site interference from mowing, tree felling, vegetation clearance and herbicide treatments. This marks the 9<sup>th</sup> year of successful weevil overwintering and establishment. Establishment and spread of the weevils has also occurred in the majority of release sites in a variety of different habitats on the mainland and to offshore islands in Long Island Sound.

**Impact:** 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 right-of ways, 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, has increased in abundance in south western 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. But there have been no attempts to mass-rear *C. stigma* and it is not available commercially. The goal of 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. *Chilocorus stigma* continued to be reared on a small scale through the fourth generation on Florida red scale, *Chrysomphalus aonidum* (FRS) on butternut squash in 2017. Butternut squash were grown and provided by Farm Manager James Preste at the CAES Farm in Windsor and stored at the CAES Griswold Farm with Farm Manager, Robert Durgy's help, and this has been a critical improvement for operations in 2017.

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

### **Insect Management**

Efforts to better quantify the potential for neonicotinoid insecticides (NNIs) for causing harm to pollinators requires 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. 'PJM' cultivar rhododendrons were drenched or sprayed with low and high labeled rates of five systemic insecticides, two of which are newly available to the ornamental horticulture industry. The concentrations of insecticides from pollen and nectar collected in 2018 and 2019 will be evaluated by Dr. Eitzer following that single treatment. A parallel experiment uses dahlias as a model plant to understand the dynamics in systemic insecticide movement into pollen from an herbaceous perennial during one growing season. These data will be of great value to establish best management practices for nursery growers, and to determine whether these insecticides can be used in ways that are not likely to harm pollinators.

### **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, 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 these replacement 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. A two-year 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 honey bee queen rearing and breeding program. The goal of this project is to obtain bees from exceptional commercial sources (based upon hygienic traits), and also from feral bee populations to use for production of queens to share with CT beekeepers. We evaluated honey bees from genetic improvement programs in other parts of the country, including “Mite Biter” bees from the Indiana Queen Breeders’ Association, VSH (varroa sensitive hygiene) bees from a California breeding program, Russian bees from a national network of breeders, hygienic bees from Michael Palmer (a renowned Vermont beekeeper), and most recently, Saskatraz bees from a collaboration between Saskatchewan and California bee breeders. Russian bees were found to develop unacceptably high populations of varroa mites, the Palmer bees were not highly competitive, and some of the California bees were found to be highly aggressive. The most reliably gentle, healthy, and productive bees to date have been the “Mite Biter” bees. An additional potential source of 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. Feral bee swarms were trapped in Mohawk State Forest (northwest corner) and in Yale Myers Forest (northeast corner of CT). Based upon the success in trapping feral bees in 2017, feral bees are being trapped in a southeast to northwest transect in state forests near New England cottontail wildlife management areas, courtesy of permission from CT DEEP. In addition to trapping feral populations bee-lining techniques are being developed that should facilitate quantification of the numbers of colonies in forested areas of the state. Conventional beelining methods do not work in heavily forested areas, and so new methods – both for initial capture of worker bees and for identifying the location of their home colonies, are being developed.

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 beekeeping supplies and 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.



Lifting and setting traps to collect feral bee colonies

**Impacts:** Nursery growers indicate that they have become more cautious about using neonicotinoid insecticides, or have discontinued their use. Connecticut beekeepers have expressed an intense interest in our bee breeding project, trapping of feral bees, and other practices to improve the health of their colonies. A leading beekeeper involved with preservation of “survivor bees” from structures in New England has initiated queen rearing from these colonies, to share with other beekeepers.

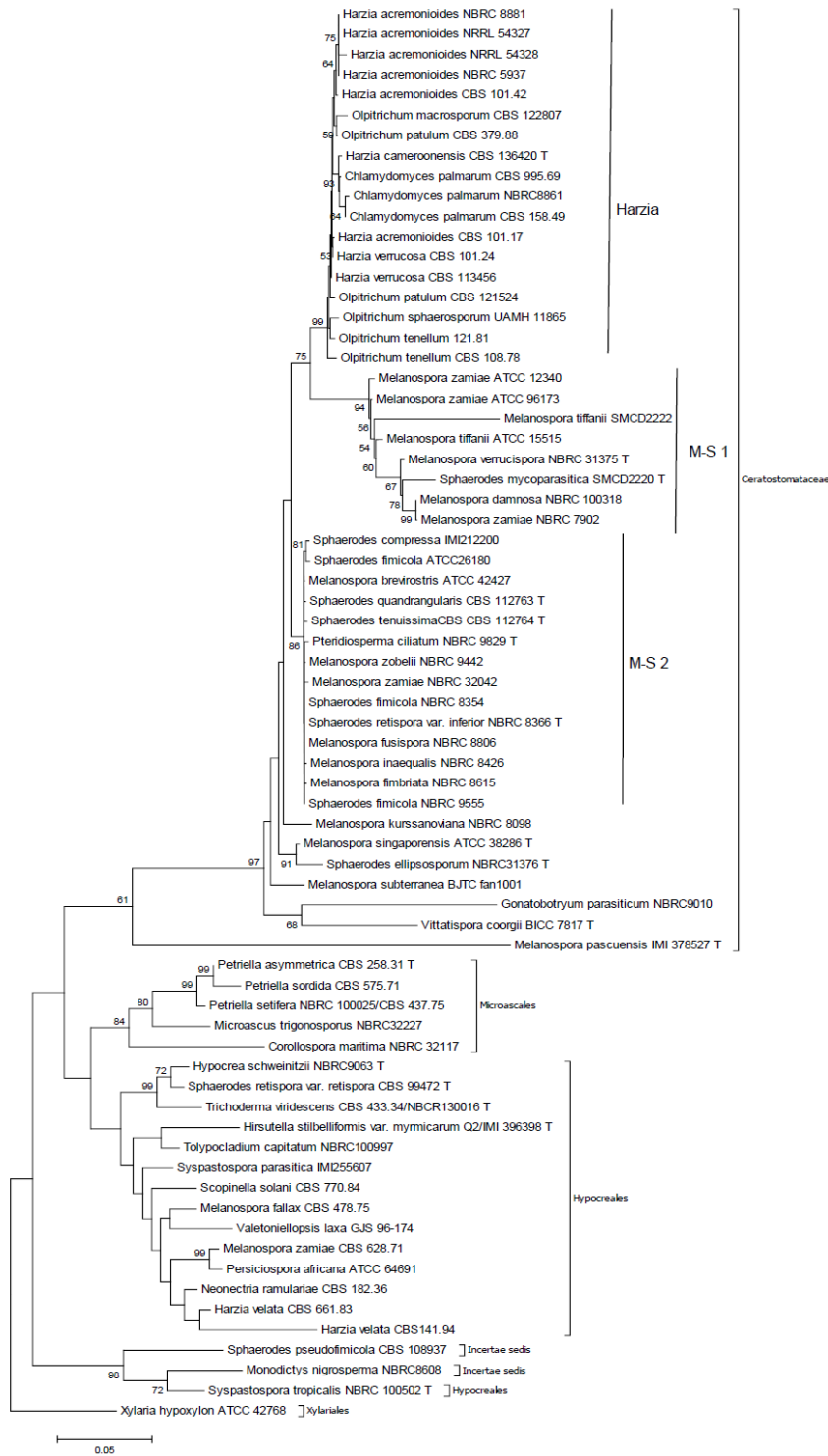
## **Mycology Research**

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.

**A phylogenetic study of *Harzia* and allies with synanamorphic *Proteophiala* state or sexual connections:** Multi-locus phylogeny of *Harzia* and allies were studied using internal transcribed spacer (ITS), large subunit rRNA (LSU), and small subunit (SSU) sequence data. The results indicated that *Harzia*, *Chlamydomyces*, and *Olpitrichum* are con-generic. Thus, *Chlamydomyces*, and *Olpitrichum* were reduced to synonymy of *Harzia*. The generic concept was amended and expanded accordingly. Eight new combinations were proposed. *Melanospora* and *Sphaerodes* are phylogenetically related to *Harzia*. The *Proteophiala* morph is not only a crucial morphological character, but also has a phylogenetical significance in defining Melanosporales. It is hypothesized that the taxa with synanamorphic or asexual *Proteophiala* all belong to Ceratostomataceae, Melanosporales. This is a collaboration with Neil Schultes, Dept. of Plant Pathology.

**Impact:** The result of this study clarified the confusion in delineation of *Harzia* and allied genera.



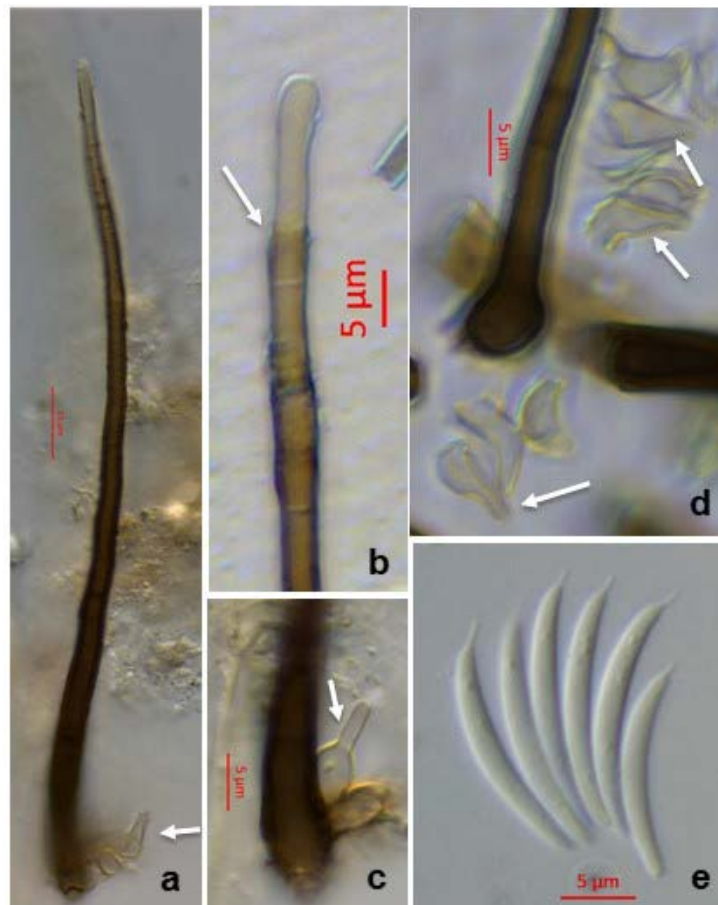


Maximum Likelihood analysis of *Harzia* and allied genera, including 70 taxa/isolates, based on concatenated sequence data of ITS, LSU and SSU. *Xylaria hypoxylon* is included as outgroup. The bootstrap test was conducted with 1000 replicates. Bootstrap values >50% were indicated by the nodes. The scale bar indicates the number of expected changes per site. T indicated the ex-types used in the analysis.

### Fungal taxonomic study

This collaborative study with Neil Schultes and mycologists from several countries: Brazil, Canada, Cuba, China, Mexico, has led to discovery of four new fungal species: *Ascotricha microspora*, *Bactrodesmiastrum domesticum*, *Circinotrichum sinense* (Figure 2), *Triadelphia acericola*, *Wiesneriomyces machilicola*, two new genera, *Ellismarsporium* and *Stanhughesiella*. Nine new combinations were made also. These new species and genera have been published in four papers and the fifth one is in press. Among them, the article on *Triadelphia* is a monographic paper on the genus with detailed descriptions on all accepted species in the genus. For the taxa, from which cultures were isolated, both morphological and molecular methods were used for the study and their phylogenies were elucidated. *Bactrodesmiastrum domesticum* is an indoor fungus and found from water damaged wood in a residence in the USA. *Triadelphia acericola* was collected on the premises at Valley Laboratory.

**Impact:** Discovery and descriptions of new fungal species add very important information for fungal diversity in the world and for the studies such as fungal ecological studies, in which fungi need to be identified. The newly described species add new information to fungal diversity, resources and conservation and utilization.

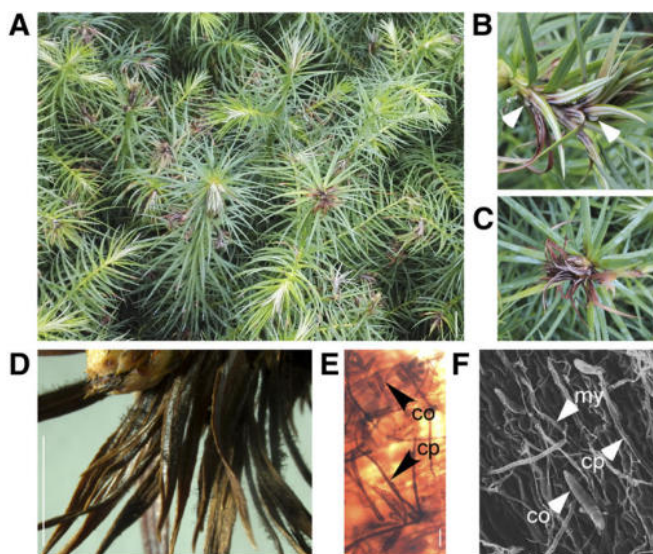


*Circinotrichum sinense* (NHES L1703) a. Seta and conidiogenous cell indicated by an arrow, b. Apical portion of seta showing percurrent extension pointed out by an arrow, c-d. Basal portion of seta and conidiogenous cells pointed out by arrows. Scale bars: a = 10  $\mu\text{m}$ , b-e = 5  $\mu\text{m}$ .

### Study on new plant diseases.

Several newly emerged diseases, walnut anthracnose diseases caused by *Colletotrichum fructicola* and *C. siamense*, and shoot blight on Chinese fir (*Cunninghamia lanceolata*) caused by *Bipolaris oryzae* (Figure 3) were found and studied from both pathological, morphological and phylogenetic aspects. The study has led to three publications. This is a collaboration with several plant pathologists in China. *Bipolaris oryzae* is a major rice pathogen, however it is reported for the first time its jumping from Graminae hosts to conifer.

**Impact:** These new diseases are causing severe damage to farmers and forest. Determination and characterization of these pathogens are imperative for disease management and future studies to fully understand the diseases for finding solutions to these diseases as well as how a phytopathogen evolved.

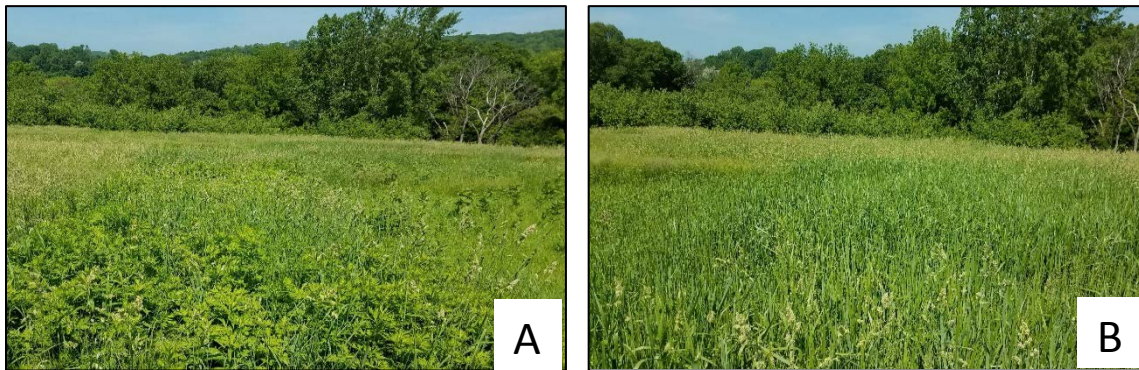


Symptoms of shoot blight disease on *Cunninghamia lanceolata*. A, Diseased shoots in the field. B and C, Diseased shoots of *C. lanceolata*. Arrows indicate the white oozed resin on the shoot. D, Mycelium on the infected shoot. Bars (A to D) = 2 cm. E, Conidia and conidiophores on the infected shoot. F, Scanning electron photomicrograph of fungal mycelium, conidia and conidiophores on the infected shoot; my, co, and cp indicate mycelium, conidia, and conidiophores, respectively. Bars (E and F) = 100  $\mu$ m.

## Weed Science

### Invasive Plant Management Trials

Mugwort (*Artemisia vulgaris* L.) is a highly invasive, non-native perennial plant that reproduces via rhizome as well as seed. Dense monotypic stands of mugwort are commonly found along roadsides, floodplains and riparian areas, pastures and rangelands, rights-of-way, and in various agronomic, turf and landscape settings. It is considered as one of the 10 most troublesome weeds in the US nursery industry. Two field research projects are underway since fall 2016 at the Lockwood research farm, Hamden to evaluate mugwort (*Artemisia vulgaris*) 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 aminopyralid, clopyralid and glyphosate. The second experiment consisted of three different levels of nitrogen (0, 25, and 50 kg N/A) and three mowing schedules (7, 15, and 30 day intervals).

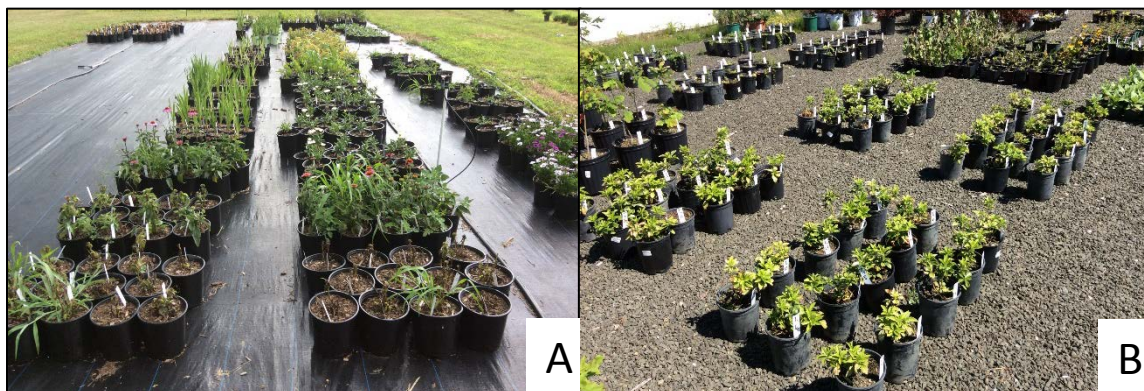


Mugwort management research at Lockwood research farm at Hamden, CT. A: nontreated control, B: milestone (aminopyralid) treated plot at  $\geq 7$  floz/a with excellent mugwort control.

Mugwort did not respond to the increased mowing frequency under any of the nitrogen fertilization levels. Intensive mowing at 7-day intervals (18 to 20 summer and fall mowings) over the last two years did not reduce mugwort rhizome biomass more than 20%. The results from chemical control trials revealed significant reduction in mugwort infestation with lower (0.5 x) than recommended (1 x) rates of aminopyralid and glyphosate herbicides. Glyphosate at  $\geq 1.1$  kg ae/ha (acid equivalent per hectare) and aminopyralid at  $\geq 0.06$  kg ae/ha resulted in 99 % visual control of mugwort. Lower rates of glyphosate at 0.55 kg ae/ha and aminopyralid at  $\geq 0.03$  kg ae/ha gave 65 and 85% visual control and reduction in mugwort rhizome biomass, respectively. Increased N fertilization did not affect mugwort control in response to any herbicide treatment. However, addition of nitrogen favorably affected perennial grasses.

### Ornamental Nursery Trials

Weed management in ornamental plants is a highly challenging and costly production activity. Ornamental species as well as cultivars within a species differ widely in their tolerance to herbicides. Several ornamental plant safety and weed control efficacy trials are being conducted in multiple ornamental species that include: black-eyed Susan, dogwood, gladiolus, goldenrod, iris, leucothoe, purple coneflower, sedum, stonecrop, sunflower, vincas, Virginia sweetspire, and zinnia. These studies will help in developing safe use practices for these new products and comparing their weed control efficacy and safety with the conventional pre-emergence herbicides.



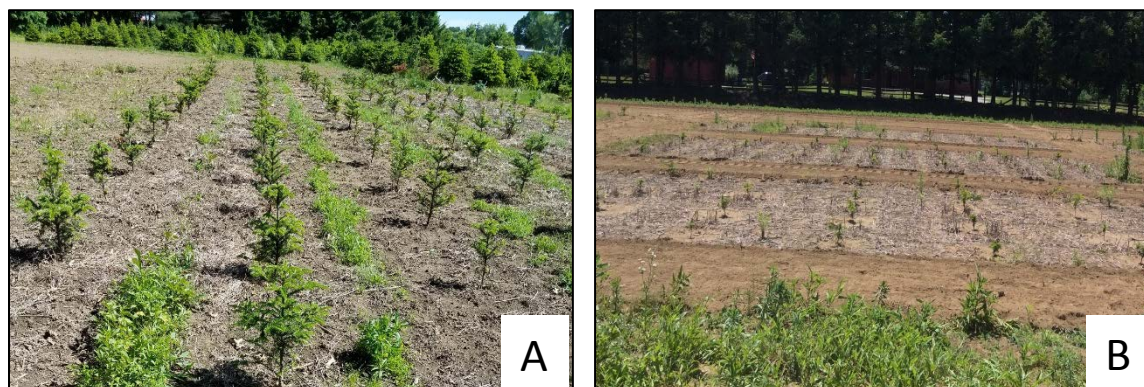
Ornamental plant safety trials at Valley Lab Windsor, CT.

**Impact:** The 2017 ornamental plant safety trials resulted in the discovery of many newer and safer chemical weed control options for sedum (biathlon and freehand 1.75 G at 200 and 300 lbs/a,

respectively), chocolate flower (freehand 1.75 G up to 600 lbs/a)), gladiolus (biathlon up to 400 lbs/a), flag iris (biathlon up to 400 lbs/a), and shasta daisy ((biathlon up to 200 lbs/a).

### Christmas Tree Weed Management Trials:

Many pre-emergence herbicides are available for controlling annual grassy and broadleaf weeds in Christmas trees. However, some weeds escape pre-emergence control, particularly the weed species that are either naturally tolerant to a pre-emergence herbicide or emerge late in the summer when the herbicide has undergone significant degradation. Dr. Aulakh is evaluating various pre-emergence (Marengo SC, Sureguard, Westar, Callisto) post-emergent herbicides (Imazapic, Fiesta, Dismiss Turf, Glyphosate), their different formulations, and combinations for weed control efficacy and Christmas tree tolerance. Christmas tree species under evaluation are: balsam fir, Canaan fir, Douglas-fir, Fraser fir, Nordman fir, Turkish fir, Colorado blue spruce, Norway spruce, eastern white pine, and eastern hemlock.



Christmas tree weed management research trials 2018 at Windsor (A) and Griswold (B), CT.

The 2017 weed management trials have discovered several safe and effective herbicides for pre-emergence weed control in Fraser fir, balsam fir, Colorado blue spruce, Canaan fir, and Douglas-fir. Full labelled rates of Marengo SC (15.5 floz/a), Sureguard (12 oz/a), Westar (10 oz/a), and a tank mix of atrazine (2qt/a) + s-metolachlor (2 pt/a) + mesotrione (5 floz/a) resulted in excellent weed control. Although the westar herbicide resulted in excellent weed control and the longest duration of weed control in 2017 it also resulted in significant reduction in leader length compared to other herbicides. Leader length in westar treated plants was not different from the non-treated plants due to weed completion in the non-treated plots. Results from these trials are being shared with the Christmas tree growers at the twilight meetings of CCTGA. The 2018 post-emergence research trials have found good to excellent levels of Christmas tree (balsam fir, Douglas-fir, fraser fir, Colorado blue spruce, Norway spruce, and white pine) tolerance to imazapic and callisto herbicides.

**Impact:** These two herbicides may become valuable post-emergence options for growers to control or suppress several of the difficult-to-control weeds such as field bindweed, yellow nutsedge, mugwort, wild carrot, and smooth bedstraw without any serious risk of Christmas tree injury.

### 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

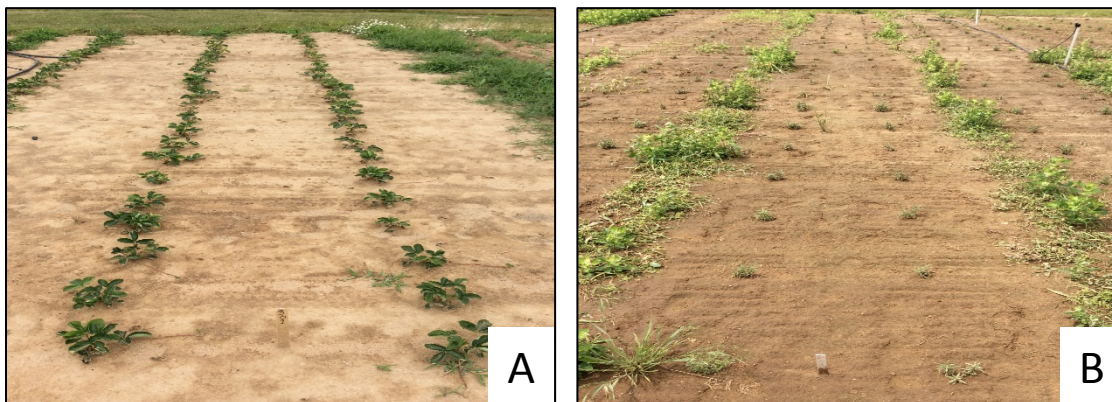
hoeing, application of vinegar or Weed Zap, an organic herbicide (clove oil 45% and cinnamon Oil 45%). First year results indicated significant reduction in weed density (common purslane, field pansy, redroot pigweed, crabgrass, and horseweed) with a combination of cereal rye and crimson clover. Following 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 Valley Lab, Windsor, CT.

### Strawberry and Rosemary Trials

There are few safe pre-emergence and early-post-emergence herbicides for weed control in newly transplanted strawberries. Two field research trials are being conducted since 2017 at the Valley Laboratory, Windsor CT to assess safety and weed control efficacy in strawberry and rosemary to A16003 (bicyclopyrone), 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 CT.



Strawberry (A) and Rosemary (B) bicyclopyrone herbicide tolerance trials 2018 at Windsor, CT.

Research trials in 2017 revealed excellent rosemary tolerance to over-the-top application of A16003 (bicyclopyrone) up to 6.84 fl. oz/a made either within 48 hours after transplanting or 14 days after transplanting. However, strawberry was very sensitive when application (directed) was made within 48 hours of transplanting with a stand loss of 55 to 70% at 3.42 and 6.84 fl. oz/a, respectively. When strawberry was treated at 3.42 fl. oz/a, 14 days after transplanting, only temporary chlorotic injury (25-

30%) was observed. Therefore, it appears that directed application of bicyclopyrone at 3.42 fl. oz/a may have a use as an early-post-emergence herbicide for controlling many broadleaf and grassy weeds in newly planted as well as established strawberries.

## **Plant Disease Research**

### **Boxwood Blight**

Boxwood blight is a new, introduced disease in Connecticut. The fungus that causes boxwood blight, *Calonectria pseudonaviculata* (*C.ps*), forms leaf spot and stem lesions resulting in defoliation and dieback of boxwood. 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.

### **Development of the boxwood evaluation program**

The breeding of disease-tolerant boxwood cultivars is important for reducing the incidence of boxwood blight in Connecticut while providing landscapers with cultivars that have desired traits. In order to better assess boxwood tolerance to blight among cultivars, Dr. LaMondia is collaborating with researchers across the United States to create a standard protocol for boxwood evaluations that can be conducted across institutions. This will include rating cultivars against previously tested plants to assign a scaling of 1 (most susceptible) to 5 (least susceptible). A number of early stage breeding lines have been evaluated and significant variation has been demonstrated consistent with parental traits. This is the first year of the evaluation program in which the standard protocol will be developed and tested at the Valley Laboratory before being assessed at other institutions.

### **Movement of *C. pseudonaviculata* through a landscape**

Boxwoods are an important component of established landscapes, especially historical plantings in which they are highly valued. A better understanding of how boxwood blight moves through a landscape from an infected plant to other cultivars and how fungicides can be used to manage disease spread are important for preserving boxwoods in landscapes. Dr. LaMondia is conducting a field trial to determine how an infected boxwood plant will spread infection to surrounding boxwoods under conditions of no fungicide treatments, the use of a protectant spray (a fungicide that stays on the surface of the plant), and the combination of protectant sprays with systemic sprays (fungicides that move into the plant). The fungicide treatments will be evaluated using a calendar-based spray approach (every month regardless of disease detection or weather) versus an incidence-based spray approach (fungicides will only be applied after disease is detected). Additionally, temperature and humidity will be monitored in the plot to determine how these two environmental conditions affect disease development. Data will be collected for three years. The results will help in creating disease management recommendations for boxwoods in established landscapes.

### **Rotation crops for management of lesion nematodes**

The lesion nematode *Pratylenchus penetrans*, is a very common pest that can directly affect perennial strawberry plantings and is associated with fungal root rots in the strawberry black root rot complex. Management of the disease complex is currently achieved through reducing the number of lesion nematodes by crop rotation, but these rotations require multiple years out of strawberry. We evaluated 4 rotation regimes in replicated field microplots to determine whether 3 potentially nematode-antagonistic crops grown in sequence within one year could effectively manage lesion nematodes within a shorter 1-year time frame. Rotation crops were planted in spring (early April), summer (beginning of July), and fall (mid-September) of 2016 and 2017. Rotation crop sequence treatments consisted of: 1) oats (*Avena sativa*) plus crimson clover (*Trifolium incarnatum*), followed by no-till soybeans (*Glycine max*), and a fall

planting of no-till rye (*Secale cereal*) plus hairy vetch (*Vicia villosa*); 2) Hockett barley (*Hordeum vulgare*), followed by no-till buckwheat (*Fagopyrum esculentum*), and a fall planting of no-till wheat (*Triticum aestivum*); 3) Pacific Gold (*Brassica juncea*) tilled in prior to Trudan 8 sudangrass (*Sorghum bicolor*) tilled in prior to Tifgrain 102 millet (*Pennisetum glaucum*) plus Nitro daikon radish (*Raphanus sativus*); and 4) *Avena strigosa* black oats, followed by no-till millet plus *Rudbeckia hirta*, and a fall planting of Dwarf Essex (*Brassica napus*) tilled in spring 2017 and 2018. Lesion nematode populations were monitored using a soybean bioassay. Roots and soil in plots were sampled and the number of lesions per g soybean root were counted after 3 weeks. In microplots, lesion nematode populations were lower after a full year for rotation sequences 3 and 4 than for rotation treatments 1 and 2, indicating that growing multiple nematode-antagonistic crops within a single year may be a viable nematode control tactic.



Lesion nematode *Pratylenchus penetrans*

### **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 1950's, to ozone damage (weather fleck) in the 1960's, black shank in the 1970's, and Fusarium wilt in the 1980's and early 1990's 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 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. A number of these lines are being evaluated under commercial conditions and three have 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 per year. New varieties in development are resistant to black root rot, for which there are no current management options.
- B1, B2 and D1 have been released as a new cultivars 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<sup>3</sup> 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.

**Impact:** 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* is 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 completely 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 and 2017. The strategy tested investigated the effects of using azoxystrobin, dimethomorph, mandipropamid, fluopicolide or oxathiapiprolin 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. Reduced spray programs were as effective in managing blue mold and target spot as standard sprays with reduced fungicide residues in cured leaves.

**Impact:** An effective spray program that results in reduced fungicide residues in broadleaf and shade cigar wrapper tobacco types 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, which is currently the largest production area worldwide (53,282 acres; IHGC - 2017 Statistical Report).

New York State has the largest production area in the Northeast (400 acres, IHGC-2017 Statistical Report) followed by Vermont and Massachusetts (25 acres each; IHGC - 2017 Statistical Report) and Maine (24 acres). Commercial hop production has just started in CT and New Jersey (15 acres each). 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.



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

The initial objective of this project, which is supervised by Dr. James LaMondia, Dr. Katja Maurer, and Dr. Elisha Allan-Perkins was to investigate the feasibility of hop production in CT. Current objectives are to expand the number of hop varieties evaluated and to demonstrate effective integrated pest management (IPM) techniques. Growing characteristics and susceptibility to diseases and pests were examined for five varieties using high and low trellis systems in two locations - Valley Laboratory in Windsor and Lockwood Farm in Hamden, CT - over the last 5 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, which is a unique pest to hops in the Northeast. Diseases and pests can be controlled by intensive scouting rigorous sanitation measures, pesticides, biological controls (e.g. predators), removing weeds, and stripping the lower leaves off of the bines. A region-specific integrated pest management program was established, which includes intensive scouting and timely control measures, and is available as the Guidelines for Integrated Pest Management for Hops in Connecticut on the CAES website.



**(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 mid of August to beginning of September. (D) The crew cuts bines to bring them to the shed and hand picks the cones or (E) using a mechanical harvester. The cones are weighed to determine yield, dried and shipped to a laboratory for quality analysis.**

The varieties Cascade and Summit are well suited for CT, with Cascade being more reliable on the high trellis set up, whereas the semi-dwarf variety Summit does well on either high or low trellis. Perle, a German breeding line, had the smallest growth and lowest yield. AlphAroma, moderately resistant in other areas, was the most susceptible to downy mildew. Cascade tended to have less downy mildew and potato leaf hopper damage than the other varieties. Hop plants at Lockwood farm produced more cones than plants at the Valley Laboratory. Especially on high trellis systems, the varieties tested met the industry standards for yield, and for alpha and beta acid content, except for Newport which was consistently low and Cascade which was consistently high for alpha and beta acids.

In conclusion, the trial has proven the general feasibility of successful hop production in CT, but not all varieties do well. More varieties are currently being tested. An additional 44 varieties were planted at Lockwood Farm since 2016 and an additional 17 more varieties were planted in Windsor. Preliminary results suggest the varieties Zeus (CTZ), Cluster High, and Super Alpha are highly susceptible to downy mildew in Connecticut. Brewer's Gold, Chinook, Comet, and Southern Brewer seem to be promising candidates, but more research needs to be done.

A recent project supported by the CT Specialty Crop Block Grant Program has been initiated to collect and assess wild or feral hops representing unique germplasm that has survived without human intervention from multiple locations and environments around the state. In that regard, ten wild hops were collected across Connecticut and were planted at the Windsor Farm. These plants will be assessed for their yield, flavor, quality, and disease susceptibility as possible sources for new breeding lines and/or to be cultivated as Connecticut specific hops with flavor profiles.

***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.
- The testing of wild hops may bring new varieties or breeding lines to CT.

### **Christmas trees**

In 2015, Dr. Cowles established a planting of firs in Brooklyn, CT, at a site with a high naturally occurring incidence of phytophthora root rot. This experiment is investigating soil acidification through the addition of elemental sulfur to the soil as a method to prevent infection by root rot organisms. The underlying hypothesis 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 sulfur. Through 2017, the order from lowest to highest in mortality rate has been Canaan with low pH, Canaan with high pH, Fraser with low pH, and Fraser with high pH. The hypothesis that phytophthora would not grow well in acid conditions was confirmed in laboratory dose-response experiments for four *Phytophthora* spp. previously isolated from CT Christmas trees by Dr. Katie McKeever. Overall, acidification of soil in this field is projected to result in acceptable yield of harvestable Canaan firs with minimal losses due to root rots, whereas the losses resulting from other treatment combinations would probably be considered unacceptable.

Diseased trees from this Brooklyn, CT, field site were used by Drs. LaMondia and Cowles to isolate the associated *Phytophthora* pathogen. Gene sequencing conducted by Dr. Schultes and morphological examination by Dr. DeWei Li have determined that this species was previously undescribed. Experiments are underway to fulfill Koch's postulates and to publish a description of this new species of plant disease organism.

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 were tested in a factorial experiment to determine which tools may benefit tree growth. Bare-root transplants significantly benefitted from the addition of controlled-release fertilizer, as evident from their improved color. Addition of sulfur at this research site, which does not have a history of problems with phytophthora root rot, did not improve the health of these trees.

**Impact:** Root dips to improve initial establishment and protect Christmas tree bare-root transplants from infection with *Phytophthora* are now being practiced, with the result of reducing by one year the time to grow a salable tree.

### **VALLEY LABORATORY SERVICE ACTIVITIES**

## Requests for Information

A total of 6,539 inquiries were answered at the Valley Laboratory during the past year. The majority of these queries were answered by Ms. Rose Hiskes (72%) in the inquiry office (65% of these from the public sector) or by Dr. LaMondia (15% of total inquiries; 90% of which were commercial). About 65% 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 (35%). The majority of inquiries answered by Ms. Hiskes concerned insects (26%), diseases (15%), pesticides (12%) or horticulture (11%). Most concerned landscape and nursery (41%), vegetable (7%) and structural entomology (10%). Dr. LaMondia responded to disease (55%), horticulture (25%), insect (5%), fertility (4%), pesticide (4%), weed (1%) and animal (1%) inquiries. These inquiries primarily concerned tobacco (42%), hops (22%), nursery and landscape (15%), vegetables (7%), fruit (5%), golf turf (8%) and Christmas trees (1%). All scientists and many of the staff at the Valley Laboratory assist growers and homeowners.

Valley Laboratory scientists made 97 presentations to grower, professional and citizen groups (over 5,000 people), were interviewed 17 times and made 213 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 inform about management options. His laboratory conducted 125 nematode diagnostic samples and conducted testing as an APHIS certified pinewood nematode export testing facility.

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

## Soil testing

A total of 4,454 soil tests were expertly performed by Ms. Diane Riddle during the past year. About 68% were performed for commercial growers and 32% for homeowners. Of the commercial samples submitted, 69% were for landscapers; 8% for tobacco growers; 5% for vegetable growers, 5% for municipalities, 3% for golf course superintendents; 1% for nursery growers; 1% for small fruit, 1% for Christmas tree growers, and 4% for research.

**Impact:** Approximately 25% of soil samples tested did not require additional fertilizer. Reducing the over-application of fertilizers protects the environment.

## 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, farmers, commercial businesses, other government agencies and nonprofits.

## Insects



Figure 1. Leafhopper nymph.  
© CAES, Rose Hiskes

During the spring and summer months, insect pests, such as gypsy moth caterpillars, leafhoppers, and the fourlined plant bug affected trees, shrubs and flowers in landscapes. In 2018, most gypsy moth caterpillars did not die from the fungus *Entomophaga maimaiga* or nucleopolyhedrosis virus. Rains in April, May and June were two inches less than in 2017 and likely insufficient to build up the fungus population and keep infection cycles going in the caterpillars. As of late June calls were coming in from eastern and central parts of the state about the numerous brown moths flying in yards.

Leafhoppers were a problem in nurseries, landscapes, vegetables and small fruits during late season 2017 and early summer 2018 (Figure 1). Hopper burn, a browning and curling of leaves caused by the toxic saliva injected when the insect feeds, causes people to think the host has a foliar disease. Redbud and witch hazel were hosts in nurseries and landscapes. Fruits such as grape and raspberries had leafhopper damage. Multiple people came in with leafhopper damage on their eggplants. For field

crops, hops were host to leafhoppers as well.

Fourlined plant bug was a problem in early summer this year. Hosts were herbs such as rosemary, lemon balm, sage, basil and mint. Also ornamentals such as coleus and hydrangea were affected. (Figure 2). With this insect as well people think their plant has a leafspot disease as there are uniform round brown spots all over the young leaves. At times the brown tissue drops out, causing people to think they have a shot hole leaf disease. The insects are skittish and disappear to leaf undersides as people approach and so are rarely seen.



Figure 2. Fourlined plant bug adult.  
©CAES, Rose Hiskes



Figure 3. Bed bug, left. Bat bug, right.  
© CAES, Rose Hiskes

Structural and human insect pests continue to create problems for Connecticut citizens. Pest control operators as well as homeowners have brought in the spotted Mediterranean cockroach, a European species found in homes and landscapes. It is a nuisance pest, not feeding on our foods or landscape plants. A human pest, the black widow spider was reported found in Rhode Island. The digital image submitted was credible. Another pest, the human bed bug, is still very problematic, coming in from congregate housing and also an Air BnB site this year. Bat bugs are also being found and need to be distinguished from the human bed bug as treatment is very different. (Figure 3).

Connecticut has a new pollinator protection law that took effect in 2017. Homeowners are no longer able to buy some neonicotinoid insecticides that may harm pollinators. One neonicotinoid, acetamiprid, is still available to homeowners. A homeowner product with acetamiprid, labelled for use on flowers, vegetables and fruits as a foliar spray is available. Homeowners can protect pollinators from insecticide poisoning by applying insecticides only to plants that are not frequented by bees.

### Diseases

Vegetables such as tomato and squash have many possible disease problems. Late blight arrived in Connecticut last September attacking tomato and potato. (Figure 4). Plants die quickly with leaves, stems and fruit being affected. Bacterial diseases were prevalent in late season 2017 and have been seen already in the summer of 2018. Bacterial leaf spot of peppers continues to be a problem in the homeowner market and since it is seed borne, it is therefore a problem in the greenhouse industry where transplants are produced.



Figure 4. Foliar symptoms, late blight of tomato.  
© CAES, Rose Hiskes

Woody plants such as stone and pome fruits suffered severe disease damage in the 2018 season. Both fruit and ornamental cultivars of plum and cherry suffered twig dieback from brown rot in June. Plants blossomed beautifully and began developing fruit before conditions became favorable and the disease struck. Fireblight has been confirmed by Dr. Quan Zeng in a large old fruiting pear. Crabapple samples have come in with the burned foliage and shepherd's crook tips as well.

### Weeds and Herbicides

Homeowners fight weeds in their vegetable gardens. Nettleleaf goosefoot, a summer annual, was a new plant to this office in 2017. Since then it has come in from other gardens throughout the state.

Lawn weeds can be difficult to manage. One shrub that many people love, Rose of Sharon, can become a weed problem in lawns. As the seeds mature in the fall the pods open and can drop seed onto the lawn. Once they germinate their broadleaves are very noticeable in a lawn. Mowing does keep them short but it does not kill them and pulling them by hand seems to be the only viable option. Just as is the case with Ajuga (bugleweed), there are no herbicides labelled for Rose of Sharon control in lawns.

### **Plant Health - Weather**

Connecticut's weather continues to live up to the statement "If you don't like the weather, wait a minute." Frost for most of the northern part of the state came the last day of October for the 2017 growing season. A hard freeze followed on November 9. There was a cold snap the week between Christmas and New Year's and the first week of January. Some boxwoods suffered significant winter injury and even death with many people suspecting boxwood blight. With boxwood blight, affected leaves drop from the plant but when winter injured the straw colored leaves remain on the plant.

The remainder of the winter was mild with some rain and some snow. Bradley Airport reached 77° F on February 21. March temperatures were more normal with two and a half inches of snow falling. The last freeze of the winter at Bradley Airport was April 23. In the light, sandy soils of the river valley cole crops such as peas and broccoli were able to be planted late March.

**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, 18 different groups used the room on 47 occasions. Our most frequent users were the CT Rhododendron Society, CT Invasive Plants Working Group, CT Farmland Trust, Pesticide License Training, CT Invasive Plant Council, Land Trust Alliance, CT Native Plant Pollinator & Wildlife Working Group, CT Department of Agriculture Food Safety, CT Christmas Tree Growers Association, CT Hop Growers Association, Nursery Landscape Research Group, CT Agriculture Information Council, CT Invasive Plant Council, CT Vineyard & Winery, West Hartford Farmers Market, UCONN Greenhouse Specialist, Farm Credit East, and Bishop's Orchard Board of Directors. 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.



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