THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

Record of the Year

2023-2024

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 Science and Forestry, 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.

TABLE OF CONTENTS

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, 2024 were:

Governor Ned Lamont, President
Terry Jones, Vice President
Kumar Venkitanarayanan, Ph.D., Secretary
Jason C. White, Ph.D., Director
Commissioner Bryan Hurlburt
Erol Fikrig, Ph.D.
Joan Nichols
Frederick Cohan, Ph.D.

The Board of Control met on August 2, 2023, October 18, 2023, January 17, 2024, and May 21, 2024.

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, 2024.

ADMINISTRATION
Jason C. White, Ph.D., Director
Lindsay R. Triplett, Ph.D., Vice Director
Michael P. Last, Chief Financial Officer
Dianne F. Albertini
Vickie M. Bomba-Lewandoski
Kelly Fairbrother
Lisa L. Kaczenski
Justin Lizon
Natalie L. Rivera
Joshua Tirado

ANALYTICAL CHEMISTRY
Christian O. Dimkpa, Ph.D., Department Head
Paul Aikpokpodion, Ph.D.
Michael A. Ammirata
Terri Arsenault
Hina Ashraf, Ph.D.
Anuja Bharadwaj, Ph.D.
Meghan S. Cahill
Chaoyi Deng, Ph.D.
Brian D. Eitzer, Ph.D., Emeritus
Alvaro Garcia, Ph.D.
Jasmine Jones
Mandeep Kaur, Ph.D.
Walter J. Krol, Ph.D., Emeritus
MaryJane Incorvia Mattina, Ph.D., Emeritus
Craig Musante
Raja Muthuramalingam, Ph.D.
Milica Pavlicevic, Ph.D.
Kitty Prapayotin-Riveros
John F. Ranciato
Sudhir Sharma, Ph.D.
Carlos Tamez, Ph.D.
Nassifatou Koko Tittikpina, Ph.D.
Yi Wang, Ph.D.
Jingyi Zhou, Ph.D.
Nubia Zuverza-Mena, Ph.D.

ENTOMOLOGY
Philip M. Armstrong, Ph.D., Department Head
John F. Anderson, Ph. D., Emeritus
Theodore Andreadis, Ph. D., Emeritus
Tia M. Blevins
Douglas E. Brackney, Ph.D.
Angela B. Bransfield
Jamie L. Cantoni

Duncan W. Cozens
Mark H. Creighton
Katherine D. Dugas
Jeffrey M. Fengler
Kelsey E. Fisher, Ph. D.
David Giesbrecht, Ph. D.
Andrea Gloria-Soria, Ph.D.
Godfrey N. Indinda, Ph. D.
Rebecca Johnson, Ph.D.
Noelle Khalil
Megan A. Linske, Ph.D.
Chris T. Maier, Ph. D., Emeritus
Michael J. Misencik
Goudarz Molaei, Ph.D.,
Tanya A. Petruff
Jacob Ricker
Gale E. Ridge, Ph.D.
Claire E. Rutledge, Ph.D.
John J. Shepard
Victoria L. Smith, Ph.D.
Kirby C. Stafford III, Ph.D., Emeritus
Kimberly A. Stoner, Ph.D., Emeritus
Heidi R. Stuber
Qi Xue, Ph.D.
Tracy A. Zarrillo

ENVIRONMENTAL SCIENCE AND FORESTRY*
*The Department of Environmental Sciences and the Department of Forestry and Horticulture merged in June 2022.
Scott C. Williams, Ph.D., Department Head
Shaik M. Allabakshi, Ph.D.
Joseph P. Barsky
Jessica E. Brown, Ph.D.
Gregory J. Bugbee
Zhihao Chen, Ph.D.
Riley S. Doherty
Jeremiah R. Foley IV, Ph.D.
Martin P. N. Gent, Ph.D., Emeritus
Susanna Keriö, Ph.D.
Jacquelyn LaReau
Abigail A. Maynard, Ph.D., Emeritus
Sara L. Nason, Ph.D.
Joseph J. Pignatello, Ph.D., Emeritus
Faisal Qaseem, Ph.D.
Brij L. Sawhney, Ph.D., Emeritus
Itamar Shabtai, Ph.D.
Blaire T. Steven, Ph.D.
Charles R. Vossbrinck, Ph.D., Emeritus
Zhengyang (Philip) Wang, Ph.D.
Elisabeth B. Ward, Ph.D.
Jeffrey S. Ward, Ph.D., Emeritus
Summer (Stebbins) Weidman
Leigh J. Whittinghill, Ph.D.

Yingxue (Charlie) Yu, Ph.D.

GRISWOLD RESEARCH CENTER
Robert J. Durgy, Research Farm Manager

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

MAINTENANCE
John Donovan
Ronald A. LaFrazier
Brian Palmieri
Miguel Roman
Gennaro Romano

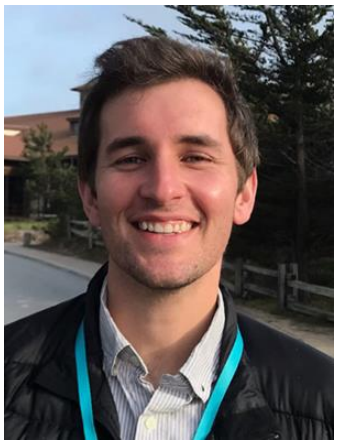
PLANT PATHOLOGY AND ECOLOGY
Lindsay R. Triplett, Ph.D., Vice Director, Department Head
Sandra L. Anagnostakis, Ph.D., Emeritus
Adam Argraves
Donald E. Aylor, Ph.D., Emeritus
Washington L. da Silva, Ph.D.
Sharon M. Douglas, Ph.D., Emeritus
Wade H. Elmer, Ph.D., Emeritus
Francis J. Ferrandino, Ph.D., Emeritus
Regan B. Huntley
Yonghao Li, Ph.D.
Robert E. Marra, Ph.D.
Neil A. McHale, Ph.D., Emeritus
Felicia Millett
Joseph Liquori
Ravikumar R. Patel, Ph.D.
Richard B. Peterson, Ph.D., Emeritus
Neil P. Schultes, Ph.D.
Stephen J. Taerum, Ph.D.
Quan Zeng, Ph.D.

VALLEY LABORATORY
DeWei Li, Ph.D., Department Head
Jatinder S. Aulakh, Ph.D.
Carole A. Cheah, Ph.D.
Richard S. Cowles, Ph.D.
Jeffrey M. Fengler
Rose T. Hiskes
James A. LaMondia, Ph.D., Emeritus
Ethan Paine
James J. Preste, Research Farm Manager
Thomas M. Rathier, Emeritus
Diane C. Riddle
Michelle R. Salvas
Nathaniel Westrick, Ph.D.

Adam Argraves

Adam joined the CAES Department of Plant Pathology and Ecology in July 2023, where he is working as an Agricultural Research Technician with Dr. Robert Marra. Adam received his bachelor's from Southern Connecticut State University in New Haven. In past years, Adam worked with Dr. Marra as a Seasonal Research Assistant on projects including boxwood blight and the assessment of internal decay in living trees. He is currently assisting with research on Beech Leaf Disease where he is conducting laboratory work using DNA extracted from single nematodes isolated from symptomatic beech trees. These isolates are taken from samples collected by Adam at 10 sites throughout Connecticut alongside ones received from 11 other states and two additional sites in Ontario, Canada, as well as a vast collection spanning the range of BLD in Japan that was sent back by Dr. Marra.

Nathaniel Westrick, Ph.D.



Nathaniel (Nate) Westrick joined the station in September of 2023 as an Assistant Scientist II with the Valley Laboratory in Windsor, CT. Nate obtained his PhD in Plant Pathology from the University of Wisconsin, Madison (2017-2022) and was a postdoctoral researcher with the USDA Agricultural Research Service (2022-2023) immediately prior to joining CAES. Nate's research primarily focuses on fungal plant pathogens, their virulence mechanisms, and plant-pathogen interactions. His work has contributed significantly to understanding how fungal enzymes and metabolites facilitate infection in crops such as turfgrass, soybeans, and strawberries. Nate has explored the function of a conserved fungal alcohol oxidase in plant invasion, highlighting its importance in fungal pathogenicity. Additionally, he has identified a key laccase enzyme in *Sclerotinia sclerotiorum* that aids in environmental sensing and host adaptation. His work on soybean resistance against *S. sclerotiorum* has revealed metabolic reprogramming and antifungal defense mechanisms targeting ergosterol biosynthesis. His research has also documented the first report of *Colletotrichum siamense* causing anthracnose crown rot in New England strawberries. By uncovering these molecular pathways, his research provides valuable insights for developing disease-resistant crops and improving plant health management strategies. His studies have broad applications in agriculture, helping to mitigate losses caused by fungal pathogens. Through interdisciplinary collaborations, he continues to advance the understanding of plant disease mechanisms and potential control strategies.

Yingxue Yu, Ph.D.

Yingxue Yu, Ph.D. joined the Department of Environmental Science and Forestry at The Connecticut Agricultural Experiment Station (CAES) as an Assistant Agricultural Scientist II in November 2023. She earned her Ph.D. in Soil Science from Washington State University in 2022, where her research focused on the fate and transport of micro- and nanoplastics in the subsurface environment. Prior to that, she received her M.S. in Hydrogeology from China University of Geosciences-Beijing and her B.Eng. in Hydrology and Water Resources Engineering from Shandong University of Science and Technology. Following her Ph.D., Dr. Yu continued her research as a postdoctoral scientist at Washington State University, further investigating the environmental impacts of biodegradable plastics. At CAES, her research explores the transport, interactions, and risks of emerging contaminants, including microplastics, PFAS, and heavy metals, in soil systems and agricultural settings. Outside the lab, Dr. Yu enjoys hiking, traveling, and discovering new coffee spots.

RETIREMENTS

Mark Creighton

Mark Creighton retired on January 1, 2024, after many years of service as the State Apiary Inspector in the Department of Entomology. Mark first joined the CAES staff on May 18, 2012, as a seasonal inspector, before transitioning into a full-time permanent position on September 5, 2014. His main duties were to examine honeybee hives for parasitic mites and other pests and foulbrood and other diseases; register beekeepers; give oral presentations on honeybees and beekeeping practices to civic groups and beekeepers; and attend exhibits at agricultural fairs and other functions. He was an Authorized Certification Official (ACO) plant inspector and a master beekeeper. Mark's services were in demand, and he enjoyed strong support from the members of the beekeeping associations, many individual beekeepers, agriculture schools, and middle and elementary schools. He advised beekeepers on the latest mite control measures and best management practices. He received praise for his passion, knowledge, and teaching ability during inspections and at schools.

The Connecticut Agricultural Experiment Station

113th Plant Science Day

Lockwood Farm
890 Evergreen Avenue, Hamden, CT 06518
Wednesday, August 2, 2023

PLANT SCIENCE DAY
2023

The weather on Plant Science Day 2023 was in the mid-80s. A total of 1156 people visited Lockwood Farm, making it one of the more heavily attended Open Houses at the Farm in recent years.

Director Jason C. White welcomed attendees in the Pavilion and gave opening remarks. Vickie Bomba-Lewandoski moderated the short talks and introduced the speakers.

All the short talks were very well attended:

SHORT TALKS:

Anuja Bharadwaj, Ph.D.	Analysis of Marijuana Products for Cannabinoids
Megan A. Linske, Ph.D.	Optimizing Integrated Tick Management Strategies
Robert E. Marra, Ph.D. And **Richard S. Cowles, Ph.D.**	Beech Leaf Disease: Biology and Management

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

DEMONSTRATION TENT:

Mark Creighton	Beekeeping in Connecticut, Planting Pollinator Habitat
Felicia Millett	Pruning Woody Plants

Attendees took advantage of several tours around the farm:

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.

- **The Pest Fly of Soft-Skin Fruits in Connecticut**. Investigator: Hany K. Dweck, Ph.D.
- **Urban Agriculture: How Research Addresses Challenges in Production**. Investigator: Leigh J. Whittinghill, Ph.D.
- **Using Biocontrols for Plant Disease Management.** Investigators: Quan Zeng, Ph.D. and Neil P. Schultes, Ph.D.
- **Asiatic Dayflower Management in Christmas Trees.** Investigator: Jatinder S. Aulakh, Ph.D.
- **Per- and Polyfluoroalkyl Substances (PFAS): An Emerging Class of Toxic Environmental Contaminants**. Investigators: Sara L. Nason, Ph.D., assisted by Sara Thomas, Ph.D. and Trung Bui, Ph.D.

- **Office of Aquatic Invasive Species.** Investigators**:** Gregory J. Bugbee and Jeremiah R. Foley IV, Ph.D. assisted by Summer Stebbins and Riley Doherty

QUESTION AND ANSWER TENT:
Throughout the day, hundreds of questions were answered by the staff under the Question and Answer Tent. The tent was staffed by Katherine Dugas, Rose Hiskes, Yonghao Li, Ph.D., Diane Riddle, and Gale Ridge, Ph.D.

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 Richard Cecarelli and his Research Technician Rollin Hannan as well as seasonal resource assistants Chris Carnale, Mary Consoli, and John DeFrancisco. Visitors were able to visit the following 75 field plots:

CHINESE CHESTNUT TREES	Sandra Anagnostakis, Ph.D. (Emeritus)
NUT ORCHARD	Sandra Anagnostakis, Ph.D. (Emeritus) assisted by Pamela Sletten (Retired)
THE FIGHT AGAINST POTATO VIRUSES	Washington da Silva, Ph.D. and Richard Cecarelli, assisted by Raja Muthuramalingam, Ph.D., Rania Eltanbouly, Ph.D., and Francisco Faggion, Ph.D., and by the graduate students Juliana Milagres and Talison da Costa
COMMERCIAL CHESTNUT CULTIVARS	Sandra Anagnostakis, Ph.D. (Emeritus) assisted by Pamela Sletten (Retired)
COMMERCIAL CHESTNUT SEEDLINGS	Sandra Anagnostakis, Ph.D. (Emeritus) assisted by Pamela Sletten (Retired)
CONTROL OF BLIGHT ON AMERICAN CHESTNUTS	Sandra Anagnostakis, Ph.D. (Emeritus) assisted by Pamela Sletten (Retired)
NEW HYBRID CHESTNUT ORCHARD	Sandra Anagnostakis, Ph.D. (Emeritus) assisted by Pamela Sletten (Retired)
REMOTE ACCESS WEATHER STATION	
GRAPEVINE DEMONSTRATION PLOT: TABLE GRAPES	Washington da Silva, Ph.D. assisted by Raja Muthuramalingam, Ph.D., Rania Eltanbouly, Ph.D., and Francisco Faggion, Ph.D., and by the Ph.D. student Talison da Costa
GRAPEVINE DEMONSTRATION PLOT: CHARDONNAY WINE GRAPES	Washington da Silva, Ph.D. assisted by Raja Muthuramalingam, Ph.D., Rania Eltanbouly, Ph.D., and Francisco Faggion, Ph.D., and by the Ph.D. student Talison da Costa
SEEDLINGS OF OLD SURVIVING AMERICAN CHESTNUTS	Sandra Anagnostakis, Ph.D. (Emeritus) assisted by Pamela Sletten (Retired)

WILD CHESTNUTS FROM TURKEY	Sandra Anagnostakis, Ph.D. (Emeritus) assisted by Pamela Sletten (Retired)
QUESTIONS AND ANSWERS TENT	Katherine Dugas, Rose Hiskes, Yonghao Li, Ph.D., Diane Riddle, and Gale E. Ridge, Ph.D.
TECHNICAL DEMONSTRATION TENT	
HAMDEN POLICE DEPARTMENT	
CROWN CASTLE CELLULAR TOWER	
THE BIG DIPPER (ICE CREAM)	Harry Rowe
KIDS' KORNER	
SELF-GUIDED ACTIVITY FOR ALL CHILDREN, INCLUDING GIRL SCOUTS	Terri Arsenault
BABY POOLS: LOW-COST CONTAINER FOR VEGETABLE PRODUCTION IN URBAN AGRICULTURE	Leigh Whittinghill, Ph.D. assisted by The Plant Health Fellows Summer Interns: Leo Babicz, Ananda Turner, Karena Kulakowski, Eva Rodriguez, Talia Tracton, Oliver Kelsey, Charles McLean, Alexandra Carabetta, Aoife Collier-Clarke, Justice Glasgow, Ana DiMauro, and Tessa Lancaster
CUT-AND-COME-AGAIN GREENS: DETERMINING FERTILIZER APPLICATION RATES TO PROMOTE HIGHER YIELDS AND NUTRIENT CONTENT IN LATER HARVESTS	Leigh Whittinghill, Ph.D., assisted by Leo Babicz
FARM EQUIPMENT USED AT LOCKWOOD FARM	Richard Cecarelli
EXPERIMENT STATION ASSOCIATES	Cheryl Cappiali
THE MINISTRY OF MOLECULAR MAGIC	Michael Ammirata and Meghan Cahill
MICROBIOME ON PLANTS AND ITS ROLE IN DISEASE MANAGEMENT	Mohamed-Amine Hassani, Ph.D., Salma PLANT Mukhtar, Ph.D., Blaire Steven, Ph.D., and Quan Zeng, Ph.D.
NEW SPECIES, FISTULINA AMERICANA FROM CONNECTICUT AND MASSACHUSSETTS	DeWei Li, Ph.D. and Yu-Cheng Dai, Ph.D.
UNDERSTANDING LEACHING AND PHOSPHORUS UPTAKE OF FIVE DIFFERENT	Shital Vaidya, Ph.D., Christian Dimkpa, Ph.D., Wade Elmer, Ph.D. (Emeritus), and Jason. C.

BIODEGRADABLE POLYMER-FERTILIZER COMPOSITE	White, Ph.D.
A WORLD OF VIRUSES	Anurag Kushwaha, Ph.D. and Rebecca Johnson, Ph.D., assisted by Duncan Cozens
CuO NANOPARTICLE COATING CONTROLS FOLIAR UPTAKE AND PLANT HEALTH	Chaoyi Deng, Ph.D., Jingyi Zhou, Ph.D., Yi Wang, Ph.D., Neil Schultes, Ph.D., Christian Dimkpa, Ph.D., and Jason. C. White, Ph.D.
USING TREATED WASTEWATER TO IRRIGATE CROPS: WHAT ARE THE IMPACTS?	Sara L. Nason, Ph.D. and Nubia Zuverza-Mena, Ph.D., assisted by Jingyi Zhou, Ph.D. and Jasmine Jones
UNDERSTANDING HOW ROOT EXUDATES FORM SOIL ORGANIC CARBON	Itamar Shabtai, Ph.D.
MYCORRHIZAL INOCULATION: PROMOTING TREE HEALTH AND SURVIVAL IN A CHANGING CLIMATE	Faisal Qaseem, Ph.D. and Susanna Keriö, Ph.D., assisted by Liberty Bednarz, Ana DiMauro, Susan Yang, and Eveleen Jiang
ENVIRONMENTAL FACTORS AFFECTING URBAN MAPLE HEALTH IN NEW HAVEN	Susanna Keriö, PhD., Faisal Qaseem, Ph.D. Leigh Whttinghill, Ph.D., and Nubia Zuverza, Ph.D., assisted by Liberty Bednarz, Ana DiMauro, Susan Yang, and Eveleen Jiang
DEEP UNDERSTANDING OF CROP GROWTH AND FOOD QUALITY BY "MULTI-OMIC" APPROACH USING LC-MS	Yi Wang, Ph.D., Chaoyi Deng, Ph.D., Christian Dimkpa, Ph.D., and Jason C. White, Ph.D.
INSECT MOVEMENT ECOLOGY INFORMS MANAGEMENT STRATEGIES	Kelsey E. Fisher, Ph.D.
FINDING THE ROOT OF THE PROBLEM: HOW NEMATODES MANIPULATE PLANTS	Raquel Rocha, Ph.D., assisted by Regan Huntley and Eva Rodriguez
HOPE FOR CONNECTICUT'S ASH TREES: EMERALD ASH BORER BIOCONTROL UPDATE	Claire Rutledge, Ph.D., assisted by Oliver and Jane Rusher
THE PAVILION AT LOCKWOOD FARM	
NATIVE WOODY SHRUBS	Elisabeth B. Ward, Ph.D. and Jeffrey S. Ward, Ph.D., assisted by Joseph P. Barsky
BIRD & BUTTERFLY GARDEN	Jeffrey Fengler and Lisa Kaczenski-Corsaro

THE PUBLIC HEALTH AND ENTOMOLOGY TENT:

STATEWIDE MONITORING PROGRAM FOR MOSQUITO-BORNE VIRAL DISEASES IN CONNECTICUT	Philip Armstrong, Ph.D., John Shepard, Andrea Gloria-Soria, Ph.D., Angela Bransfield, Michael Misencik, and Tanya Petruff
TREATING WHITE-TAILED DEER FOR TICK MANAGEMENT IN CONNECTICUT	Scott C. Williams, Ph.D. & Megan Linske, Ph.D. assisted by Heidi Stuber, Madison Grieger, and Matilda Kutschinski
RANGE EXPANSION OF NATIVE AND INVASIVE TICKS: A LOOMING PUBLIC HEALTH THREAT	Goudarz Molaei, Ph.D., assisted by Noelle Khalil, Kristy Lok, Yarida Abigail Urbina Espinoza, and Emily Siegel
ASSESSING POLLINATOR RESPONSE TO ECOTYPE NATIVE PLANTS	Tracy Zarrillo, Assisted by David Rubin, Anais Bolduc, and Connor Grace
INVASIVE AQUATIC PLANT PROGRAM	Gregory Bugbee Jeremiah Foley IV, Ph.D., Summer Stebbins, and Riley Doherty, assisted by Madison Manke
HEMP DEMONSTRATION PLOT	Terri Arsenault, Richard Cecarelli, Anuja Bharadwaj, Ph.D.,
CHESTNUT SPECIES AND HYBRIDS	Sandra Anagnostakis, Ph.D. (Emeritus) assisted by Pamela Sletten (Retired)
HEALTHY PLANTS – HEALTHY BUSINESS: SUPPORT OF THE GREEN INDUSTRY BY INSPECTION	Victoria Lynn Smith, Ph.D., assisted by Tia Blevins, Dana Crandall, Mark Creighton, Jeffrey Fengler, and Jacob Ricker
A WELCOME REPRIEVE FOR EASTERN HEMLOCKS IN 2023	Carole Cheah, Ph.D.
THE ROCK	
ASIAN CHESTNUT GALL WASP ON CHESTNUT	Sandra Anagnostakis, Ph.D. (Emeritus) assisted by Pamela Sletten (Retired)
HYBRID ELM TREES	Sandra Anagnostakis, Ph.D. (Emeritus) assisted by Pamela Sletten (Retired)
ROCKY HILL AMERICAN CHESTUNUT TREES	Sandra Anagnostakis, Ph.D. (Emeritus) assisted by Pamela Sletten (Retired)
GRAPEVINE DEMONSTRATION PLOT: HYBRID AND VINIFERA GRAPE CULTIVARS	Washington da Silva, Ph.D.
CONNECTICUT COLLEGE ARBORETUM	Maggie Redfern
CONNECTICUT FARM BUREAU ASSOCIATION	Joan Nichols

US DEPT. OF AGRICULTURE, ANIMAL AND PLANT HEALTH INSPECTION SERVICE, PLANT PROTECTION AND QUARANTINE (APHIS-PPQ)	Eric Chamberlain
UNITED STATES DEPARTMENT OF AGRICULTURE - FARM SERVICE AGENCY (USDA-FSA)	Teresa Peavey
THE AMERICAN CHESTNUT FOUNDATION	Florian Carle
CONNECTICUT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION (DEEP) FORESTRY- PRIVATE AND MUNICIPAL LANDS	Daniel Thomas
THE FEDERATED GARDEN CLUBS OF CONNECTICUT, INC.	Kelle Ruden
WILD ONES – MOUNTAIN LAUREL CHAPTER	Lydia Pan
LEVO INTERNATIONAL, INC.	Nate Heiden
THE CONNECTICUT TREE PROTECTIVE ASSOCIATION	Cathy Dvorsky
CONNECTICUT PROFESSIONAL TIMBER PRODUCERS ASSOCIATION	Kyle Bruetsch
THE CONNECTICUT INVASIVE PLANT WORKING GROUP	Rose Hiskes
THE CONNECTICUT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION-PESTICIDE MANAGEMENT PROGRAM	Zachary Donais
CONNECTICUT CHRISTMAS TREE GROWERS ASSOCIATION	Lisa Angevine Bergs
US DEPARTMENT OF LABOR, WAGE AND HOUR DIVISION	Heather Callahan
THE CONNECTICUT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION-WILDLIFE	Paul Benjunas
UNIVERSITY OF CONNECTICUT IPM TEAM	Shuresh Ghimire
CONNECTICUT DEPARTMENT OF AGRICULTURE	Rebecca Eddy

THE CONNECTICUT DEPARTMENT OF LABOR'S DIVISION OF OCCUPATIONAL SAFETY AND HEALTH (CONN-OSHA)	Catherine Zinsser
BONSAI SOCIETY OF GREATER NEW HAVEN	Alexander J. Amendola
MASTER GARDENERS, UNIVERSITY OF CONNECTICUT (UCONN)	Eric Larson

Lockwood Farm made a beautiful appearance due to the hard work of the farm crew: Richard M. Cecarelli (Farm Manager) and Rollin J. Hannan, Jr., who worked on the plots, grass, trimming, and setup. The barns, buildings, and grounds were cleaned by the Maintenance crew – Eric Wagner (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, and Miguel Roman.

At 10:45 a.m., Director Jason C. White announced that the winner of the 2023 CT Century Farm Award is Horton Farm, South Glastonbury, CT.

CENTURY FARM AWARD

Horton Farm
South Glastonbury, 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 Ned Lamont:

In 1860, Sampson Horton purchased a house and 16 acres of farmland along the Connecticut River from the Treat family that became the Horton Farm. Sampson was a shipping merchant who sold textiles produced in Glastonbury in the Caribbean Islands and returned with rum and molasses which he sold along the East Coast on his way back to Glastonbury. He also farmed dairy and tobacco. The Hortons still have the receipt for his first tobacco crop in 1860, $5 for '2 acres of tobacco, more or less'. His son Howard was followed by two additional Howard Hortons. The fourth generation on the farm consisted of brothers Howard Hamilton Horton and Ken Horton. Howard was the Fire Marshall in Glastonbury for 45 years and a 4H leader. The whole family was and continues to be involved in agricultural education and the Future Farmers of America (FFA). Howard's son Kenneth currently runs the farm assisted by his children Brian, Natalie, and Emily. The family still lives in the 1760 farmhouse. The farm was expanded in 1936 to 1938 by 20 acres and again in 2011 by an additional 20 acres. Dairy production stopped in the 1960's and tobacco and vegetables were increased over time, resulting in the building of a new tobacco shed in 2020. Currently, broadleaf tobacco is being grown on 22 acres, as well as 13,000 tomato plants and additional acres of winter and butternut squash. Additionally, smaller plantings of a variety of vegetables and laying chickens supply a farm stand on the farm. The sixth generation of Hortons is currently involved in building the future of this historic Connecticut farm.

At 11:15 a.m., Director Jason C. White introduced Gil Simmons, Chief Meteorologist from WTNH, Storm Team 8 as the Samuel W. Johnson Memorial Lecturer.

EVENTS HELD AT THE STATION

The Plant Health Fellows Internship Program

From June 5th through August 3rd 2023, Lindsay Triplett, Ph.D. coordinated the USDA-funded SCSU/CAES Plant Health Fellows internship program for its sixth year. Ten undergraduate students began mentored research projects in four departments at The CAES campus. In addition to research, they are participating in a group field project, five communication and leadership activities, and conversing with thirteen panelists from industry, federal agencies, and universities in weekly career panels focusing on different types of plant health careers. Organizing this program included creating advertising and recruiting applicants, evaluating applications, planning move-in logistics, assigning mentors, mentoring one student through a research project, providing communication and career training, planning and conducting a group project with the students, organizing and moderating the final virtual symposium on August 3rd, and reporting outcomes to the USDA after the end of the program. Drs. Zeng, Rocha, and da Silva served as program mentors.

UConn 2024 Spring Bedding Plant Meeting

On January 15, 2024, Yonghao Li, Ph.D. co-organized "UConn 2024 Spring Bedding Plant Meeting" at Jones Auditorium and presented "Recap 2023, Bedding Crop Diseases to Prepare for 2024".

Forest Health Monitoring Workshop 2024

On March 12, 2024, Victoria Smith, Ph.D. organized and participated in the annual CAES Forest Health Monitoring Workshop held in person at Jones Auditorium.

9:00-9:15	Vicki Smith	Welcome and Introductions
9:15-9:30	JP Barsky	Nuthing Much to Talk About: 2023 Acorn Mast Survey Results
9:30-10:00	Mirza Faisal Quseem	Association of Urban Heat Island (UHI) to Urban Maple Condition in New Haven
10:00-10:30	Jeff Ward	Slashing Your Way to Increased Oak
10:30-10:45	BREAK	
10:45-11:00	Kelsey Fisher/Claire Rutledge	Is the Spotted Lanternfly a Forest Pest?
11:00-11:30	Susanna Kerio	Sooty Bark Disease--Should We Worry?
11:30-12:00	Eli Ward	Competition Between Regenerating Oaks and Invasive Plants in Irregular Shelterwood Harvests
12:00-12:30	BROWN BAG LUNCH	
12:30-1:00	Amanda Bunce	Climate-Adaptive Silviculture and Diversity Indices: Is It Working?
1:00-1:30	Carole Cheah	Climate Change Impacts Shape HWA Biological Control Strategies in CT
1:30-1:45	SEVENTH INNING STRETCH	
1:45-2:15	Bob Marra	Beech Leaf Disease: Research Advances for 2023
2:15-2:45	Claire Rutledge	Southern Pine Beetle and the Fate of Pitch Pine
2:45-3:15	Yonghao Li	Common Diseases of Pine
3:15	EVERYONE	Discussion and Wrap Up

The CAES Vector-borne Disease Symposium

On March 25, 2024, the Center for Vector Biology & Zoonotic Diseases at the CAES organized a one-day symposium (in the morning) and workshop (in the afternoon) on vector-borne diseases (VBDs) in Connecticut, assisted by John Shepard and Noelle Khalil. The symposium and workshop invited participation from state and local government agencies, including DPH, DEEP, DoAg, departments of health, representatives from pest and vector control agencies, and other interested groups.

2024 Connecticut Farm and Winery Education Symposium

On March 26th, 2024, Washington DaSilva, Ph.D. organized the 2024 Connecticut Farm and Winery Education Symposium held at Jones Auditorium at CAES and presented the seminar "Gathered from the Vine: Grapevine Viruses in Connecticut"; da Silva Lab members presented posters during the symposium (Rania El-Tanbouly, Ph.D. and the graduate students, Jarlan Silva, Maria Helena Diogenes, and Talison da Costa) (60 attendees).

The International Festival of Arts and Ideas 2024

On June 28, 2024, the Station participated in the International Festival of Arts and Ideas. Goudarz Molaei, Ph.D. spoke to visitors about the tick and tick-borne pathogen surveillance and tick testing program and provided a tour of the CAES Tick Testing Laboratory both days. Philip Armstrong, Ph.D. spoke to visitors about the mosquito trapping and testing program. Katherine Dugas and Gale Ridge, Ph.D. spoke to visitors about their work at the CAES Insect Information Office; and Yonghao Li, Ph.D. talked about the Plant Disease Information Office and disease diagnosis to the tour groups. Lindsay Triplett, Ph.D. twice gave a presentation titled "CAES Then and Now" to members of the public. The presentation was followed by campus tours guided by Drs. Lindsay Triplett, Christian Dimkpa, and Jason White; tour stops were presented by Drs. Goudarz Molaei, Carlos Tamez, Phil Anderson, Claire Rutledge, Washington da Silva, Gale Ridge, and Yonghao Li (24 adult) (June 16) and (24 adults) (June 23).

EVENTS HELD AT LOCKWOOD FARM

The 2023 Connecticut-FFA Forestry Career Development Event

On November 17, 2023 the Departments of Entomology and Environmental Science & Forestry hosted the Connecticut-FFA Forestry Career Development Event at the Lockwood Farm Pavilion. The event evaluated student's general forestry knowledge, forest mensuration, and identification of cut wood, trees, forestry related equipment, and tree disorders (disease and insect damage). Forty-six students from 10 State FFA Chapters participated in this year's event, with the four-student team from the E. O. Smith High School Agricultural Education Program taking first place. These students will represent the State of Connecticut at the 2024 National FFA Convention in Indianapolis, IN.

We would like to thank Eric Hansen of Ferrucci and Walicki, LLC, Frank Cervo and Emily Picard (former CAES seasonal employee) of the Connecticut Department of Energy and Environmental Protection and George Lyman of USDA-APHIS for their assistance with individual components of the exam.

DR. MEGAN LINSKE of the Department of Entomology and MR. J.P. BARSKY of the Department of Environmental Science and Forestry organized and coordinated the event.

EVENTS HELD AT THE VALLEY LABORATORY

Tobacco Field Day

Twenty-five people attended the Connecticut Agricultural Experiment Station Valley Laboratory's Tobacco Field Day held at the Valley Laboratory on August 24, 2022. Dewei Li, Ph.D. welcomed growers. Tours of field plots were conducted; Jim Lamondia, Ph.D. spoke about target spot management and fungicide trials, breeding for resistance to multiple pathogens and new varieties under development, Fusarium wilt resistance, PVY and tobacco ringspot viruses, and with MR. JIM PRESTE discussed reduced tillage pros and cons and cover cropping. Jim Hyde of USDA NRCS and Julie Fine contributed to the discussion of reduced tillage and soil quality. Pete Kisselburgh (Arthur Carroll Insurance) answered questions about risk management in tobacco and the tobacco insurance program. Jim Preste, Michelle Salvas and Ethan Paine 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.

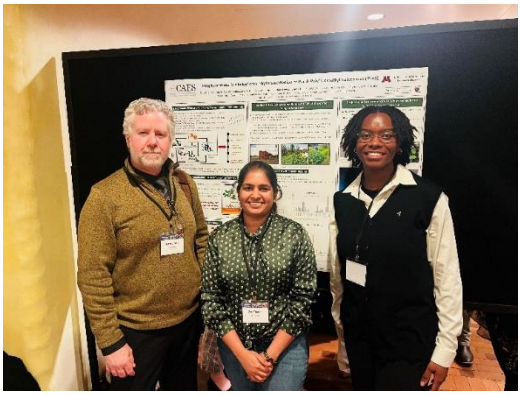
Tobacco Research Meeting

Ninety people attended the Connecticut Agricultural Experiment Station's annual Tobacco Research Meeting held at Joannas Restaurant in Somers CT on March 6, 2024. Dr. Jatinder Aulakh spoke about Palmer Amaranth, water hemp and herbicide updates; Dr. Nathan Westrick introduced himself as the new pathologist at the Valley Lab; Dr. Srikanth Kodati, the new UConn Extension IPM and Pesticide coordinator, spoke about pesticide safety; Julie Fine of Farmland Trust spoke about soil health; and Dr. Jim LaMondia discussed tobacco breeding, and progress in resistance development. Bill Syme spoke about rotating chemical families and label updates for tobacco. Jim Preste, Ethan Paine and Michelle Salvas 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 52 persons received credit.

THE STATION IN THE COMMUNITY

On September 12 and 23, 2023, CAES sponsored the Northeast Aquatic Plant Management Society Plant Camp at UCONN Avery Point and Camp Hazen. (approx. 40 participants)

Between November 9 and 12, 2023, Drs. Jingyi Zhou, Paul Aikpokpodion, Nubia Zuverza-Mena, Christian Dimkpa, and Jason White attended the 12th Sustainable Nanotechnology Organization's annual meeting which held in Marina Del Rey, California. Dr. Jingyi Zhou gave a poster presentation. Drs. Aikpokpodion and Zuverza-Mena gave oral presentations. Dr. Dimkpa and Dr White chaired different sessions during the meeting. Attendance was 120 participants.



Jason White, Ph.D., Nubia Zuverza-Mena Ph.D., Sara Thomas, Ph.D., and Jasmine Jones attended the Annual NIEHS Superfund Research Program meeting in Albuquerque, New Mexico, during December 3-6, 2023. Jones presented a poster titled "Using nano material to enhance the phytoremediation of per- & polyfluoroalkyl compounds".

During March 12-16, 2024, Dr. Carlos Tamez, Dr. Nassifatou Tittikpina, Ms. Terri Arsenault, Ms. Meghan Cahill attended the Laboratory Flexible Funding Model (LFFM) CAP Grantee Meeting in Houston, TX; Terri Arsenault presented a poster on "Melamine adulteration of human food and animal feed"; Carlos Tamez, Ph.D. presented a poster on "Investigation of beverage adulteration with ethylene glycol". Terri Arsenault was the veteran panelist for the round table discussion of "LFFM experiences for FERN labs – vets vs NKTOB".

DONATIONS MADE TO THE COMMUNITY

Lockwood Farm

A total of 20,748 pounds of fresh produce grown at the Lockwood Farm were donated to various organizations in the community.

Valley Laboratory

A total of 6,025 lbs pounds of fresh produce including squash, cucumbers, watermelons, peppers, eggplant, zucchini, tomatoes, cabbage, and broccoli grown at the Valley Laboratory were donated to Foodshare of Hartford. Mr. Preste and DeWei Li, Ph.D. generated the fresh produce, and Jim Preste organized the distribution effort.

AWARDS AND RECOGNITION RECEIVED BY STATION STAFF

In July 2023, DR. MEGAN LINSKE (PI) and DR. SCOTT WILLIAMS were awarded a two-year contract from the Centers for Disease Control and Prevention to evaluate "Efficacy of fall application of synthetic and natural acaricides to suppress host-seeking Ixodes scapularis ticks." $230,818.

In July 2023, DR. RICHARD COWLES was awarded a grant of $16,133 from the Christmas Tree Promotion Board for his project "Comparison of long-lasting deer repellents."

In August 2023, KELSEY FISHER, PH.D., and CLAIRE RUTLEDGE, PH.D., "Using the stable isotope of nitrogen as a long-term marking strategy to estimate natural dispersal capacity of spotted lanternfly," were awarded $93,345, USDA Specialty Crop Block Grant Program.

In September 2023, ITAMAR SHABTAI, PH.D., was awarded a USDA-CT DoAG Specialty Crop Block Grant program for proposed project "Evaluating the Use of Organic Amendments to Reduce Crop Drought Stress by Increasing Plant Available Water." $96,162.

In September 2023, SCOTT C. WILLIAMS, PH.D. and MEGAN A. LINSKE, PH.D. were awarded a subcontract with Genesis Laboratories, Inc. on the Centers for Disease Control and Prevention contract "Field Trial of Fipronil-Laced Oral Bait for Control of Ticks on White -Tailed Deer" #75D30123R72772 (September 2023–August 2026, $80,000).

In October 2023, ITAMAR SHABTAI, PH.D. received a Foundation for Food & Agriculture Research's (FFAR) New Innovator Award "Evaluating the use of calcium containing amendments to manage the bioavailability of organic carbon in agricultural soils" $449,607, as PI.

In October 2023, QUAN ZENG, PH.D., YONGHAO LI, PH.D., and Kenneth Johnson, Ph.D. (Oregon State Univ.) are awarded a USDA-NIFA-OREI four-year grant to identify yeasts that induce apple immunity and deploy them towards organic control of apple diseases ($997,657 to CAES), QUAN ZENG, PH.D. is also awarded a USDA-NIFA-ORG grant as a co-PI, ($279,480 to CAES) to study a biological control product Pseudomonas soli T307 in collaboration with Ching-Hong Yang, Ph.D. (University of Wisconsin-Milwaukee).

In November 2023, QUAN ZENG, PH.D., and a team of 14 scientists were awarded a USDA-SCRI grant "An all-stage fire blight control: remote sensing, DNA, enzyme and plant activator technologies for cankers, blossom blight and shoot blight" ($679,710 to CAES, $5.7 million total).

In December 2023, RAQUEL ROCHA, PH.D. in collaboration with Claudia Dias-Arieira, Ph.D. from State University of Mariga-Brazil was awarded a CAPES-PrInt grant for $13,300 for a joint project to study virulence mechanisms of root-knot nematodes. The award will be used to host the student Monique Rodrigues e Silva to perform experiments at CAES in 2024.
In December 2023, SF-BSF: Synthetic mycorrhizal community (SynMC) and parasitism management in rhizosphere ecosystems guided by systems biology of mycoparasitism. PI: Jeffrey P. Townsend, Yale University, CoPIs: Zheng Wang, Yale University, and DEWEI LI, CAES, BSF collaborator PI: Oded Yarden, The Hebrew University of Jerusalem. CAES portion of the grant: $131,660, 2023-2025.

In January 2024, BLAIRE STEVEN, PH.D. was recognized with an Extraordinary Service Award by the American Society of Microbiology (ASM). The announcement was made January 23 and acknowledged his work as an editor for the journal Microbiology Spectrum as well as to the local organizing committee of the Connecticut Valley branch of the ASM. As part of the award, Dr. Steven will receive a free publication in an ASM journal and a recognition at the ASM Microbe meeting in Atlanta, Georgia during the editors meeting. Established in 1899, ASM is a scientific society of 36,000 members and ASM Journals publish 26% of all microbiology articles and contribute 44% of all microbiology citations.

In January 2024, RAQUEL ROCHA, PH.D., in collaboration with Danilo Daloso, Ph.D. and Cleverson Freitas, Ph.D. from the Federal University of Ceará-Brazil (UFC) was awarded a CNPq grant for $50,000 for a joint project to study the molecular mechanisms driving tomato-root knot nematode interaction in response to temperature. The award will be used to host one postdoctoral researcher and one visiting UFC grad student at CAES.

In February 2024, ELISABETH WARD, PH.D. received two awards from the Forest Ecosystem Monitoring Cooperative at the University of Vermont for $40,756 to support regional forest health monitoring and to serve as the Connecticut State Coordinator for the Cooperative in 2024.

In February 2024, CAROLE CHEAH, PH.D. was awarded two 2024 grants from the Farmington River Coordinating Committee for implementation of HWA biocontrol with Sasajiscymnus tsugae in the Upper Farmington River watershed ($12,625.50) and by the Lower Farmington Salmon Brook Wild and Scenic Committee ($15,150) for implementation in the Lower Farmington River and Salmon Brook watershed.

In March 2024, ELISABETH WARD, PH.D. received $93,178 of core funding from the USDA Forest Service Cooperative Forest Health Protection Program and became the new Connecticut Forest Health Program Director—a position that was previously held by Victoria Smith, Ph.D, in the Department of Entomology. The purpose of the Cooperative Forest Health Protection Program is to facilitate the surveying and monitoring of forest health conditions to protect forests and trees on non-Federal public and private lands from insects, diseases, and invasive plants. The core Forest Health Protection funding received through the USDA Forest Service will therefore support cross-departmental work on the monitoring and management of pests, pathogens, diseases, and other forest health concerns at CAES.

In April 2024, ANDREA GLORIA-SORIA, PH.D., (Co-Investigator) and Seth Reymond, Ph.D., (PI - Yale YSPH) received seed money from The Ambrose Monell Vector Borne and Zoonotic Diseases Grant Program, Yale School of Public Health, to develop “A low-cost amplicon sequencing panel for Aedes aegypti genomics.” $49, 237.

In June 2024, Eli Ward, Ph.D. and Susanna Keriö, D.SC. received $136,833 from the USDA Forest Service through the Bipartisan Infrastructure Law Invasive Species High-Priority Regional Project competitive grant program for a project titled “Rapid forest assessment to monitor the effects of beech leaf disease to inform management.”

In June 2024, Jeremiah Foley, PH.D (Co-Investigator) and Kelly Aho, Ph.D., (PI - Michigan State University) were awarded an NSF RAPID grant “Hydrilla and carbon cycling: leveraging an ecosystem-scale herbicide application to investigate feedbacks between invasive plants and greenhouse gas emissions” ($36,885 to CAES, $196,466 in total).

In June 2024, Washington da Silva, Ph.D. received a research grant from the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), a Brazilian Federal Agency for Support and Evaluation of Graduate Education, to host students from Brazil in his lab at CAES for training in molecular biology.

THE PUBLIC SPEAKS

- From: Anastasia Mixsell
  To: Kerio, Susanna
  Cc: Ward, Elisabeth
  Subject: Re: Tree Warden School 9-7-23
  Date: Thursday, September 7, 2023 12:36:15 PM

  Thank you, thank you both for your help today teaching Tree Warden School! You did a GREAT job covering the material in an engaging, energetic, and fresh way. It's so amazing to have so many smart women in the field to pull from
  I'll let you know about a review session in case you want to attend. It will likely be Tues, 10/10 around 10:30 after we cover the law portion of the course.

  Annie Mixsell
  Tree System Coordinator / Tree Warden
  City of New Haven
  Department of Parks and Public Works
  Desk: 203-946-8092
  Email: amixsell@newhavenct.gov
  CT Licensed Arborist S-5641

- From: education
  To: Beth Bernard; jwcaes@gmail.com; Ward, Elisabeth; Ward, Jeffrey; Casey Cordes; Urbano, Andrea
  Subject: Re: MWM Forest Ecology Program in N. Madison - September 16th 9am-12pm
  Date: Thursday, September 21, 2023 11:30:41 AM

  Yes -- thank you so much for a great program. I wish I was able to stay the whole time. The students really got a lot out of it. Below is some feedback I received from a few MWM folks.
  "BTW - Yesterday's session was excellent! Andrea, Eli, Casey, and Jeff were so animated & passionate about what they do, and seeing that deer exclusion area was an incredible example of the impact of browsing. So much to learn!"
  "Great program this past Saturday. If the quality of this Forest Ecology program in Madison is any indication of what's to come, the MWM is going to be so educational, eye-opening, and rewarding."
  Thank you again for spending your Saturday morning with the group.

  Best,
  Elizabeth
  Elizabeth Merow
  Adult Education Programs Contractor
  Connecticut Forest & Park Association
  education@ctwoodlands.org
  860.398.4527

- **From:** Michael Glynn <michaelglynnarchitects@gmail.com>
  Sent: Friday, August 18, 2023 6:06 PM
  To: Cheah, Carole <Carole.Cheah@ct.gov>
  Cc: Paul Bowyer <israel80277@yahoo.com>; barbara timken <bctimken@me.com>
  Subject: Re: Mile-a-minute at Wamphassuc

  Carole, this is valuable information, thank you for the update and the guidance. I am copying this to my client on Wamphassuc Point in Stonington. Perhaps she and her neighbors might want to engage Dr. Mervosh.
  By the way, we have been purchasing "our" weevils from the State of New Jersey program, might there be a source in Connecticut?

  Have a sunny weekend.

  Hale to the weevil.

  michael

  Michael Jennings Glynn, AIA, NCARB

  Michael Glynn Architects
  33 Orchard Street
  Stonington, Connecticut
  06896
  telephone: 203-664-1919
  mobile: 917-319-5720

- From: Murphy-Dunning, Colleen
  To: Dawn Henning; Doroski, Danica; Ward, Elisabeth
  Subject: thank you!!!
  Date: Thursday, August 24, 2023 4:10:22 PM

  Hi Dawn, Danica and Eli,
  Just a quick note to thank you again for all of the time you invested to bring your professional expertise to the incoming students. I really admire your work, and am grateful to be able to partner with you. Thank you so much for your help to make this new MOD a success!

  Warmly,
  Colleen
  Colleen Murphy-Dunning
  Executive Director, Hixon Center for Urban Ecology
  Executive Director, Urban Resources Initiative
  203-687-6845 (cell)
  Pronouns: she/her/hers
  Yale School of the Environment
  environment.yale.edu
  Hixon.yale.edu
  URI.yale.edu

Hiskes, Rose

From: WENDY QUINN <quinn.family@comcast.net>
Sent: Wednesday, August 30, 2023 4:37 PM
To: Hiskes, Rose
Subject: Re: lilac samples

EXTERNAL EMAIL: This email originated from outside of the organization. Do not click any links or open any attachments unless you trust the sender and know the content is safe.

Thank you so very much, Rose! I am so grateful for your wisdom! :)

Hope you have a beautiful holiday weekend
Wendy

-

Hiskes, Rose

From: HERBERT A NEUHAUSER <hneuhauser@comcast.net>
Sent: Monday, September 18, 2023 5:23 PM
To: Hiskes, Rose
Subject: Re: pine sawflies

EXTERNAL EMAIL: This email originated from outside of the organization. Do not click any links or open any attachments unless you trust the sender and know the content is safe.

Thanks Rose
Looks like what we have. What a great resource .
Herb N.

-

Hiskes, Rose

From: angelduke@aol.com
Sent: Tuesday, October 10, 2023 7:11 PM
To: Hiskes, Rose
Subject: Re: paper hive image

You don't often get email from angelduke@aol.com. Learn why this is important

EXTERNAL EMAIL: This email originated from outside of the organization. Do not click any links or open any attachments unless you trust the sender and know the content is safe.

Hi Rose,

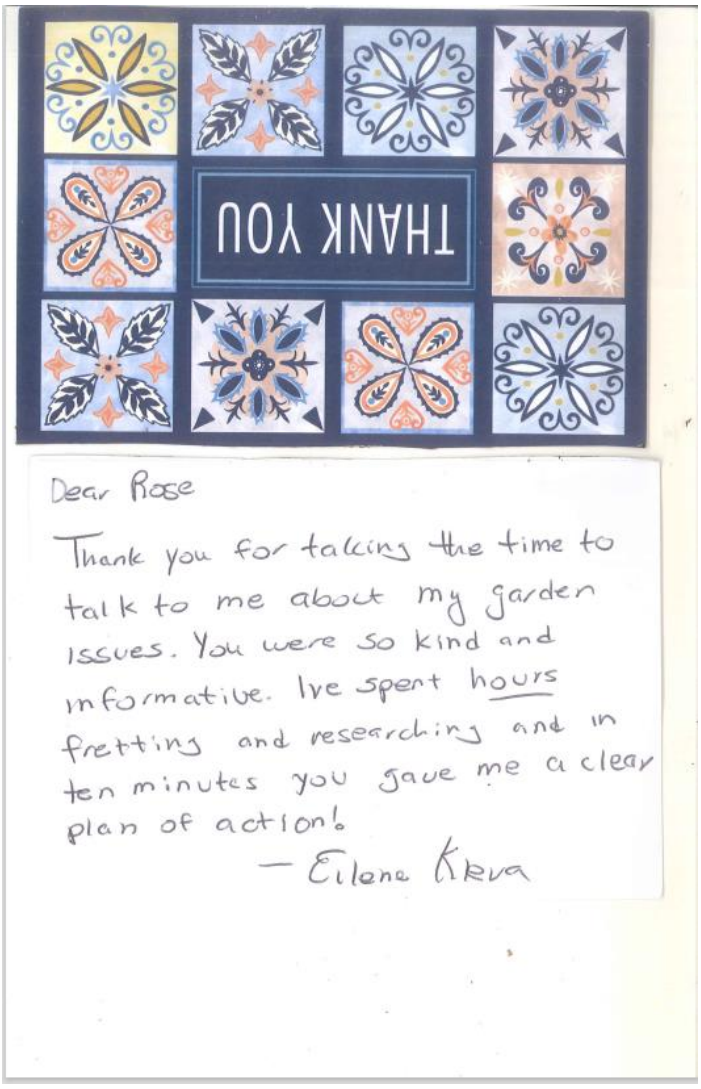
I went to look at the nest again but I didn't see any action at all. Therefore, I don't think it is worth doing anything about it. It is amazing that they build such a big thing in one year.

I always thought yellow jackets were yellow. It was a very interesting article.

If I ever find a body of one, I will bring it to you.

Thanks you so much!!

Jan

- 

- From: Lilian Ruiz
  To: Ward, Elisabeth
  Subject: Your work
  Date: Tuesday, October 17, 2023 7:45:06 AM

  Reading through your work now in the eleventh hour- it is excellent, Eli! Thank you!
  Learning so much from what you wrote.

  Lilian Ruiz
  Executive Director
  CT Council on Soil and Water Conservation
  (203)424-846

- **RE: LFSWS Beetle Report and planning for summer**
  Aimee Petras <apetras@frwa.org>
  Fri 1/19/2024 8:59 AM
  To:Cheah, Carole <Carole.Cheah@ct.gov>

  Carole,

  This is great! So many wonderful photos. If it is ok with you, we have shared it with our National River representative as they are drafting an annual report and looking for projects to highlight from each river. This one is great and you provided so many wonderful photos.

  Let me know when you want to chat. We are happy to support your project at whatever levels you think is appropriate.

  Aimee Petras
  Executive Director
  Farmington River Watershed Association
  749 Hopmeadow Street
  Simsbury, CT 06070
  860 658-4442 x205
  www.frwa.org

- On January 19 2024, Meg V, of MVH Design LLC - Dear Claire, I drove back to Westchester, NY yesterday and could not stop thinking about your amazing progress with EAB!!!!! I want to thank you for all your long hard work and work of others to have the real possibility to control the EAB in our ever-fragile ecosystem. AND you did it in a relatively short time span with bio control - simply - you and your team are amazing!!! I wish I had thought fast enough to get up and have all give you a standing ovation -(Anyway I am so appreciative and thankful for your research and dedication to help change and control the demise of our important ash trees. It will hopefully have outcomes which only improve in time. Most sincerely, Meg V certified landscape designer and arborist.

- **From:** kreczkoaj@aol.com <kreczkoaj@aol.com>
  Sent: Thursday, February 1, 2024 5:24 PM
  To: Rosemary Powers <wfrap67@gmail.com>; Cheah, Carole <Carole.Cheah@ct.gov>
  Subject: Re: Thank you!! follow up---Wooly adelgid talk cancelled at Simsbury library

  Carole,

  Thank you so much for your prompt response and for the attached material.
  And we do hope that in the future a Google search for "HWA control" will include references to your work, not simply pesticide entries as my search 3 days ago did!!

  Becky

- On February 8, 2024, Lorraine Boylan of the Harwinton Garden Club wrote the following to Felicia Millett, "Thank you for coming to the Harwinton Garden Club tonight. Your presentation is very much appreciated as we are participating in the Pollinator Pathway Project."

- On February 16, 2024, Rita Moriarty of the Down to Earth Garden Club in South Winsor wrote the following to Felicia Millett, "Our garden club has been buzzing with excitement about the program on Mountain Laurels. I want to thank you for the informative, well-documented and clear presentation you gave on Wednesday night. You gave us what I personally was expecting and much more. Well done!"
- **From:** Laura Hart <lhart@frwa.org>
  Sent: Monday, February 26, 2024 7:51 PM
  To: Cheah, Carole <Carole.Cheah@ct.gov>
  Subject: FRCC approved beetles!

  Hi Carole,

  Just wanted to let you know FRCC approved the 5,000 beetles. Let me know how you'd like me to proceed to order. They are very impressed with your work and your detailed report. Thank you from the whole committee!

  Thanks!

  Laura Hart
  Conservation Director
  Farmington River Watershed Association
  749 Hopmeadow Street
  Simsbury, CT 06070
  860-658-4442 ex202

- On March 4, 2024, Jeremiah Foley, Ph.D. received the following thank you email:

  Jeremiah, I wanted to pass along an email I got today about your lecture:

  To Whom it May Concern,

  My husband and I just returned from a fantastic discussion presented by Dr. Foley. His presentation was interesting and informative, while his commentary was sincere and extremely impressive. He was able to answer all questions posed with an impressive range of knowledge.

  As members, this is the first lecture we have attended, but if this is the quality of presenters we can expect, we look forward to attending many more in the future.

  Thank you!

  Kelly McQuade (she/her)

  Seaside Center Manager

  the Bruce

  1 Museum Drive, Greenwich, CT 06830

  P (203) 413-6768

- On March 14, 2024, Jeanne Hughes wrote the following to Felicia Millett, “Thanks for going the extra mile and researching this further. The article makes perfect sense from what I have observed. Now armed with knowledge, I have more chance of reducing or eliminating (bittercress). I really appreciate it.”

- On March 19, 2024, Susan Grant of the Burlington Garden Club wrote the following to Felicia Millett, “Wanted to let you know that you and your presentation were a big hit and enjoyed by all. We learned that there is a lot to learn about successfully growing annuals. I’m planning on starting zinnias.”

- **From:** JOHN REYNOLDS <john.reynolds5@comcast.net>
  Sent: Tuesday, April 23, 2024 8:41 AM
  To: Cheah, Carole <Carole.Cheah@ct.gov>
  Subject: Re: Invoice with Zero Balance

  Carole,

  Our two experiments, namely planting some Hemlocks and applying some beetles are underway. I hope for some initial success as a foundation for future efforts to scale up a Hemlock preservation and propagation program at Potatuck.

  Many thanks for your time last Friday. I learned a lot, and came away with a more optimistic sense of the possibilities.

  I will stay in touch,

  John

- On April 24,2024, Elise Cusano, a cut flower grower at Four Root Farm, wrote the following to Felicia Millett, “Thank you so much for your help. I feel really lucky to have you all as a resource!”

- **From:** Smith, Marilyn <msmith@townofwindsorct.com>
  Sent: Wednesday, April 24, 2024 12:23 PM
  To: Cheah, Carole <Carole.Cheah@ct.gov>; Joshua Mead <mead@townofwindsorct.com>; Nodine, Theresa <nodine@townofwindsorct.com>
  Subject: RE: Wild and Scenic Grant for 2024 S. tsugae releases to control hemlock woolly adelgid

  Hi, Carole

  Thank you so much for reaching out with this opportunity, and I apologize for the delayed response. We are very happy to participate in the adelgid control project again this year. Your notes and maps are very helpful so we can track progress in the park and I can share with others in the Town. I’m very grateful for the chance to mitigate HWA in the park, while also doing what’s best for the regional watershed. Let us know any updates as the project comes along.

  Best regards,

  Marilyn Smith
  Manager, Northwest Park
  860-285-1886

- On April 29,2024, Joan Baffaro of the Duck River Garden Club wrote the following to Felicia Millett, “It was wonderful to have you come to speak about native plants in our landscapes at our recent Duck River Garden Club meeting. Personally, I hope I am able to find the lovely native grass, “Hair-Awned Muhly”, which I didn’t previously know about. Hearing about natives, ethnobotany and the importance of our eco-region was excellent information. Thank you for sharing your expertise with us. Now off to get dirty in the garden!”

- **From:** Elaine Gan

  To: Ward, Elisabeth
  Subject: thank you so much
  Date: Thursday, May 2, 2024 9:35:20 AM

  Dear Eli,
  Thank you so much for speaking at Wesleyan! It was lovely to meet you and learn more about your research with plants, trees, and mycorrhizae. Students were thrilled to learn even just a small part of your work. And me too, of course!
  I would love to invite you back, or perhaps take my students on a field trip to visit you in the field if possible. I am teaching an upper-level seminar (small, about a dozen undergrads) called Botanical STS this Fall. It'll be a new course for me, but part of a seed grant from New England Humanities Consortium (NEHC) to try and develop curriculum that brings together the social and natural sciences with the humanities and arts to think with --not just about-- plants or vegetal life ways. It would be great to have you as guest speaker -- for longer than 30 minutes!
  I know CAES prevents you from accepting honoraria, and Wesleyan prevents us from making a donation to CAES. Maybe we can chat at some point (after university semester ends in 2-3 weeks); Helen also mentioned that you may be collaborating so I wonder how to support your research in any small way that we can figure out.
  For now, a very big THANK YOU!!!

  cheers,
  Elaine

- On May 9, 2024, the members of the Harwinton Garden Club wrote Claire, Thanks you very much for your presentation tonight. You have reminded us of how closely connected organisms are. We are so glad to have you share your knowledge as we start the new garden season, sincerely HGC

- On May 16, 2024, Simsbury, Connecticut – Town officials, in conjunction with Dr. Carole Cheah, a research scientist with the Connecticut Agricultural Experiment Station (CAES); Aimee Petras, Executive Director of the Farmington River Watershed Association (FRWA); and Sally Rieger, Simsbury Representative to the Lower Farmington River & Salmon Brook Wild and Scenic Committee (LFSWS), on Tuesday released Japanese Lady beetles (*Sasajiscymnus tsugae*) on town property at the Town Forest Park, Ethel Walker Woods, Darling Hills, and Belden Forest.
  Town Manager Marc Nelson said: “Smart and forward-thinking partnerships like this one are when we see government at its best, and we thank Dr. Cheah and her collaborators, for their tireless work protecting the environment and supporting important public education efforts.”

- **From:** Victoria McCarthy <vmccarthy@savatree.com>
  Sent: Tuesday, May 28, 2024 7:34 PM
  To: Cheah, Carole <Carole.Cheah@ct.gov>
  Subject: Re: Beetles for hemlock

  Thank you so much for the info! Vicky

  Victoria McCarthy | Arborist | SavATree | New Milford Office
  T# (203) 794-0922 x12206 | C# (203) 231-7266 | vmccarthy@savatree.com

- To:Cheah, Carole
  Thu 5/30/2024 12:52 PM
  This sender msmith@townofwindsorct.com is from outside your organization.

  Thank you, Carole! I'm so impressed you did all the releases in one day… I regret I haven't been able to participate myself, but am very grateful to have your help with this. What's good for the park is good for the entire region!

  Marilyn Smith
  Manager, Northwest Park
  860-285-1886

- On June 4, 2024, Rosemary Whelan, PhD, Professor of Biology and Chemistry, Albertus Magnus College wrote the following to several station scientists who gave a tour to Albertus Magnus students, "We would like to thank you all so much for your generosity in sharing your time and knowledge with our students last Friday. The students were so inspired by your facilities and the interesting work you are doing in your laboratories and departments."

- On June 6, 2024, Joanne Rees wrote the following to Felicia Millett, "Thank you so much—as ever, the AG Station is so helpful!"

- **From:** E L <mtlejl@outlook.com>
  Sent: Tuesday, June 11, 2024 9:04 AM
  To: Cheah, Carole <Carole.Cheah@ct.gov>
  Subject: Re: Woolly adelgid

  Hi Dr. Cheah,

  Thank you for the interesting and informative articles on the Woolly Adelgid. Your research and publications are certainly impressive and extensive.

  We have hemlocks in our wooded area that have never been sprayed with any control that are infected and are prime candidates for the Japanese Lady Beetle. I did call and email Tree Savers regarding the purchase of a colony but have not heard back yet. I am hopeful and would love to try out a colony to control the Woolly Adelgid in our hemlocks.

  Thank you again for all your help.

  Sincerely,
  Elsbeth Lawlor

- **From:** Dave Lombardo <Lombardo@zitomedia.net>
  Sent: Thursday, June 13, 2024 3:01 PM
  To: Cheah, Carole <Carole.Cheah@ct.gov>
  Subject: RE: Interesting PA factsheet

  Carole,

  Again thanks for taking the time to fix my fact sheet was going to give out. Also for clarification on questions I had. You have been very helpful and too bad the newer folks want to throw out the old proven research but I have seen this happen a lot over my career!

  I updated my fact sheet with your inputs and will be utilizing that!

  Have a good trip and hope it is a fun not work trip

  Dave

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

ADMINISTRATION

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
- Committee member of the ISO/TC 229/WG 3 on Health, Safety and Environmental Aspects of Nanotechnology
- Member, Sustainable Nanotechnology Organization (SNO)
- Member, Society of Environmental Toxicology and Chemistry (SETAC)
- Member, American Chemical Society (ACS)

DEPARTMENT OF ANALYTICAL CHEMISTRY

CHRISTIAN O. DIMKPA

- Affiliateship Of the Center for Sustainable Nanotechnology
- Senior Editor, Journal of Basic Microbiology
- Committee Member of The Iso/Tc 229/Wg 3 On Health, Safety and Environmental Aspects of Nanotechnology

- External Graduate Dissertation Examiner, School of Life and Environmental Sciences Deakin University, Australia.
- External Graduate Dissertation Examiner, Faculty of Natural and Agricultural Sciences North-West University, South Africa.

- Adjunct Gratis Faculty of The Plant Science And Landscape Architecture Department, University Of Connecticut
- Member, Sustainable Nanotechnology Organization

YI WANG
- Member, American Chemical Society
- Member, Sustainable Nanotechnology Organization
- Member, Editorial Advisory Board of Acs Agricultural Science & Technology
- Member, Editorial Advisory Board of Agronomy
- Member, Editorial Advisory Board of Plant Nano Biology

NUBIA ZUVERZA-MENA
- Member, Sustainable Nanotechnology Organization
- Member, Materials Research Society
- Member, American Chemical Society

DEPARTMENT OF ENTOMOLOGY

GOUDARZ MOLAEI
- Associate Clinical Professor, Department of Epidemiology of Microbial Diseases, Yale School of Public Health
- Editorial Board Member, *Tropical Medicine and Infectious Diseases*
- Lead, Vector-borne Disease subtopic of the Public Health Section of Connecticut Governor Council on Climate Change
- Leadership Team, Northeast Regional Center for Excellence in Vector-Borne Diseases
- Member, Multi-State Research Project NE-1443, "Biology, Ecology, and Management of Emerging Disease Vectors"

PHILIP ARMSTRONG
- Associate Clinical Professor, Department of Epidemiology of Microbial Diseases, Yale School of Public Health
- Leadership Team, Connecticut Mosquito Management Group
- Leadership Team, Northeast Regional Center for Excellence in Vector-Borne Diseases
- Member, Multi-State Research Project NE-1443, "Biology, Ecology, and Management of Emerging Disease Vectors"
- Biosafety Committee Member, Yale University

DOUG BRACKNEY
- Adjunct Assistant Clinical Professor, Department of Epidemiology of Microbial Diseases, Yale School of Public Health
- Adjunct Associate Professor in the Department of Pathobiology and Veterinary Sciences, University of Connecticut
- Academic Editor, *PLoS Neglected Tropical Diseases*
- Leadership Team, Northeast Regional Center for Excellence in Vector-Borne Diseases

- Member, Multi-State Research Project NE-1443, "Biology, Ecology, and Management of Emerging Disease Vectors"
- Biosafety Committee Member, Yale University
- Member of the American Society of Tropical Medicine and Hygiene
- Member of the American Committee of Arboviruses (ACAV)

ANGELA B. BRANSFIELD

- Member, Beta Beta Beta Biological Honor Society (Upsilon Omicron chapter)
- Member, Phi Sigma Biological Honor Society (Gamma Rho chapter)
- Member, The Connecticut Biosafety Alliance Group
- Member, The American Biological Safety Association
- Diversity, Equity, and Inclusion Committee Member, The Connecticut Agricultural Experiment Station
- Health and Safety Committee Member, The Connecticut Agricultural Experiment Station
- Biosafety Committee Member, Yale University

HANY K. M. DWECK

- Research Associate, Department of Molecular, cellular, and Developmental Biology, Yale University
- Member, Multi- State Research Project NE2001 - Harnessing Chemical Ecology to Address Agricultural Pest and Pollinator Priorities
- Editorial Board Member, *Insects*
- Review editor for *Frontier in Ecology and Evolution*, Section of Chemical Ecology
- External Reviewer for Cell Reports, Current Biology, , FEBS Journal, iScience, E, Proceedings of the National Academy of Sciences of the United States of America
- Member Entomological Society of America

KELSEY E. FISHER

- Member, Multi-State Research Project NC1173 – Sustainable Solutions to Problems Affecting Bee Health
- Member, Multi-State Research Project NC246 – Ecology and Management of Arthropods in Corn
- Editorial Board Member: Agricultural and Environmental Letters, Northeast Naturalist
- External Reviewer: Ecology and Evolution, PLOS ONE, Journal of the Lepidopterist's Society
- Science Policy Fellow, Entomological Society of America
- Member, Entomological Society of America's Insect Loss Working Group
- Secretary, Ecological Society of America's Communication and Engagement Section
- Member of Professional Societies: Entomological Society of America, Ecological Society of America, The Wildlife Society, Society of Conservation Biology, Connecticut Entomological Society, and American Entomological Society

ANDREA GLORIA-SORIA

- Leadership Team, Northeast Regional Center for Excellence in Vector-Borne Diseases/ TEC
- Laboratory Associate, Department of Ecology and Evolutionary Biology, Yale University
- Member, Multi-State Research Project NE-2443, "Biology, Ecology, and Management of Emerging Disease Vectors"
- Member Entomological Society of America
- Member Society for the Study of Evolution
- Member of Society of Vector Ecology
- Member of Latin-American Society of Vector Ecology

MEGAN A. LINSKE

- Postdoctoral Association Liaison, The Connecticut Agricultural Experiment Station

- Diversity, Equity and Inclusion Committee Member, The Connecticut Agricultural Experiment Station
- Mentoring Girls in STEM Committee Member, The Connecticut Agricultural Experiment Station
- Member, The Northeast Regional Center of Excellence in Vector-Borne Diseases
- Past President, The Wildlife Society, Northeast Section
- President, The Wildlife Society, Northeast Section
- Workshop Committee Chairperson, The Wildlife Society, Northeast Section
- Leadership Institute Co-Chairperson, The Wildlife Society
- Leadership Institute Mentor, The Wildlife Society
- Leadership Institute Selection Committee Member, The Wildlife Society
- Network and Engagement Committee Member, The Wildlife Society
- Member, The Ecological Society of America
- Certified Ecologist, The Ecological Society of America
- Adjunct Faculty, Unity College Distance Education Program
- MS Committee Member for Sandra M. Zapata-Ramirez, Western Connecticut State University

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, Connecticut Pest Management Association (CPCA)
- Co-chair, Sustainable Bethany
- Member, Entomology Society of America

CLAIRE E. RUTLEDGE
- Member, Entomological Society of America
- (Board of Directors), The Connecticut Tree Protective Association

JOHN J. SHEPARD
- Member, Connecticut Mosquito Management Group
- 2nd Vice President, Northeastern Mosquito Control Association

VICTORIA LYNN SMITH
- Member, American Phytopathological Society
- Member and Past President, Eastern Plant Board
- Member, New England Wildflower Society, Connecticut Task Force
- 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
- Administrator for eLicense for the CAES

KIRBY C. STAFFORD III (Retired as of June 1, 2022, with Emeritus status)
- Member, Board, Connecticut Coalition Against Bed Bugs
- Member, Tick IPM Working Group
- Member, NEVBD Tick Working Group
- Assistant Clinical Professor, Department of Medical Sciences, Frank H. Netter MD School of Medicine, Quinnipiac University

KIMBERLY A. STONER (Retired as of June 1, 2022, with Emeritus status)

- Member, Multi-State Research Project NC1173 – Sustainable Solutions to Problems Affecting Bee Health
- Guest Editor of Research Topic "Pollen as Food for Bees: Diversity, Nutrition, and Contamination" for the journal Frontiers in Sustainable Food Systems
- Organizer and Member, Connecticut Native Plant, Pollinator, and Wildlife Working Group
- Member of the Connecticut Friends of Right-of-Way Habitat Stakeholder Group
- Member of the Bee Nutrition Task Force of COLOSS (Society for the Prevention of Honey Bee Colony Loss)
- Member of the US National Native Bee Monitoring Research Coordination Network
- Member American Association for the Advancement of Science
- Member Entomological Society of America

TRACY ZARRILLO

- Member, Entomological Society of America
- Member, Entomological Society of Connecticut
- Member, Pollinator Advisory Committee
- External reviewer: Northeastern Naturalist
- Member, IUCN SSC Wild Bee Specialist Group
- Member, US National Native Bee Monitoring Research Coordination Network (RCN)
- Secretary (Board Member), Hamden Land Conservation Trust
- Member, Connecticut Native Plant, Pollinator, and Wildlife Working Group
- Member, Pollinator Pathway Group of Hamden

DEPARTMENT OF ENVIRONMENTAL SCIENCE AND FORESTRY

SCOTT C. WILLIAMS

- Adjunct Professor, Department of Natural Resources and the Environment, University of Connecticut, Storrs
- Certified Wildlife Biologist, The Wildlife Society
- Professional Certification Review Board, The Wildlife Society
- Executive Treasurer, Northeast Section of The Wildlife Society
- Member, The Wildlife Society
- Member, Entomological Society of America
- Associate Editor for the peer-reviewed journal, *Animals*
- Vice Chair, Town of Guilford Inland Wetlands Commission
- Vice Chair, Town of Guilford Land Acquisition Commission
- Commissioner, Town of Guilford Conservation Commission

JOSEPH P. BARSKY

- Vice-Chair, State Consulting Committee for Agricultural Science and Technology Education
- Editor, NESAF News Quarterly, New England Society of American Foresters
- Chair, Management and Utilization Working Group, New England Society of American Foresters
- Member, Connecticut Environmental Review Team

GREGORY J. BUGBEE

- Past President, Northeast Aquatic Plant Management Society
- Chair, Scholarship Committee, Northeast Aquatic Plant Management Society

- Panelist, Northeast Aquatic Nuisance Species Panel
- Member, United States Army Corps of Engineers, CT River Hydrilla Education & Outreach Working Group
- Member, United States Army Corps of Engineers, CT River Hydrilla Control Demonstration Project Working Group
- Member, Connecticut Invasive Plant Working Group
- Director, Clear Lake Improvement Association
- Member, North American Lake Management Society
- Member, Aquatic Plant Management Society

JEREMIAH R. FOLEY IV
- Member, Entomological Society of America
- Member, Aquatic Plant Management Society
- Member, North American Invasive Species Management Society

SUSANNA KERIÖ
- Secretary, Connecticut Urban Forest Council
- Secretary, Connecticut Tree Protective Examination Board
- Member, Forest Pathology Committee, American Phytopathological Society
- Member, Society of American Foresters
- Member, Yale Biosafety Committee
- Secretary, Connecticut Tree Protective Examination Board (Ex Officio)

SARA L. NASON
- Adjunct Assistant Research Scientist, Department of Plant Science and Landscape Architecture, University of Connecticut
- Website Manager, Best Practices for Non-Targeted Analysis Working Group
- Co-Chair, Stakeholder Outreach Committee, Best Practices for Non-Targeted Analysis Working Group

JOSEPH J. PIGNATELLO (Emeritus)
- Editorial Board, *Molecules*
- Editorial Board, *Environmental Engineering Science*
- Appointed Technical (Associate) Editor, *Soil Science Society of America Journal*
- Editorial Board, *Environmental Research*
- Secretary, The Connecticut Agricultural Experiment Station Research Foundation, Inc.
- Technical Board Chair of Agriculture, Food & Nutrition, Connecticut Academy of Science and Engineering

ITAMAR A. SHABTAI
- Member, Soil Health Subcommittee, Connecticut Council on Soil and Water Conservation
- Chair, Multi-State Research Project NC-1178, “Land use and management practice impacts on soil carbon and associated agroecosystems services”
- Adjunct Professor, Department of Natural Resources and the Environment, University of Connecticut, Storrs, CT
- Member, Review Panel for the Department of Energy’s Environmental Molecular Sciences Laboratory User Access grants program

BLAIRE T. STEVEN
- Adjunct Assistant Research Professor, Department of Natural Resources and the Environment, University of Connecticut

- Editorial Board, Canadian Journal of Microbiology
- Editor for the American Society of Microbiology journal Microbiology Spectrum
- Member American Society of Microbiology
- Member International Society of Microbial Ecology

ELISABETH B. WARD
- Member, State Coordinators Committee, Forest Ecosystem Monitoring Cooperative
- Member, Multi-state Beech Leaf Disease Working Group
- Member, Society of American Foresters
- Member, Ecological Society of America
- Member, American Geophysical Union

JEFFREY S. WARD (Emeritus)
- Executive Board, Connecticut Forest and Park Association
- Trustee, Great Mountain Forest
- Secretary, Connecticut Tree Protection Examination Board

LEIGH J. WHITTINGHIL
- Editorial Board, Journal of Living Architecture
- Member, Scientific Committee for the 2022 Urban Food System Symposium conference
- Member, Planning Committee, Connecticut Vegetable and Fruit Conference
- Member, Connecticut State Consulting Committee for Agricultural Science and Technology Education
- Member, Connecticut Council on Soil and Water Conservation
- Member, Soil Health Subcommittee, Connecticut Council on Soil and Water Conservation
- Scientist Mentor, CAES Postdoctoral Scholar Association
- Member, grant review panel, CT Department of Agriculture
- Member, grant review panel, USDA NIFA

DEPARTMENT OF PLANT PATHOLOGY AND ECOLOGY

LINDSAY R. TRIPLETT
- Faculty Affiliate, Colorado State University
- Gratis Faculty, University of Connecticut
- Senior Editor, Phytobiomes
- Chair, APHIS Widely Prevalent Bacteria Committee
- Member, Dissertation Advisory Committee, University of Connecticut
- Member, Bacteriology Committee, American Phytopathological Society

WASHINGTON DA SILVA
- Professor Collaborator, Universidade Federal Rural do Semi-Árido (UFERSA), Brazil
- Gratis Faculty, University of Connecticut
- Member, Research Thesis Advisor, University of Maryland
- Member, Research Thesis Advisor, University of Connecticut
- Member, Thesis Advisory Committee, Universidade Federal Rural do Semi-Árido (UFERSA), Brazil
- Member, Thesis Advisory Committee, Universidade Estadual de Maringa (UEM), Brazil
- Member, Research Thesis Advisor, Universidade Federal de Viçosa (UFV), Brazil
- Member, Research Thesis Advisor, Universidade Federal do Ceara (UFC), Brazil
- Scientific Member, Connecticut Farm Wine Development Council
- Member, Science/Education Committee, Connecticut Farm Wine Development Council

- Member, New England, New York, and Canada Tree Fruit Pest Working Group
- Editor, Portuguese Translations for the Plant Health Instructor/APS Education Center
- Member, American Society for Virology (ASV)
- Member, American Phytopathological Society (APS)
- Member, Brazilian Society of Plant Pathology (SBF)
- Member, Virology Committee, American Phytopathological Society (APS)
- Member, Tropical Plant Pathology Committee, American Phytopathological Society (APS)
- Chair, Working Group, American Phytopathological Society (APS) and the Brazilian Society of Plant Pathology (SBF)

YONGHAO LI
- Member, Tree Improvement Committee, Connecticut Christmas Tree Grower Association
- Member, Scholarship Committee, Connecticut Nurserymen's Foundation
- Member, Online Communication and Web Portal Committee, National Plant Diagnostic Network
- Member, Honorary Advisory Board, Edgerton Park Conservancy

ROBERT E. MARRA
- Gratis Faculty, University of Connecticut
- Adjunct Faculty, Yale University School of the Environment, The Forest School
- Member, Beech Leaf Disease Working Group
- Member, American Phytopathological Society
- Member, Northeastern Division, American Phytopathological Society (NED-APS)
- Member, Forest Pathology Committee, American Phytopathological Society
- Member, Society of American Foresters
- Member, International Society of Arboriculture
- Member, Connecticut Tree Protection Examining Board

FELICIA MILLETT
- Chair, Proficiency Committee, National Plant Diagnostic Network
- Member, Professional Development Committee, National Plant Diagnostic Network

RAQUEL ROCHA
- Gratis Faculty, University of Connecticut
- Member, American Phytopathological Society (APS)
- Member, Genetics Society of America (GSA)
- Member, Society of Nematologists (SON)
- Member, Biological Control of Nematodes Committee, Society of Nematologists (SON)
- Member, Dissertation Advisory Committee, Federal University of Ceara (UFC), Brazil
- Member, Dissertation Advisory Committee, Universidade Estadual de Maringa (UEM), Brazil

NEIL P. SCHULTES
- Member of the Linnean society, London, UK
- President, Quinnipiac Chapter Sigma Xi, Hamden, CT
- Member, New England, New York and Canada Tree Fruit Pest Working Group
- Gratis Faculty, University of Connecticut

QUAN ZENG
- Senior Editor, Phytopathology
- Editor, Microbiology Spectrum
- Guest Editor, Frontiers in Plant Science
- Review Editor, Frontiers in Microbiology

- Member, New England, New York and Canada Tree Fruit Pest Working Group
- Member, Bacteriology Committee, American Phytopathological Society
- Member, Graduate Student Research Committees, Michigan State University (2) and University of Wisconsin-Milwaukee (1)
- Gratis faculty, University of Connecticut

VALLEY LABORATORY

DEWEI LI
- Associate editor of Frontiers in Fungal Biology (journal)
- Editorial board member of Fungal Biology and Biotechnology (journal)
- Mycological Society of America
- American Phytopathological Society
- International Association for Aerobiology
- Pan-America Aerobiology Association
- International Mycological Association

JATINDER AULAKH
- Northeastern Weed Science Society
- Weed Science Society of America
- The Connecticut Invasive Plants Working Group
- Connecticut Invasive Plant Council.

CAROLE CHEAH
- Nearctic regional section of IOBC (International Organization for BioControl of Noxious Animals and Plants)
- Honorary Advisory Board, Edgerton Park Conservancy, New Haven
- Fellow of Cambridge Philosophical Society

RICHARD COWLES
- Secretary, Connecticut Christmas Tree Growers' Association
- Entomological Society of America
- Connecticut Entomological Society, Treasurer
- Connecticut Urban Forest Council, Grant Review Panel Leader, Small and Large Grants

ROSE HISKES
- Co-Chair, Connecticut Invasive Plant Working Group

JAMES A. LAMONDIA
- Northeast Regional Project NE-2140, "Sustainable Management of Nematodes in Horticultural and Field Crop Production Systems".
- Connecticut Agricultural Information Council Chair
- 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

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.

ARMSTRONG, PHILIP M.

- Interviewed by NBC Connecticut and Connecticut Public Radio about the recent detection of EEE virus in mosquitoes (September 5).
- Interviewed by NBC Connecticut (September 19), News Channel 8 (September 21), Fox 61 (September 28) on the growing risk of EEE virus in eastern Connecticut.
- Presented "Phylogenetic Analysis of EEE virus during the 2019 Outbreak in the Northeastern U.S." to the Vector Borne Disease One Health Sharing Table Meeting for the Public Health Agency of Canada (September 12).
- Gave an overview of the mosquito surveillance program to state auditors (October 6)
- Met with the Connecticut Commissioner of Public Health and DPH staff to present findings about EEE virus activity in Connecticut and responses to protect the public (October 10):
- Met with Dr. Laura Kramer and colleagues at the University of Parma in Italy to discuss student exchanges and research collaborations in vector-borne and zoonotic diseases (November 14).
- Met with Drs. Daniel Carrion and Jennifer Wang from Yale University to develop student projects and internships at CAES related to climate change and public health (November 15).
- Gave a talk titled "An Overview of Jamestown Canyon Virus: Epidemiology and Ecology of an Emerging Arbovirus" at the Annual Northeastern Mosquito Control Association Meeting held in Mystic, CT (December 5).
- Attended the CDC Vector Week annual meeting and met with colleagues at Cornell University and the CDC to discuss plans for the Teaching and Evaluation Centers (February 6-8).
- Gave a guest lecture titled "Emergence of West Nile and Eastern Equine Encephalitis Virus in Connecticut' to undergraduate students at Central Connecticut State University (March 1)
- Gave a talk titled "Jamestown Virus Comes into View: Understanding the Threat from an Underrecognized Virus" at the Annual American Mosquito Control Meeting held in Dallas, TX (March 6)
- Gave a talk titled "Arbovirus Risk in CT: EEE, WNV, and JCV" at the Vector-Borne Disease Symposium and Workshop held at CAES New Haven campus (March 22).
- Held an online meeting with members of the Connecticut Mosquito Management Program from the Departments of Public Health and Energy and Environmental Protection to review surveillance and response plans for 2024 (May 20).
- Interviewed by WTIC about the start of statewide mosquito monitoring program and findings from last year (June 3)
- Interviewed by Hearst Media about the detection of West Nile virus in mosquitoes (June 26).

ARSENAULT, TERRI

- attended the annual meeting for the multi-state Hatch grant for industrial hemp (S1084) in Raleigh North Carolina (February 15). The hatch grant remains focused on fiber and grain hemp. The meeting included a tour of the the University of North Carolina Wilson College of Textiles which demonstrated every process of turning raw materials into consumer products such as socks and fabric. Spoke at the UCONN Cannabis symposium about optimizing testing for cannabinoids on March 16, 2023. The talk discussed how field sampling and laboratory handling affect the measurement uncertainty associated with test reports.
- TERRI ARSENAULT, MEGHAN CAHILL, CARLOS TAMEZ, PH.D., NASSIFATOU TITTIKPINA, PH.D. attended the Laboratory Flexible Funding Model (LFFM) CAP Grantee Meeting in Houston, TX

(March 12-16): TERRI ARSENAULT presented a poster on “Melamine adulteration of human food and animal feed”, she was the veteran panelist for the round table discussion of “LFFM experiences for FERN labs – vets vs NKTOB”.; CARLOS TAMEZ, PH.D. presented a poster on “Investigation of beverage adulteration with ethylene glycol”.

AULAKH, JATINDER S.

- attended the 113th Annual Plant Science day in Hamden, CT and presented a barn exhibit titled “Asiatic Dayflower Management in Christmas Trees “(August 2); reviewed a research paper titled “Selective method for invasive plant removal enhances restoration” for Restoration Ecology Journal (August 15); and reviewed a grant proposal titled “Biological Control of Arthropod Pests and Weeds” (August 28).
- attended the Northeastern Weed Science Society Meeting in Boston MA (January 8-11); presented poster titled “Weed and Christmas Tree Response to Topramezone Herbicide” (January 9); co-authored a poster titled, “Control of Glyphosate-Resistant Common Waterhemp (Amaranthus tuberculatus) in 2,4-d/Glyphosate/ Glufosinate-Resistant Soybeans” in New York (January 10); submitted a manuscript titled, “EPSPS Gene Amplification Confers Glyphosate Resistance in Palmer Amaranth in Connecticut” to the Weed Technology Journal (January 16); and submitted an article titled “Tips for Spring and Summer Weed Management in Christmas Trees” (January 22); and presented a co-authored poster titled “Impact of Spray Nozzle Types and Spray Volumes on Herbicide Efficacy for Weed Control in Enlist Soybean” at the Weed Science Society Meeting in San Antonio, TX (January 22-25).
- attended the annual meeting of the Connecticut Christmas Tree Growers Association in Middletown, CT (80 attendees) (March 2); and presented a talk titled “Postemergence weed control and crop safety of Frequency and Mission Herbicides”; and gave a talk at the Connecticut Tobacco Growers Meeting in Somers, CT titled “Herbicide Resistant Weeds and Tobacco Weed Management Review” (90 attendees) (March 6); and published an article in the Real Tree Line Magazine titled “Tips for Spring and Summer Weed Management in Christmas Trees” (March 10); and reviewed a manuscript titled “Response of Tahitian bridal veil (Gibasis pellucida) and small-leaf spiderwort (Tradescantia fluminensis) to postemergence herbicides under greenhouse conditions” for the Invasive Plant Science and Management Journal (March, 27).
- published a manuscript titled “EPSPS Gene Amplification Confers Glyphosate Resistance in Palmer Amaranth in Connecticut” in the Weed Technology Journal (online since March 18); published a manuscript titled “Ornamental Plant and Weed Response to Oxyfluorfen + Prodiamine Herbicide” in the Horticultural Technology Journal (April 10); published a factsheet titled “Chemical Control of Mugwort in Asparagus” in CAES factsheets (April 15); and gave a talk “ Identification of terrestrial Invasive plants in Connecticut” in Waterbury (18 attendees) (April 24).
- attended the Connecticut Christmas Tree growers’ twilight meeting and talked about identification and management of weeds in Christmas trees at Hemlock Hill Tree Farm – 304 Parker Avenue, Meriden, CT (60 attendees) (June 5).

BARSKY, JOSEPH

- was interviewed by Joy VanderLek (RJ Media Group) regarding the results of the 2023 Connecticut Acorn Mast Survey (November 1)
- led a guided hike titled “Biodiversity in Connecticut Forests” for the Sleeping Giant Park Association in Hamden (November 4)
- gave virtual presentation titled “The Clean Dozen - Our Silent Heroes the Native Shrubs” as part of the Land Trust Hot Topics Seminar Series, hosted by Flanders Nature Center (17 attendees) (November 14)
- gave presentation titled “Tree Identification, Biodiversity and Urban Forestry Challenges” to 12th grade environmental science students at W. F. Kaynor Technical High School in Waterbury (21 students, 1 teacher) (November 21)
- gave three presentations on “Forest Biodiversity” to 8th grade students at Ledyard Middle School (71 students, 1 teacher, 1 teacher aide) (November 27).

- spoke on “2023 Acorn Mast Survey Results” during the annual Forest Health Monitoring Workshop at CAES (65 attendees) (March 12)
- presented a research poster on the 2023 Connecticut Acorn Mast Survey Results during the New England Society of American Foresters Winter Meeting in Burlington, VT (March 26-29)
- presented a talk on forest research during ENV 674 -Yale School of the Environment field trip to the Naugatuck State Forest along (18 attendees) (April 19)

BHARADWAJ, ANUJA

- gave a talk at the UCONN seminar series titled “Analysis of marijuana products for cannabinoids.” (September 1).

BLEVINS, TIA M.

- Attended the Connecticut Nursery & Landscape Association (CNLA) Summer Field Day with presentations highlighting pests of concern for Connecticut’s green industry including beech leaf disease, spotted lanternfly, and box tree moth (July 26).
- Participated in the Horticultural Inspection Society (HIS) Eastern Chapter’s 2023 Interstate Inspection Meeting, held in Lewiston, NY. The group of 46 inspectors from the Eastern Chapter and Central Chapter of HIS visited multiple locations to observe box tree moth infestations (October 2-5); traveled to Sandwich, MA, with personnel from USDA-APHIS-Plant Protection and Quarantine and from Massachusetts and Rhode Island, to observe box tree moth at two locations (October 19).
- Attended the Connecticut Tree Protective Association’s (CTPA) 102nd annual meeting held in Plantsville, CT (January 18); and attended the two-day Winter Symposium of the Connecticut Nursery & Landscape Association held in Plantsville, CT (January 24-25).
- Attended a virtual training session about the SANC program, offered by the National Plant Board. SANC stands for Systems Approach to Nursery Certification, and it is a voluntary state-managed nursery certification program (February 22)
- Attended the 8th Annual Spotted Lanternfly Summit, hosted virtually by the National Plant Board and Cornell University. Topics included updates on biological control, detection, and monitoring of spotted lanternfly (February 28–29).
- Attended the 49th annual meeting of the Horticultural Inspection Society Eastern Chapter in Burlington, VT. Ms. Blevins, the chapter’s Archivist, participated in discussions on box tree moth, spotted lantern fly, elm zigzag sawfly, export issues, rose mosaic virus, and the regulation of pest and diseases of concern to the agricultural industry of Connecticut. (April 1-5).

BRACKNEY, DOUG, PH.D.

- Presented a talk titled “Virus-Vector Interactions: Overcoming Barriers to Infection” as part of the The influence of arboviruses on the mosquito’s journey from host-seeking to blood-feeding symposium at the American Society of Tropical Medicine and Hygiene annual conference ((October 21, 2023).
- Guest lectured at Southern Connecticut State University titled “Hematophagy, digestion, and oogenesis” (January 25, 2023).
- Guest lectured at Southern Connecticut State University titled “Virus/parasite - vector interactions” (February 1, 2024).
- Guest lectured at Southern Connecticut State University titled “Emerging tick-borne viruses” (April 18, 2024).

BRANSFIELD, ANGELA B.

- Participated in the Federal Select Agent Program’s Responsible Official webinar “eFSAP Information System Updates” (August 31).
- met with an aide from U.S. Congresswoman Rosa DeLauro's office to talk about research conducted in the Biosafety Level 3 laboratory (September 6),

- Accompanied an inspector from the Connecticut Department of Health through the two biosafety level 3 laboratories on the New Haven campus (September 14)
- Participated in the Federal Select Agent Program's Responsible Official webinar "Effluent Decontamination Systems (EDS): General Maintenance; Common Observations/Citation Analysis CY2022" (September 21)
- Met with representatives from the Office of Policy and Management and Office of Fiscal Analysis to talk about research conducted in the BSL3 Laboratory (October 6)
- Participated in the Federal Select Agent Program's Responsible Official webinar "Restricted Experiments and Enhanced Select Agents and Toxins Workgroup (Form 1: Section 7); History and Evolution of the U.S. Federal Select Agent Program (FSAP): 20 Years and Counting" (October 26)
- Participated in the "FBI Weapons of Mass Destruction & Bioeconomy Webinar" hosted by the Association for Biosafety and Biosecurity (Nov 9 & 16);
- Attended the CAES Symposium & Workshop on Vector-borne Diseases (Mar 22).

BUGBEE, GREGORY

- gave a talk entitled "Bashan Lake Update - 2023" at the annual meeting of the Bashan Lake Association at the East Haddam Grange (50 attendees) (July 21)
- gave a talk entitled "*Hydrilla* Invades the Northeast" at the Aquatic Plant Management Society Conference in Indianapolis, Indiana (60 attendees) (July 27)
- spoke on "Invasive Aquatic Plants in Connecticut" at the Southbury Public Library (August 1); interviewed on "CT River Hydrilla" by CNBC TV (August 15)
- spoke on "CT River Hydrilla" at a press conference hosted by Rep. Christine Palm and attended by Sen. Richard Blumenthal at Chester Marina (August 16)
- interviewed on "CT River Hydrilla" by WBUR radio (August 16); interviewed on "CT River Hydrilla" by FOX 61 TV (August 16)
- gave a talk entitled "Survey Methods for Aquatic Plants" to the Northeast Aquatic Plant Management Society Plant Camp at UCONN -Avery Point (40 participants) (September 12)
- gave a talk entitled "The Aquatic Vegetation of Cedar Lake, Chester, CT" to The Northeast Aquatic Plant Management Society Plant Camp at Camp Hazen (40 participants) (September 13)
- interviewed by Mark Branhill of Bird Notes on Hydrilla in the Connecticut River (September 18); gave a virtual seminar entitled "Plants/Agriculture" to the Federated Garden Club Environmental School (40 participants) (September 21)
- interviewed by Debra Atkins of the Lakeville Journal on Hydrilla in Connecticut (September 21).
- was interviewed on Connecticut River hydrilla by Adé Ben-Salahuddin for an episode of the podcast "Bird Notes" (October 1)
- interviewed by Debra Aleksinas of the Lakeville Journal on hydrilla in East Twin Lake (October 4)
- gave a virtual presentation sponsored by the Last Green Valley Advisory Committee on "Connecticut River Hydrilla" (25 attendees) (November 21)
- gave a talk entitled "CAES Aquatic Plant Surveys of Pinewood Lake" to the Pinewood Lake Association in Trumbull (35 attendees) (November 28)
- interviewed By Brian Smith as part of a podcast on the CAES Office of Aquatic Invasive Species (December 20)
- interviewed by Ed Mahoney of the Hartford Current on CAES work with Northeastern University on remote sensing of Hydrilla in the Connecticut River (December 21)
- gave two Invasive Aquatic Plants Workshops at the Envirothon at Goodwin College (50 attendees) (January 13)
- gave an update on "CAES OAIS and Hydrilla in the CT River" at a virtual meeting sponsored by the Connecticut River Conservancy (30 attendees) (January 29)

- gave an invasive aquatic plant workshop as part of the Three Rivers Community College Environmental Issues Seminar (25 attendees) (February 21)
- gave a presentation entitled “Pachaug Pond - Aquatic Vegetation Survey 2023” to the Pachaug Pond Weed Control Association at the Griswold Town Hall (30 attendees) (February 28)
- gave a talk entitled “Lake Wononpakook: 2023 Aquatic Plant Survey and Management Options” to the Lake Wononpakook Association at the Salisbury Town Hall (30 attendees) (March 16)
- gave an Invasive Aquatic Plant Workshop to Bridgeport Academy middle school students in the Trout Unlimited Program at the Beardsley Park Zoo (20 attendees) (March 26)
- presented invited talk “Invasive Aquatic Plants and Their Management” to the Essex Land Trust at Essex Town Hall (30 participants) (April 3)
- spoke on “Soil Testing” to a soils class from Southern Connecticut State University (20 participants) (April 11)
- gave a talk entitled “Container Gardening Indoors and Out” to the North Haven Garden Club at the North Haven Congregational Church. (40 participants) (April 11)
- gave a tour of the OAIS greenhouse and short talk to a 6th grade class from St. Thomas Day School (20 participants) (April 23)
- presented an invited talk on “Invasive Aquatic Plants and Their Management” at a CT DEEP training program at the American Jobs Center in Waterbury (20 attendees) (April 25)
- presented invited talk “Update on Invasive Aquatic Plants in Connecticut” at the Connecticut Federation of Lakes annual meeting at the Bristol Nature Center (70 attendees) (April 26)
- spoke at a United States Army Corps of Engineers “Hydrilla in the Connecticut River Demonstration Project” information seminar on CAES/OAIS discovery and surveillance on the problematic invasive plant (20 participants) (May 29)
- presented invited talk on “Composting” at the Church of Christ Congregational in Newington (June 2)
- gave invited talk on “Hydrilla in the Connecticut River” at a United States Army Corps of Engineers public meeting at the Middletown Town Hall (June 4)
- spoke on hydrilla in the Connecticut River at a press conference hosted by Senator Richard Blumenthal at Riverside Park in Hartford (June 26)
- gave an invited talk on “Hydrilla in the Connecticut River” at a United States Army Corps of Engineers public meeting at the East Haddam Town Hall (June 27)
- gave an Invasive Aquatic Plant Workshop to the Bantam Lake Protective Association at the Morris Town Hall (June 29)

CAHILL, MEGAN

- attended the 2023 National Rapid Response Team Face to Face meeting in Columbus, Ohio from December 5 to 7, 2023.

CANTONI, JAMIE L.

- participated in the International Festival of Arts and Ideas as a tour guide, introducing the participants to the Station’s grounds and escorting them around the Station to several key scientist speakers (15 attendees) (June 28).

CHEAH, CAROLE A.

- Gave an overview of biological control of mile-a-minute weed (MAM) to staff and forest interns (7 attendees) from the Bent of the River Audubon Center in Southbury and then led a field excursion to collect and release Rhinoncomimus latipes weevils to control MAM (July 26); gave a presentation on biological control of hemlock woolly adelgid to camp students grades 5-8 and staff from the Northwest Park Nature Center, Town of Windsor (12 attendees) and led a field tour to see hemlock trees where Sasajiscymnus tsugae predator beetles had been released (July 27).

- presented her research and implementation of HWA biological control to 9th grade students from D.F. Harris Sr. AgriScience Center at Bloomfield High School during their tour of the Valley Laboratory (21 attendees) (November 1); assessed New Hartford Land Trust properties for HWA and inclusion for biological control implementation in 2024 with the President of NHLT (November 15).
- was interviewed by Michayla Savitt, for Connecticut Public Radio on impacts of climate change on hemlocks and hemlock woolly adelgid (December 6) (https://www.nhpr.org/2023-12-28/milder-winters-mean-more-of-this-insect-invading-cts-hemlock-trees).
- was interviewed by Darcy Dennett, Firefly Film Works on biological control of hemlock woolly adelgid at Peoples State Forest for the 100th anniversary documentary (January 29).
- presented on climate change impacts shaping HWA biological control strategies in Connecticut at the Forest Health Workshop, CAES New Haven (65 attendees) (March 12); scouted for HWA on New Hartford Land Trust properties with a land trust steward (March 25); gave an evening talk on Hemlock Woolly Adelgid and the biological control programs supported by the National Wild and Scenic River Program at the Simsbury Library (40 attendees) (March 27)
- was interviewed by Timothy Brown, Editor of Connecticut Woodlands, for an article on HWA biological control (April 1); met with Foresters from the South Central Regional Water Authority to assess hemlock needs for HWA biological control at the Glen Reservoir and Lake Bethany (April 9); met with volunteers from the Wyndham Land Trust and Pomfret Audubon Center to assess previous HWA biological control efforts at the Bafflin Sanctuary and then met to discuss with the Director of the Pomfret Audubon Center (April 10); met with members of the Stream Committee of the Potatuck Club, Newtown to discuss hemlock conservation plans and assess needs for HWA biological control (April 19).
- gave an overview of biological control of HWA and inspected hemlocks at North West Camp, Appalachian Mountain Club CT Chapter in Salibury (February 25); through a federal grant from the Lower Farmington and Salmon Brook Wild and Scenic Committee funded by the National Park Service's Partnership Wild and Scenic River Program, 6,000 commercially purchased Sasajiscymnus tsugae predator of HWA were released for HWA biological control for protection of hemlocks along the Lower Farmington River and Salmon Brook in May 2024; released S. tsugae in Penwood and Talcott Mountain State Parks (May 12); led staff from Eversource in releases in riparian hemlocks along the Farmington River in the Town of Avon followed by releases along Punch Brook, Nassahegon State Forest, Town of Burlington (May 13); led Town of Simsbury staff and volunteers in releases along Stratton Brook on Town Forest Park, Ethel Walker Woods and Darling-Hills Forest (Simsbury Open Space) then at Tanager Hill, Simsbury Land Trust, with a volunteer (May 14); released at Belden Forest (Town of Simsbury) and Stratton Brook State Park (May 15); released at Town of Bloomfield's Farmington River Park and state-owned Windsor Wildlife Management Area (May 21); led CT DEEP staff and a volunteer in releases along Mountain Brook, Enders State Forest, Town of Granby (May 22); with staff from the Town of Windsor's Northwest Park Nature Center, released S. tsugae (May 28); with staff of McLean Game Refuge, Town of Granby, released S. tsugae (May 29); through a second grant from the Farmington River Coordinating Committee funded by the National Park Service's Partnership Wild and Scenic River Program, 5,000 commercially purchased S. tsugae predators of HWA were released for HWA biological control for protection of hemlocks along the Upper Farmington River in May 2024; released on a Canton Land Conservation Trust property on Onion Mountain Preserve followed by an interview with reporter Natasha Sokoloff, CT Insider, who accompanied releases with staff from the Roaring Brook Nature Center in Werner Woods, Nepaug State Forest (May 20); released along Sandy Brook, Algonquin State Forest (May 21); released at Pratt Preserve, Canton Land Conservation Trust (May 22); gave an brief overview of HWA biological control and led three volunteers from the New Hartford Land Trust in S. tsugae releases at four land trust properties on East Mountain and Torringford Brooks (3 attendees) (May 23); gave an overview of HWA biological control and led volunteers, DEEP staff and the Community Planner from the National Park Service in releases at Mathies Grove, Peoples State Forest, followed by further releases at American Legion and Tunxis State Forests, (7 attendees) (May 25); released at Peoples State Forest with volunteers including a retired CAES technician,

and was interviewed and filmed by documentary film maker Darcy Dennett of Firefly Filmworks, followed by a release at Cedar Swamp WMA in New Hartford (May 26).

COWLES, RICHARD S.

- was a coauthor with several others on "Management of beech leaf disease" and attended the symposium on this subject at the Society of Nematology annual meeting, Columbus, OH, (100 attendees) (July 10); presented "Insect management" at the Connecticut Christmas Tree Growers' Association Twilight Meeting, Harwinton (36 participants) (July 11); provided the keynote presentation "Small investments while planting have big returns" at the Christmas Tree Farmers' Association of New York, (100 participants) (July 21), and presented "Armored scale management" to the same group, (60 participants) (July 22).
- remotely presented "Small investments with large returns," a description of practices that improve establishment of transplants to the Virginia Christmas Tree Growers' Association, (30 participants) (August 4). He discussed "Armored scale management," and demonstrated "Make your own deer repellent," to the Connecticut Christmas Tree Growers' Association Fall Meeting, Mystic, (60 participants) (August 19), and the same two subjects to the MA Christmas Tree Growers' Association (60 participants) (August 20). He spoke about "Climate change and horticulture, beech leaf disease, and a new deer repellent" to the Enfield Garden Club, (20 participants) (August 23).
- demonstrated "Make your own deer repellent," to the Maine Christmas Tree Association Fall Meeting, Newburgh, ME, (60 participants) (September 9). Co-presented with JAMES LAMONDIA, PH.D., "Opening a can of worms: careers in nematology," to the Biology Department, Eastern Connecticut State University, Willimantic (30 attendees) (September 29). Demonstrated "Make your own deer repellent," and "Managing conifer root aphids, white grubs, and phytophthora with root dips at planting," to the NH/VT Christmas Tree Growers' Association Fall Meeting, Hampton Falls, NH, (60 participants) (September 30).
- presented "Facts and Fallacies of Organics" to the Spring Glen Garden Club, Hamden, (14 participants) (October 9); was interviewed by Robin Kazmier of "Science Friday" resulting in the following piece on their web site: https:// www.sciencefriday.com/articles/identify-beech-leaf-disease/ (October 11); co-presented virtually with Robert Marra, Ph.D. "Beech leaf disease biology and management," as a Flanders Land Trust Hot Topics subject, (18 attendees) (October 24); discussed "Importance of exotic invasives," to the Bloomfield High School Introduction to Agriculture class, (15 students) (October 27); was interviewed by Sophie Noelle Hartley of MIT's Science Writing Program on beech leaf disease (October 30).
- presented "Beech Leaf Disease" to arborists, Woodbury (80 participants) (November 18), interviewed by Debra Aleksinas, writer for the Lakeville Journal, about Christmas trees. This resulted in an article published on November 23; sponsored by the Connecticut Tree Protective Association, New Haven (85 participants) (November 27).
- presented "Facts and fallacies of organics," to the Ledyard Garden Club, via Zoom, (20 attendees) (January 8). He discussed "Climate weirding, causes and effects," to the South Windsor Garden Club, (28 attendees) (January 10). He talked about "Climate change, causes and impact on turf culture," to the Massachusetts Association of Lawn Care Professionals, Marlboro, MA, (190 attendees) (January 17). He provided the CAES lunchtime seminar on "Deer repellents," (25 attendees) (January 24).
- presented "The invasion continues," to the Helena Nursery workshop, Ledyard, CT (100 participants) (February 7). He discussed "Climate change and effects on plants, insects, and diseases," to the Manchester Garden Club (18 participants) (Febrary 12). He talked about "Aphids," to the Great Lakes Christmas Tree Growers via Zoom, hosted by Michigan State University (100 participants); discussed "Exotic invasives," to the CT Groundskeepers' Association, Milldale, CT (650 participants) (February 20); lectured on "Failures of neonicotinoids in turf," to the Atlantic Golf and Turf seminar, Turners Falls, MA, (80 participants) (February 21).
- presented "The physiology of needle retention," and "Root aphid management," at the CT Christmas Tree Growers' Association annual meeting in Middletown, CT (60 attendees) (March 2).
- presented "Climate change science and impacts on gardening" to the Manchester Garden Club (28

attendees) (April 8) and to the Mansfield Garden Club (25 attendees) (April 18).

- discussed insect, disease and horticultural practices in growing Christmas trees at the Twilight Meeting of the Connecticut Christmas Tree Growers' Association, Meriden (60 attendees) (June 5). He discussed "Tick and fly management" with the Reindeer Owners and Breeders Association via Zoom, (20 attendees) (June 12).

CREIGHTON, MARK H.

- Attended the annual Eastern Apicultural Society short Couse and conference at UMass Amherst (August 1–4)
- Received training at Api Engineering in Wheatfield Ill (August 13–15)
- Spoke at the Portland Public Library on Beekeeping in Connecticut (August 21)
- Visited Temple Israel in Westport, CT during their Rash Hashanah event with his educational hive and spoke with attendees over the course of a few hours (September 16)

da SILVA, WASHINGTON

- São Paulo School of Advanced Science on Nanotechnology, Agriculture & Environment conference in Campinas, SP – Brazil, Jul 3-15, 2023
- USDA-NIFA-nano Project Director meeting in Knoxville TN – Aug 10-11, 2023
- Center for Nanophase Materials Science (CNMS) at Oak Ridge National Laboratory in Knoxville TN Aug 11, 2023
- APS 2023 Annual Meeting in Denver CO – Aug 12-16, 2023
- International Congress of Plant Pathology (ICPP) in Lyon, France – Aug 20-25, 2023
- Invited seminar speaker, Department of Plant Science and Landscape Architecture at the University of Maryland, MD – Oct 2, 2023.
- The Genome Editing Symposium hosted by Texas A&M University, College Station, TX – Oct 12, 2023.
- Sussex Plant Biology Symposium, Yale University October 20, 2023
- Twilight Meeting for CT Grape Growers (Organizer), November 2023
- 12th Sustainable Nanotechnology Conference (SNO), Marina del Rey CA – Nov 10-12, 2023.
- Invited to give 10 lectures and 10 lab sessions, Department of Plant Science at the Universidade Federal do Rio Grande do Norte, Brazil December 15, 2023.
- USDA and NSF grant review panel (Panelist), December 2023
- Presented at the CT Small Fruit and Vegetable Conference held at UCONN on January 9th, 2024
- California Department of Food and Agriculture board funding grant review panel (panelist) on March 18-20, 2024
- Organized the 2024 Connecticut Farm Winery Education Symposium held at Jones Auditorium - CAES on March 26, 2024.
- Presented at USDA-NIFA-nano Project Director meeting in Manchester, NH - Jun 26, 2024.
- CAES/UCONN Institute of Materials Science Nanoparticle research meeting. Storrs, CT – Jun 4, 2024.

DENG, CHAOYI

- participated in a collaborative symposium on Nano-enabled Agriculture Symposium at UMass Amherst (July 25).
- attended the Gordon Research Conference at the Southern New Hampshire University between June 23 and 28 and presented a poster on Nanoscale CuO Coating Controls Attachment To and Absorption Across the Leaf Biointerface.

DIMKPA, CHRISTIAN

- Gave a virtual presentation entitled "Nanotechnology in agro-environmental research: insights into implications and applications" on July 4th 2023 at the Bio-Geo Colloquium of the University of Jena,

Germany. The presentation was attended by 32 persons, including faculty, students and staff of the Institute of Geosciences, Institute of Microbiology and Institute of Biodiversity.

- Participated in a collaborative symposium on Nano-enabled Agriculture at UMass (Amherst, MA) on July 25th 2023 (25 participants).
- Was a keynote speaker at the 1st International Conference on Soil Sustainability and Innovation (ICSSI) as part of the 47th National Congress of Soil Sciences activities of Mexico. Dr. Dimkpa gave a presentation on *Nanomaterials in agriculture: insights into soil health and quality implications*. The event took place at the National Autonomous University of Mexico (UNAM) Mexico City from October 16 to 20, 2024. The congress brought together scientists, academics, technicians, students, businesspeople, and agricultural and forestry producers to exchange experiences related to the rational and efficient use of soil resources that ultimately lead to sustainable development. Attendance was approximately 150 participants. During the meeting, a group of the participants visited the CORENADR Agricultural Research Center in Xochimilco (pictured).

- Drs. Jingyi Zhou, Paul Aikpokpodion, Nubia Zuverza-Mena, Christian Dimkpa, and Jason White attended the 12th Sustainable Nanotechnology Organization's annual meeting which held in Marina Del Rey, California between November 9 and 12, 2023. Dr. Jingyi Zhou gave a poster presentation. Dr. Aikpkpodion and Zuverza-Mena gave oral presentations. Dr. Dimkpa and Dr White chaired different sessions during the meeting. (120 participants).
- Gave a presentation entitled "A unique blend of regulatory and research efforts towards food and environmental safety" to the Plant Science and Landscape Architecture Department of the University of Connecticut on February 16, 2024. (About 30 participants).
- Was a keynote Speaker at the Annual Conference of the Phytopathology Society of Nigeria (PSN) during April 21- 24, 2024. During the event, Dr. Dimkpa organized a workshop on "Nanotechnology Applications to Address Plant Disease and Increase Yield", followed by a presentation on "Nano-Enabled Applications for Plant Disease Control". Over 100 participants attended the conference. Dr. Dimkpa also made a book presentation to the PSN. The book is entitled Mineral Nutrition and Plant Disease, the Chapter 11 of which was co-authored by Dimkpa and Wade Elmer.

DOHERTY, RILEY

- gave an aquatic plant workshop to 7-9 year olds for the Ledyard Parks and Recreation Department (85 attendees) (July 26)
- gave an aquatic plant workshop to the Four Oakes Day Camp in Redding (20 attendees)
- gave a presentation entitled “Pachaug Pond - Aquatic Vegetation Survey 2023” to the Pachaug Pond Weed Control Association at the Griswold Town Hall (30 attendees) (February 28)
- gave an Invasive Aquatic Plant Workshop to Bridgeport Academy middle school students in the Trout Unlimited Program at the Beardsley Park Zoo (20 attendees) (March 26)
- gave a GIS workshop to a group of Sound School high school students to teach them how to utilize free ArcGIS online tools for their environmental justice project (15 students) (March 6)
- presented on the new web mapping application for statewide invasive aquatic species data for the Essex Land Trust in the talk “The Spread of Aquatic Invasive Species in Connecticut” (30 participants) (April 3)
- presented on the new web mapping application for statewide invasive aquatic species data at the Connecticut Federation of Lakes Annual Meeting (70 people) (April 27)
- presented an invasive aquatic plant workshop with SUMMER STEBBINS for the Eightmile River Wild & Scenic Watershed and the Salmon River Watershed Partnership at the East Haddam Town Hall (May 1) (20 attendees)

DUGAS, KATHERINE

- Attended the monthly Managed Pollinator Protection Plans working group virtual meeting (July 20); and University of Georgia (July21)
- Attended a webinar through Monarch Joint Venture to learn about combining solar energy strategies with monarch butterfly and pollinator conservation (July 25).
- Led a hands-on insect collecting and identification activity with students at Edgerton Park (30 attendees) (May 28).

DWECK, HANY

- Presented a talk on" Olfaction in Spotted Lanternfly" at Yale University (November 16, 2023) (20 attendees)
- Presented a talk on" Functional Characterization and Evolution of olfactory responses in Coeloconic sensilla of the global fruit pest D. suzukii " at Yale University (March 21, 2024) (20 attendees)
- Presented a talk on" The Emergence of a Pest Fly: The Neurobiology of Ecological Niche Adaptations" at Yale University (June 21, 2024) (20 attendees)

EITZER, BRIAN D.

- Attended the 59th annual North American Chemical Residue Workshop in Fort Lauderdale, Florida July 23-27. Dr. Eitzer is a member of the board of directors for the conference and acts as a judge of the posters.

FISHER, KELSEY E.

- Presented a webinar titled "Monarch butterfly ecology, behavior, and vulnerabilities in North Central United States Agricultural Landscapes" in collaboration with Dr. Steven Bradbury (Iowa State University) and Dr. Niranjana Krishnan (University of Maryland) for the Corteva Agrosciences Ecological Modeling Seminar Series for 85 attendees (July 12)
- Presented a table display on monarch butterfly ecology and conservation needs at the All Things Pollinator outreach event serving the Newhallville community with the Community Placemaking Engagement Network in New Haven, CT for 30 attendees (July 15)
- Presented about general entomology and monarch butterfly ecology and conservation (2-hour event) for the CT DEEP Teacher Summer Camp at Lockwood Farm with Katherine Dugas for 15 attendees (July 19)
- Presented virtually "Advancing monarch butterfly conservation through engaged research" within the "Approaches to engaged scholarship in ecology and adjacent fields" inspire session of the Ecological Society of America annual meeting (August 7)
- Provided statement to Joy VanderLek with the Cheshire Citizen (August 7) on monarch butterfly populations https://www.zip06.com/living/20230905/where-are-the-bees-and-butterflies-in-2023/
- Provided statement to Kathy Connolly with Zip06.com (August 21) on monarch butterfly populations https://issuu.com/recordjournal/docs/sc081823/s/30004278
- Presented "Monarchs in Motion" for Earthplace's Environmental Learning Series in Westport, CT for 15 attendees (September 7)
- Served as a panelist for the Entomological Society of America Early Career Professional Career Track Webinar series for State/County Government (September 12; https://www.entsoc.org/events/webinars/archive/ecp-career-track-state-county-gov)
- Served as an Entomological Society of America Science Policy Fellow in Washington DC and met with staff from Health & Bioscience Innovation Practice Group, USDA NIFA, Smithsonian Institution Entomological Collections, US FS, USDA APHIS, DOI, CDC, DARPA, NIH (September 18-20);
- Interviewed by Rich Hill and Laura Modlin on the Organic Farm Stand radio show on WPKN 89.5 (October 19).
  https://soundcloud.com/wpkn895/nextfarm?utm_source=clipboard&utm_campaign=wtshare&utm_medium=widget&utm_content=https%253A%252F%252Fsoundcloud.com%252Fwpkn895%252Fnextfarm
- Presented "Monarch Butterfly Biology, Ecology, and Conservation Needs" for 250 attendees at the UConn Native Plants and Pollinator Conference (Nov 2)
- Attended Entomology 2023 in National Harbor, MD from November 5-8, 2023: presented oral presentation "My path to conducting research as a state employee" in the "Exploring alternative careers as an ECP so you are more prepared and less scared" symposium (Nov 7); organized and moderated a symposium titled "Policies that worked: How policy shapes entomology and impacts people" and a corresponding workshop titled "Priorities into policy: Driving change on the next generation of policies that work" (Nov 7); presented a research poster "Insect movement ecology informs management strategies" (Nov 7);
- Presented "Monarch Butterfly Biology, Ecology, and Conservation Needs" at the Connecticut

Entomological Society's 580th monthly meeting (Nov 17).

- Attended and presented on work related to European corn borer to subject experts (~ 30 attendees) at the multistate NC246: Ecology and Management of Arthropods in Corn annual working group meeting in Savannah, GA (Jan 22-25).
- Presented "Conservation and restoration recommendations that align with monarch butterfly behavior and biological needs" at University of Connecticut's Plant Science and Landscape Architecture departmental seminar for 45 attendees (Feb 9)
- Presented "Using the stable isotope of nitrogen as a long-term marking strategy to estimate natural dispersal capacity of spotted lanternfly" for Earthplace's Environmental Learning Series in Westport, CT for 12 attendees with Dr. Claire Rutledge (Feb 15)
- Presented "Conservation and restoration recommendations that align with monarch butterfly behavior and biological needs" at Western Connecticut State University's biology departmental seminar for 30 attendees (Feb 22)
- Presented "Conservation and restoration recommendations that align with monarch butterfly behavior and biological needs" at Stonehill College's biology departmental seminar for 20 attendees (Feb 23).
- Attended and presented "Is SLF a Forest Pest" at the Forest Health Monitoring Workshop (Mar 12)
- Presented a table about monarch butterfly conservation at Ag Day at the Capital in Hartford, CT (Mar 20)
- Presented "Temporal and spatial trends in continental-scale monarch butterfly dispersal" during Wesleyan University's environmental science Departmental seminar and met with faculty members for ~35 attendees (Mar 28).
- Presented "Conservation and restoration recommendations that align with monarch butterfly behavior and biological needs" for Wallingford Garden Club for 30 attendees (Apr 9)
- Presented about bumblebees for third graders at Seth G. Haley School for Mayor Borer's Earth Day event (~100 students; Apr 22)
- Presented "Understanding insect movement and dispersal behavior helps protect pollinators and biodiversity" for the Experiment Station Associates (Apr 24)
- Table display with Gale Ridge about careers in entomology at the Amity School Environmental Science Career Day (May 1; ~100 high school students)
- Presented "Conservation and restoration recommendations that align with monarch butterfly behavior and biological needs" for the Cheshire Public Library and Cheshire Pollinator Pathway (May 7; 20 adults)
- Presented a research update at the CAES Board of Control meeting (May 21)
- Presented "Conservation and restoration recommendations that align with monarch butterfly behavior and biological needs" for the Bethany Land Trust (May 23; 75 adults).
- Presented "Conservation and restoration recommendations that align with monarch butterfly behavior and biological needs" for the Connecticut Butterfly Association (June 8; 45 attendees).

FOLEY, JEREMIAH IV

- co-presented "Novel *Hydrilla* Invades the Northeast" at the 63rd Annual Meeting of the National Aquatic Plant Management Society, Indianapolis, IN (July 24-27)
- interviewed by Elizabeth Regan from The Day on an article titled "Scientists conduct dye test as they look to rid Connecticut River of invasive weed" (August 30)
- was interviewed by Amelia Nierenberg of the New York Times on the state of the Hydrilla infestation in the Connecticut River (September 6)
- was interviewed by WCBS 880 News on the threat *Hydrilla* poses to the Connecticut River (November 29)
- was interviewed by Northeastern Global News about his role as an advisor to a group of 19 mechanical and computer engineering students working on their capstone project. The project centers around developing an autonomous rover with the ability to detect *Hydrilla* underwater using hyperspectral

analysis. The article "Northeastern students develop robotic boat to attack invasive plants" was published by "The ROBOT REPORT" (December 17).

- presented talk voted "most liked" at the Northeastern Aquatic Plant Management Society titled "The Spread and Establishment of Connecticut River Hydrilla Outside of the Connecticut River" in Portsmouth, NH (250 attendees) (January 10)
- gave invited presentation titled "Ripples of Invasion: Understanding the Spread and Impact of Aquatic Invasive Plants" to The Bruce Museum in Greenwich, CT (30 attendees) (March 3)
- gave an update on Connecticut River hydrilla to the Essex Land Trust at the Essex Town Hall (30 attendees) (April 3)
- presented a terrestrial invasive pest workshop as part of a CT DEEP training program at the American Jobs Center in Waterbury (20 attendees) (April 24)
- gave an update on Connecticut River hydrilla to the Connecticut Confederate of Lakes (70 attendees) (April 27)
- interviewed by Michigan State University Extension for an article on the threat of hydrilla expansion in new lakes and ponds throughout Connecticut (May 15)
- gave a presentation about beneficial insects titled "Big and Pretty or Both" to the YMCA Learning Community at Choate School (30 children, 4 teachers) (May 31).
- gave an Invasive Aquatic Plant Workshop to the Bantam Lake Protective Association at the Morris Town Hall (June 29)
- presented an invited lecture titled "Ripple of Invasion: The Spread and Impact of Aquatic Invasive Species" to Big Pond Association in Otis, MA (50 attendees) (June 15)

GIESBRECHT, DAVID

- Presented a talk on "genomic approaches to better understand insecticide resistance in Culex pipiens" at the Northeast Mosquito Control Association Annual Meeting in Mystic, Connecticut (December 4-6).

GLORIA-SORIA, ANDREA

- Gave the talk "Evolutionary history and population genetics of the Aegypti group in the South West Indian Ocean" at the "Beyond the Bite: Natural history, Systematics, and Ecology Enhance Knowledge of Our Most Deadly Foe" symposium. Entomological Society of America Annual Meeting, November 5-8, 2024. National Harbor, MD (80 attendees).
- Gave the invited talk "The invasion history of the yellow fever mosquito, Aedes aegypti" at Texas Tech Biology Department weekly seminar series on January 31st, 2024, Lubbock, Texas (80 attendees).
- Gave the talk "Addressing vector control challenges using a population genetics approach" at the Vector-Borne Symposium hosted by the Connecticut Agricultural Experiment Station on March 22, 2024, New Haven, CT (110 attendees).
- Gave the lecture "Vector Population Genetics and Control", as part of the Thursday Afternoon Southern Connecticut State University Graduate Seminar Series in Vector Control. In-person. Southern Connecticut State University, New Haven, CT. March 28, 2024 (4 students).
- Participated as a poster judge at the 13th Sigma Xi Student Research Conference that took place on April 24, 2024 at Quinnipiac University (70 attendees).
- Presented the talk "Argentina may hold the key to understanding Aedes aegypti domestication" at the Vector Biology & Zoonotic diseases Yale Institute for Global Health Faculty Network quarterly meeting on May 10, 2024, New Haven, CT (50 attendees).
- Meet with seven students enrolled in the Summer Research Training Program at Albertus Magnus College and two of their professors to talk about her research and tour the Gloria-Soria laboratory and associated CAES facilities on May 31, 2024 at CAES.

- Presented the research short talk “New challenges in vector control and how population genetics can help”(~70 attendees) and hosted the “Kids Corner” activity booth during the 114th Plant Science Day of the Connecticut Agricultural Experiment Station on August 7, 2024.
- Presented the talk “Population genetics of insecticide resistance in the Culex pipiens complex within the USA” at the International Congress of Entomology 2024, hosted in Kyoto Japan (80 attendees). August 25-30, 2024.
- Gave the virtual lecture “Mosquito Biology, Ecology, and Behavior”, as part of the Graduate Biology Seminar series in Vector Biology at Central Connecticut State University on September 3 (5 students, 2 professors).
- Gave the lecture “Vector Population Genetics and Control”, as part of the BIO337/598 Medically Important Arthropods course offered by Southern Connecticut State University. October 28, 2024 (18 students, 1 professor).
- Presented the talk “Diversity of the Aedes aegypti group in the Southwest Indian Ocean” at the European Society of Vector Ecology annual meeting in Montpellier, France on October 14-17, 2024 (300 attendees).
- Participated in an outreach research panel: El dengue y otros virus transmitidos por mosquitos.¿Es possible evitar su avance? (Spanish). Broadcasted by the School of Public Health in Cuernavaca, Mexico via social media. October 7, 2024.
- Gave invited lectures “Evolución y marcadores genéticos de los mosquitos Aedes aegypti ” and “Competencia vectorial de los mosquitos Aedes spp para transmitir arbovirus ” (Spanish) at the "New insights in dengue and other arboviruses: from molecular biology to public health" workshop hosted by the Research Center for Infectious Diseases at the National Instituto of Public Health in Cuernavaca, Mexico (40 student attendees; 20 professional attendees). September 30 – October 4, 2024.

HISKES, ROSE T.

- assisted Peter Picone, DEEP Wildlife on a free Invasive and Native Plant Walk and Talk at Robbins Swamp Wildlife Management Area, Canaan, (15 attendees) (August 27). She conducted a site visit to Mill Woods Pond Park, Wethersfield, with Tree Warden Brian Kenny to examine a dead hickory tree. The tree had been stuck by lightning (September 12). Taught a class on invasive plants to the Federated Garden Club school via Zoom (25 attendees) (September 14). Along with KATHERINE DUGAS and JACOB RICKER, staffed the CAES information booth at the Big E, Springfield, MA (September 19).
- with Victoria Wallace from UConn Extension, conducted a General Meeting and a Steering Committee Meeting of the Connecticut Invasive Plant Working Group (CIPWG) at the Tolland Agricultural Center in Tolland (15 and 10 attendees respectively) (October 11); taught a class on Exotic Insects to the St. Joseph College entomology class via Zoom (11 attendees) (October 18); participated as the Connecticut Agricultural Experiment Station (CAES) representative at the Invasive Plant Council (IPC) meeting via Zoom (October 18); mentored Wilton High School sophomore Shriya Natajaran with her science project developing an artificial intelligence app that would analyze photos of invasive plants over time and space (October 20); with other Valley Lab staff, presented the Diagnostic Office work to Bloomfield Agriscience Freshman (11 attendees) (October 27).
- with other Valley Laboratory staff, presented the Diagnostic Office work to Bloomfield Agriscience Freshman (21 attendees) (November 1); mentored Wilton High School sophomore, Shriya Natajaran, with her science project developing an artificial intelligence app that would analyze photos of invasive plants over time and space via Zoom (November 28-29).
- mentored Wilton High School sophomore Shriya Natajaran with her science project developing an artificial intelligence app that would analyze photos of invasive plants over time and space via Zoom (January 22).
- participated in a virtual invasive plant focus group run by UCONN Sustainable Landscape team (Feb. 9), participated in a virtual Connecticut Invasive Plant Working Group (CIPWG) Symposium Planning Committee meeting (Feb 15), with Felicia Millett, staffed at CAES booth at the Connecticut Groundskeepers winter meeting in Southington (Feb. 20), participated in the virtual CAPS meeting (Feb 21), organized, set up and staffed the CIPWG display at the Connecticut Flower Show; mentored Wilton

High School sophomore Shriya Natajaran with her science project final report (Feb. 29)

- gave a talk on “Exotic Insects and Jumping Worms” to the Tolland Garden Paths Club at the Tolland Agricultural Center (17 attendees) (March 2); participated in a virtual Connecticut Invasive Plant Working Group (CIPWG) Symposium Planning Committee meeting (March 14); led a meeting of the Connecticut Invasive Plant Outdoor Educators on Zoom (March 26). She participated in the Connecticut Tree Protective Association Arboriculture 101 Review Night (36 attendees) (April 4); participated in a virtual Connecticut Invasive Plant Working Group (CIPWG) Symposium Planning Committee meeting (April 17); organized the CIPWG display for the West Hartford Earth Day (April 20) and Hamden Earth Day (April 27); gave a talk on “Invasive Plants: The Silent Invaders” at the Stafford Library in Stafford (19 attendees) (April 22) as well as at the Gardeners of Simsbury meeting at the Simsbury Library (30 attendees) (April 23); led a meeting of the Connecticut Invasive Plant Outdoor Educators on Zoom (April 23).
- participated in CIPWG symposium planning committee meetings via zoom (May 10 & 22).

KHALIL, NOELLE

- Attended the CCSU Biology Internship and Career Fair and presented a short talk on research and tick testing services at the CAES Tick and Tick-borne Pathogen Surveillance Program (Tick Testing Laboratory) (February 5)
- Presented an invited lecture with MEGAN LINSKE, PH.D., titled “Tick Biology, Ecology, and Behavior” at Southern Connecticut State University (8 attendees) (April 4)

KERIÖ, SUSANNA

- gave a talk on "Basic Tree Biology and Physiology" at the Connecticut Tree Warden Association’s Tree Warden School (47 participants) (September 7)
- attended the NE1833 Multistate Chestnut Research Project meeting in Chattanooga, TN and presented a talk on "Chestnut Research in CAES" (18 participants) (September 7-10)
- gave a talk at the Sussex Symposium at Yale University titled "Conditions impacting maple health in New Haven" (30 attendees) (October 20)
- presented research poster titled "Association of hardscape and site factors with street tree condition in New Haven, Connecticut" at the USDA Interagency Research Forum on Invasive Species in Annapolis, MD (January 9-12)
- gave a keynote talk titled "Urban Tree Health - Management Challenges and Research Opportunities" at the CT Society of American Foresters meeting (40 participants) (February 8)
- presented a talk "Sooty Bark Disease - Should We Worry?" at the Connecticut Forest Health Monitoring Workshop (65 attendees) (March 12)
- gave an invited talk on "Urban tree pathology" at Wesleyan University (30 participants) (April 26)
- presented two talks at the International Union of Forest Research Organizations World Congress in Stockholm, Sweden titled "Mycorrhizal Inoculation: Promoting Tree Health and Survival in a Changing Climate" (200 attendees) (June 25) and "Impact of Neighborhood-Scale Urban Site Factors and Soil Conditions on Urban Tree Health" (70 attendees) (June 27)

LAMONDIA, JAMES A. (EMERITUS)

- accepted the Century Farm Award for Horton Farms as a part of the CAES Plant Science Day (August 5); conducted a tour of tobacco plots and breeding lines with Lewis Flowers (Universal Leaf) (August 9); and presented a webinar ‘Battling Boxwood Blight’ as a part of the Boxwood Blight Insight Group webinar series hosted by the Horticultural Research Institute (250 attendees) (August 23).presented a seminar at Eastern Connecticut State University on Nematology and Beech Leaf Disease with RICHARD COWLES, PH.D., (25 attendees) (September 29).
- and RICHARD COWLES, PH.D. were interviewed about beech leaf disease by Jennifer Ahrens of Connecticut Public Radio WNPR (October 11).

- spoke about tobacco breeding and progress in resistance development at the CAES Tobacco Research meeting held in Somers (90 attendees) (March 6); and participated in Agriculture Day at the Capital, speaking about the 2023 Century Farm Award recognizing Horton Farms (100 attendees) (March 20).

LI, DEWEI

- presented an online seminar on "New fungal species and new diseases" to The Annual meeting of Wuhan Society of Forestry (60 attendees) (September 28) via Tencent Meeting.
- along with RICH COWLES, PH.D., NATE WESTRICK, PH.D., JIM PRESTE, ROSE HISKES, and DIANE RIDDLE hosted a visit by Bloomfield Agriscience Freshman (11 attendees) (October 27). Each Valley Laboratory staff member made an oral presentation about their research/work to the students and their teacher.
- along with_CAROLE CHEAH, PH.D., RICHARD COWLES, PH.D., ROSE HISKES, MICHELLE SALVAS, DIANE RIDDLE, and NATE WESTRICK, PH.D. hosted a visit by Bloomfield Agriscience Freshman (21 attendees) (November 1). Each aforementioned Valley Laboratory staff member made an oral presentation about their re search/work and Valley Laboratory to the students and their teachers.
- participated in an international online conference 'The Genus Phy tophthora - Don't Change a Winning Concept?' (April 22-26)

LI, YONGHAO

- Spoke about "Plant Diagnosticians" at the Career Panel for the Plant Health Fellows in Jones Auditorium (July 31).
- Presented "Pruning Woody Plants" at the Plant Science Day Demonstration Tent (August 2).
- "What's Wrong with My Plants?" and "Check it Out: How to Evaluate Container Plant Quality – A hands on Demonstration" at Flourish: Unveiling the Secrets of Plants to Elevate Your Designs Workshop organized by The Connecticut Chapter of the American Society of Landscape Architects in Lebanon, CT (August 3)
- "Where do apples come from?" West Haven Parks & Rec. Summer camp (August 8)
- Presented "Three Common Tree Diseases in 2023" for the Tree Warden Workshop (September 15)
- Presented "Tree Diseases" for Tree Warden School (September 21)
- CT Arboriculture 101 Course (September, October, December, February, and April)
- CTPA Summer Meeting (July 21)
- "Tree Diseases" – CTPA Arboriculture 101 Course (October 12)
- Presented "Common Perennial Diseases and Their Managements" to the Kensington Garden Club members in Berlin (35 adult) (October 19);
- "Common Diseases of Perennials" – Colchester Garden Club (October 23)
- "Tree Diseases – Hand-on Night" – CTPA Arboriculture 101 Course (October 26)
- Presented "Backyard Composting" to Morris Cove Garden Club members in New Haven (13 adults) (November 8),
- "Pruning Woody Plants in the Landscape" for the Town and Garden Club of Newtown (November 8)
- "Tree Diseases – Review Night" – CTPA Arboriculture 101 Course (December 7)
- "Phytophthora bleeding canker – Review Night" CTPA Arboriculrure 101 Course (December 7)
- Vegetable & Small Fruit Growers' Conference (January 9)
- "All bout Fungi and Fungicides: What Every Gardener Need to Know" Burlington Garden Club in Burington (January 11)
- CTPA Winter Meeting (January 18)
- CNLA Winter Meeting (January 24)
- Presented "Recap 2023, Bedding Crop Diseases to Prepare for 2024" at UConn Bedding Crop Training Program (January 30)
- "Gardening with Native Plants" Harwinton Garden Club (February 8)

- "Growing Mountain Laurels in Connecticut" Down to Earth Garden Club, South Windsor (February 14)
- Gave a lecture "Diseases of Trees" for the Connecticut Tree Protective Association Arboriculture 101 Courses in New Haven (February 15)
- Presented "Bonsai Tree Disease Management" to the Bonsai Society of Greater Hartford in Hartford (February 20)
- CGKA Turf and Landscape Conference (February 20)
- APS Northeastern Division Industry and Extension Meeting (Disease Updates, March 6).
- "Pruning Woody Plants in the Landscape" Manchester Garden Club (March 11)
- "Diseases of Perennials" Spring Glen Garden Club (March 11)
- Presented "Common Diseases of Pines" at the Forest Health Monitoring Workshop in New Haven (March 12)
- Presented "Submitting Samples for Bacterial Leaf Scorch Testing" - Forest Health Monitoring Workshop (March 12)
- Presented "Common Diseases of Pines" at the Forest Health Monitoring Workshop in New Haven (March 12)
- "Growing Annuals from Seed" Burlington Garden Club (March 14)
- Presented "Organic and Biological Control of Plant Diseases" at the CT NOFA's Winter Conference via Zoom (March 21)
- "Pruning Woody Plants in the Landscape" Orchard Valley Garden Club of Southington (March 26)
- "Tree Diseases – Review Night" – CTPA Arboriculture 101 Course (April 4)
- Instructed "Phytophthora bleeding canker" in the Review Night of the Connecticut Tree protective Association Arboriculture 101 Course in New Haven (April 4)
- Presented "Useful Tips of Container Gardening" For Old Greenwich Garden Club and Perrot Memorial Library Educational Program in Old Greenwich via Zoom (April 22)
- "Gardening with Native Plants" Duck River Garden Club, Old Lyme (April 24)
- Hamden Earth Day Celebration (April 27)
- Presented "Backyard Composting" to Avon Public Library via Zoom (April 30)
- Presented "Organic Plant Disease Management Class" at KNOX Hartford (April 30)
- Presented "Spring and Summer Gardening Tip" to Avon Public Library in Avon (May 7)
- "Growing Annuals from Seed" Watertown Garden Club (May 9)
- "Growing Annuals from Seed" Avon Free Public Library (May 14)
- CT Envirothon (May 23)
- "Common Diseases of Tomato and Pepper" North Haven Garden Club (May 28)

LINSKE, MEGAN A.

- Hosted the Diversity, Equity, and Inclusivity (DEI) discussion section of the 2023 Leadership Institute training program at the National Wildlife Society (TWS) meeting in Louisville, KY (10 participants) (Nov 7)
- Co-hosted in the Northeast Section of TWS Annual Fall Member's Meeting (Nov 8)
- Co-hosted the FFA Forestry CDE at Lockwood Farms with 12 high schools in attendance (60 participants) (Nov 17)
- Presented an invited lecture titled "Tick Biology, Ecology, and Behavior" at Southern Connecticut State University (8 attendees) (April 4)
- Interviewed by Ms. Nicole Nalepa and Mr. Scot Haney for WFSB News to discuss "Staying Safe from Tick Bites" for families (April 15); participated in a podcast titled "Ticked Off Over Ticks" hosted by Ms. Nicole Nalepa (WFSB News) (April 15)
- Interviewed by Ed Ricciuti on recent study on the peridomestic habitat traits that correlate with increased nymphal, blacklegged tick abundances and the impact on pesticide applications (May 6)

- Presented an invited lecture on tick taxonomy (May 21) followed by a tick identification lab for the CDC-funded Northeast Center for Excellence in Vector Borne Diseases and Training and Evaluation Center Boot Camp in Scarborough, Maine (May 22, 25 attendees)

MARRA, ROBERT E.

- The Yale School of the Environment Forest School. Seminar on Beech Leaf Disease at the Yale-Myers Forest Camp.
- CT Nursery & Landscape Association: Presentation on Beech Leaf Disease. Monrovia Nursery, Granby, CT July 26, 2023.
- CT Tree Wardens Association Fall Workshop
- CT Tree Wardens Association, Fall Picnic, presentation on Beech Leaf Disease. Hammonasset Beach State Park, Madison, CT September 15.
- Flanders Land Trust: Presentation on Beech Leaf Disease. Remote October 24, 2023.
- CT Tree Wardens Association: Presentation on Oak Wilt and Beech Leaf Disease during CTWA Lunchtime Webinar January 23, 2024.
- Northeastern Division Meeting of the American Phytopathological Society, March 6-8, Ithaca, NY
- Forest Health Monitoring Workshop. Updates on Beech Leaf Disease March 12.
- CT Tree Wardens Association March 2024 Annual Meeting
- Staffed table and presented on Beech Leaf Disease at "Agriculture Day At The Capitol", joined by Dr. Kelsey Fisher (Entomology) and Milica Pavlicevic (Analytical Chemistry) March 20, 2024.
- CT Tree Protection Examining Board: Board member (6 meetings) and Examiner (4 exams)
- Organized and presented workshop, "Controlling Beech Leaf Disease on Land Trust Properties: A Landscape-scale Effort to Protect and Preserve CT's Beeches," at annual meeting of CT Land Conservation Conference, Wesleyan University Connecticut Land Conservation Council Annual Meeting, March 23, 2024.
- Yale School of the Environment, The Forest School: ENV 654, Forest Ecosystem Health and Stability in a Changing Climate. Marra is co-lecturer with USFS scientist Talbot Trotter for this class for MS students. 10 lectures and 3 field trips.
- Norfolk Conservation Commission and Norfolk Public Library. Presentation on Beech Leaf Disease May 18, 2024.
- Master Woodland Manager Field Class on Pests & Pathogens. Naugatuck State Forest June 1, 2024.

MILLETT, FELICIA

- exhibited at the CNLA Summer Field Day (July 26) (Granby, CT); participated in the NEPDN Monthly Meeting (12 adults) (July 27); and spoke at the Career Panel for the Plant Health Fellows in Jones Auditorium (15 adults) (July 31).
- presented "Pruning Woody Plants" at the Demonstration Tent during Plant Science Day 2023 (2 presentations, 75 adults each) (August 2); presented on Apple Trees to West Haven Parks and Recreation Summer Camp Program in West Haven, CT (17 youths, 4 adults) (August 8); attended USDA Federal Seed School in Gastonia, NC, (August 14–16); participated in the NPDN Proficiency Committee Meeting (7 adults) (August 22); participated in the NEPDN Monthly Meeting (15 adults) (August 24).
- participated in the NEPDN Monthly Meeting via Zoom (15 adults) (September 14); participated in the NPDN Proficiency Committee virtual Meeting (6 adults) (September 19); contributed an image of maple anthracnose to the article authored by Abby Weiss at Hearst Connecticut Media "Here's why maple leaves in Connecticut are turning brown and falling early, according to experts" published in CT Insider (September 21); and joined the Workshops and Field trips Sub-Committee for the 2024 NPDN National Meeting; visited the Plant Health Clinic at the University of Arkansas and met with Sherrie Smith and Jason Pavel for a tour of the diagnostic lab facility, Fayetteville, AR (September 27).

- participated in the National Plant Diagnostic Network (NPDN) Cross Committee Meeting (28 adults) (October 11); participated in the Northeast Plant Diagnostic Network monthly meeting (17 adults) (October 12); with Yonghao Li, PH.D. met with Elena Karlsen-Ayala, from the USDA Forest Service Northern Research Station (October 16); participated in the NPDN Proficiency Committee Meeting (6 adults) (October 17); participated in the NPDN Professional Development Committee Meeting (10 adults) (October 24); participated in the NPDN National Meeting Workshops and Fieldtrips Sub-Committee Meeting (5 adults) (October 26); and presented on "Diseases of Trees" to the CTPA Arboriculture 101 course "Tree Conditions Lab" (30 adults) (October 26).
- presented "Pruning Woody Plants in the Landscape" for the Town & Country Garden Club of Newtown, CT (50 adults); participated in the Northeast Plant Diagnostic Network monthly meeting (15 adults) (November 9); participated in the NPDN Accreditation Help Session (7 adults) (November 14); provided support for the CTPA Workshop on Beech Leaf Disease in Jones Auditorium (November 27); and participated in the NPDN National Meeting Workshops and Fieldtrips Sub-Committee Meeting (5 adults) (November 30).
- participated in the monthly meeting of the Beech Leaf Disease Working Group (46 attendees) (December 4); assisted students in the CTPA Arboriculture 101 course on Review Night in New Haven (30 attendees) (December 7); participated in the NPDN National Meeting Workshops and Fieldtrips Sub-Committee Meeting (6 attendees) (December 11); gave tour of seed testing in the PDIO Lab to the Jamica Minister of Agriculture, Fishing, and Mining as a part of the CAES tour (6 attendees) (December 11); and participated in the NPDN Proficiency Committee Meeting (6 attendees) (December 19).
- joined the NPDN Professional Development Committee; staffed the Station booth at the Connecticut Vegetable and Small Fruit Growers' Conference at UConn (January 9); participated in the NEPDN monthly meeting (17 attendees) (January 11); participated in the NPDN Proficiency committee Meeting (8 attendees) (January 16); participated in the NPDN Professional Development Committee Meeting (14 attendees) (January 16 & 30); staffed the Station booth at the CTPA Annual Meeting in Plantsville, CT (January 18); staffed the Station booth at the CNLA Winter Symposium in Plantsville, CT (January 24); participated in the NPDN IT/ Diagnostician Meeting (30 attendees) (January 25); and participated in the Bedding Plant Disease Workshop (35 attendees) (January 30).
- has taken on the position of Chair of the NPDN Proficiency Committee; participated in the NEPDN monthly meeting (18 people) (February 8); presented "Native Plant Gardening" to the Harwinton Garden Club in Harwinton (32 attendees) (February 8); presented "Growing Mountain Laurels in Connecticut" to the Down to Earth Garden Club in South Windsor (30 attendees) (February 14); staffed the CAES booth with ROSE HISKES at the Connecticut Grounds Keepers Association Turf and Landscape Conference in Plantsville, CT (February 20); led the plant disease at the CTPA Arboriculture 101 Tree Conditions Workshop (36 attendees) (February 22); participated in the NPDN Proficiency Committee Meeting (7 attendees) (February 23); and attended the USDA-APHIS PPQ Morphological Fungal Identification Techniques Workshop in Greenbelt, MD (February 27–29).
- presented "Disease Updates from 2023" at the Northeast Division Meeting of the American Phytopathological Society in Ithaca, NY (65 Attendees) (March 6- 8); presented "Collecting Samples for Detection of Bacterial Leaf Scorch" at the Forest Health Monitoring Workshop in New Haven (65 attendees) (March 12); presented "Pruning Woody Plants in the Landscape" to the Chester Garden Club in Chester, CT (22 Attendees) (March 12); reported on 2023 Accomplishments and the 2024 Plan of Work of the Proficiency Committee at the NPDN Cross Committee Meeting (47 Attendees) (March 13); presented "Growing Annuals from Seed" to the Burlington Garden Club in Burlington, CT (16 Attendees) (March 14); attended the workshop, "Production and Validation of Diagnostic Assay Controls" (March 15); attended the "ELISA Proficiency Preparation Workshop" at the USDA Plant Pathogen Confirmatory Diagnostics Laboratory (PPCDL) in Laurel, MD (March 19-20); presented "Pruning Woody Plants in the Landscape" to the Orchard Valley Garden Club in Southington, CT (36 attendees) (March 26); and participated in the NPDN Proficiency Committee Meeting (5 attendees) (March 28).

- led a plant disease discussion at the CTPA Arboriculture 101 Review Night (36 attendees) (April 4); participated in the NPDN Professional Development Committee Meeting (9 attendees) (April 9); participated in the NEPDN monthly meeting (9 attendees) (April 11); participated in the NPDN Proficiency Committee Meeting (6 attendees) (April 16); presented "Gardening with Native Plants" to the Duck River Garden Club in Old Lyme (36 attendees) (April 24); and staffed the CAES table with KATHERINE DUGAS and JAMIE CANTONI at the Hamden Earth Day Celebration (Hamden Town Center Park) (April 27).
- participated in the NEPDN monthly meeting (18 attendees) (9 May); presented "Growing Annuals from Seed" to the Watertown Garden Club (Watertown, CT) (17 attendees) (May 9); presented "Growing Annuals from Seed" to the Avon Free Public Library in Avon, CT (18 attendees) (May 14); participated in the NPDN Proficiency Committee Meeting (7 attendees) (May 21); Participated in CT Envirothon at Lockwood Farm (May 23); represented the NPDN Proficiency Committee at a meeting with NPDN Accreditation and the USDA Plant Pathogen Diagnostic Certification Program (PPDCP) (10 attendees) (May 29); and hosted a visit to Plant Disease Information Office to students from Albertus Magnus College (5 attendees) (May 31).
- participated in the NPDN Professional Development Committee monthly meeting (10 adults) (June 4); participated in the NEPDN monthly meeting (18 adults) (June 13); participated in the NPDN Proficiency Committee monthly meeting (8 adults) (June 18); and hosted the seed testing lab tour stop during the Arts and Ideas Fest Tour (25 adults) (June 28).

MOLAEI, GOUDARZ

- Interviewed by Cape Cod Times/ USA Today (July 12); WTIC Radio, NPR, WTNH, WFSB Channel 3, and Fox 61 (July 31).
- Interviewed by Hartford Courant (August 1), Record-Journal (August 3), NBC CT (August 21), Channel 3 (August 21), Connecticut Post (August 21), and CT Insider (August 24), on ticks and tick-borne diseases especially babesiosis and Powassan virus.
- Interviewed by WCBS (November 15), WTNH (November 17), and CT Insider (November 20) on the incursion and range expansion of the longhorned tick, Haemaphysalis longicornis, in Connecticut and the Northeast.
- Interviewed with the CT Examiner about tick and tick-borne diseases (Jan 11).
- Interviewed by the CT Insider: "Warmer, wetter seasons in CT are fostering more disease-carrying pests like ticks and mosquitoes" (February 26).
- Interviewed by the NBC News on tick and tick-borne diseases activity (March 11).
- Interviewed on ticks and tick-borne disease activity by the following media outlets: WTIC (April 1).
- WTNH Channel 8 (April 2), WSHU, NBC, and
- Interviewed by News 12 (April 8), NBC CT (April 23).
- Interviewed by WCBS 880 and WTNH Channel 8 (April 24),
- Interviewed by CT Insider (April 25).
- Interviewed by Boston Globe about climate change and tick-borne diseases (June 17).
- Presented an invited talk on challenges of ticks and tick-borne diseases in Connecticut (July 6).
- Presented an invited talk, "Climate Change and Invasion Potential of Human Disease Vectors", to the CT Association of Public Health Nurses (August 10).
- Presented a short talk, "Ticks & Tick-Borne Diseases As A Serious Public Health Concern" (Sept 6).
- Presented an invited talk, "Emerging Ticks & Tick-Borne Diseases As A Serious Public Health Concern" (Sept 11).
- Presented an invited talk, "Vector-Host-Pathogen Interactions and Vector-borne Disease Surveillance Programs in Connecticut" to the Biology Department, University of Bridgeport (Sept 25).
- Presented an invited talk, "Pleading for a Cross-Disciplinary Conversation: Range Expansion of Native and Invasive Ticks and Ensuing Public and Veterinary Health Challenges" to the symposium, "Rising to the

Grand Challenge: Building Collaborations for Innovative Cattle Fever Tick Research" at the annual meeting of the Entomological Society of America at National Harbor, MD (November 7-8).

- Presented an invited talk: "Eco-Epidemiology of Eastern Equine Encephalitis virus and Novel Approaches to Study Vector-Host-Pathogen Interactions" to the annual meeting of the Virginia Mosquito Control (February 20–21).
- Presented an invited talk: "New Threats and Old Enemies: Vector-Host-Pathogen Interactions and the Emergence and Expansion of Arboviruses" to the University of New Haven (March 25).
- Presented a seminar at the Southern Connecticut State University on ticks and tick-borne diseases (April 11).
- Presented a talk, "Range Expansion of Native and Invasive Ticks and Ensuing Public Health Challenges" to the Flanders Nature Center in Woodbury, CT (April 18).
- Presented a seminar at the Southern Connecticut State University on ticks and tick-borne diseases surveillance (April 25).
- provided an overview of the CAES tick and tick-borne disease surveillance programs to the state auditors (October 6).
- Attended a Lyme disease-Anaplasmosis case discussion (conference) at Yale School of Medicine
- Organized and co-edited a "Special Collection: Emerging and Lesser-Known Arboviruses Impacting Animal and Human Health", which included 10 articles, for the Journal of Medical Entomology (October 20).
- Organized a symposium and workshop on tick and tick-borne diseases in Connecticut, and presented a talk: "Pleading for a Cross-Disciplinary Conversation: Range Expansion of Native and Invasive Ticks and Ensuing Public and Veterinary Health Challenges" (March 22).
- Participated in the Northeast Regional Center for Excellence in Vector-Borne Diseases (NEVBD) and Training and Evaluation Center (TEC) Leadership meeting (October 17).
- Participated in the monthly meeting of the CT Tick-borne Disease group, including CAES, CT DPH, and Yale Emerging Infections Program, and presented a short talk about tick and tick-borne disease activity in Connecticut (October 31).
- Participated in the Northeast Regional Center of Excellence in Vector-Borne Diseases (NEVBD) and Training and Evaluation Center (TEC) Leadership Meeting to discuss the Academic Training Program (Jan 16).
- Participated in a nationwide tick blitz organized by USDA to map the distribution of the longhorned tick in the United States; tick surveys were conducted in multiple sites in eight Connecticut counties (June 17–27).
- Attended the annual meeting (virtual) of the Multistate NE1943, "Biology, Ecology, and Management of Emerging Disease Vectors" (November 27).
- Attended the first joint meeting between the Northeast Regional Center of Excellence in Vector-Borne Diseases (NEVBD) and Training and Evaluation Center (TEC) Leadership and advisory board to discuss the NEVBD-TEC programming (December 11).
- Attended the CDC Cross-Centers of Excellence for Vector-Borne Diseases Working Group on Public Health Entomology and reviewed the training activities and priorities and discussed training needs assessment collaborations (December 18).
- Attended the quarterly meeting of the New England Center of Excellence in Vector-Borne Diseases (NEWVEC) and discussed the projects' updates and progress (Jan 29).
- Attended the CDC Vector Week annual meeting and discussed several research and projects and surveillance programs with the CDC authorities (February 6–8).
- Attended the CDC Tickbite Prevention Working Group to discuss tick-bite prevention projects across the U.S. (February 16).
- Attended the monthly meeting of the New England Center of Excellence in Vector-Borne Diseases (NEWVEC) and discussed the projects' updates and progress (February 26).

- Attended the Longhorned Tick (Haemaphysalis longicornis) Stakeholders' monthly meeting and reported on the activity of this tick species in Connecticut (June 3).
- Met with Dr. Daniel Carrión and Dr. Jennifer Wang of the Yale school of Public Health to discuss collaborative projects to engage graduate students on the intersection of climate change and health as well as hosting Yale graduate students as summer interns at the Connecticut Agricultural and Experimental Station (CAES) through the Yale Center on Climate Change and Health's Climate Change and Health Summer Practice Experience Program (November 15).
- Met with representatives from Yale University School of Public Health and the University of Connecticut School of Medicine to discuss collaborative epidemiological studies on the outcomes of patients who had their ticks tested by the CAES Tick Testing Laboratory (November 17).
- Met with the Dean of the College of Science and Society, the head of the Department of Biology, and faculty at the University of Bridgeport and discussed internship and research opportunities at the CAES Center for Vector Biology & Zoonotic Diseases for their students and faculty (Jan 5).
- Met with four MPH students of EPH 555 project group and a faculty from the Yale School of Public Health and discussed a research project, "Barriers to Engagement in Passive Tick and Tick-borne Disease Surveillance Program in Connecticut" (Jan 22).
- Met (virtual) with the CDC Cross-CoE group to discuss personal protection projects against tick bite (March 14).
- Met with faculty of Department of Biology and Environmental Science and Dr. Shaily Menon, Dean and Vice Provost For Interdisciplinary Initiatives, College of Arts & Sciences, to discuss collaboration and student training at the CAES (March 25).
- As a member of the stakeholders advisory council, attended the quarterly meeting of the New England Center of Excellence in Vector-Borne Diseases (NEWVEC) and discussed the projects' updates and progress (November 20).
- As a member of the stakeholders advisory council, attended the quarterly meeting of the New England Center of Excellence in Vector-Borne Diseases (NEWVEC) and discussed the projects' updates and progress (December 18).
- As a member of the Stakeholders Advisory Committee attended the monthly meeting of the New England Center of Excellence in Vector-Borne Diseases (NEWVEC) and discussed the projects' updates and progress (March 18).

NASON, SARA

- participated in the American Chemical Society meeting (San Francisco, CA) and presented talk titled "Working with stakeholders to determine high impact research directions for non-targeted analysis" (25 attendees) and research poster titled "Expanding work on microcontaminants in agricultural and wastewater systems using non-targeted analysis with high resolution mass spectrometry" (August 12-17)
- attended the Society for Environmental Toxicology and Chemistry North America meeting in Louisville, KY (November 13-16) presented a research poster titled "Characterizing Variability in Wastewater Effluent and its Effects on Wastewater Reuse for Irrigation" (November 13)
- gave a presentation titled "Investigation of PFAS in Domestic Water Supplies in an Oil and Gas Producing Region of Northern West Virginia" (100 attendees) (November 16).
- presented at the Best Practices for Non-Targeted Analysis monthly webinar, titled "Working with stakeholders to determine high impact research directions for non-targeted analysis" (55 attendees) (February 20)

PETRUFF, TANYA A.

- Presented a talk titled, "Connecticut Mosquito Surveillance Program for West Nile Virus and Eastern Equine Encephalitis" to community members of the Middletown Senior Center (June 5).

PRAPAYOTIN-RIVEROS, KITTY

- Attended the annual US-FDA Laboratory Flexible Funding Model (LFFM) CAP Grantee Meeting in St. Louis, Missouri, November 15–17, 2022 and gave a presentation on State Experiences with ORA DX. Over 200 participants were present.

RICKER, JACOB

- Attended NPB's 2023 Interstate Inspection Meeting, in Lewiston, NY, which included discussion, presentations, and field meetings (October 2-5); virtually attended UMass Extension's 2023 Invasive Insect Certification Program (October 10-11)
- Participated in a multiagency field meeting to investigate box tree moth infestations in Barnstable County, MA (October 19).
- Attended the CT Nursery and Landscape Association's 2024 Winter Symposium where he presented "Box Tree Moth: Scouting and Monitoring" and graduated from the CT Accredited Nursery Professional program receiving his certificate of accreditation
- Attended the Eastern Plant Board's 98th Annual Meeting in Burlington, VT, which held discussions, presentations, and a meeting for the Eastern Horticultural Inspection Society (April 1-4).
- Attended a National Certified Investigator and Inspector Training course (May 20-22), held by the Council on Licensure, Enforcement, and Regulation in Austin, Texas

RIDGE, GALE E.

- Interviewed by Debra Aleksinas correspondent for the Lakeville Journal about the 2024 spongy moth activity (July 5).
- Interviewed by Andrew DeRosa of Hearst Connecticut Media Group about Hammerhead worms, Bipalium spp. Planarians who prey on the invasive Asian jumping worms, Amynthas agrestis, Amynthas tokioensis, and Metophire hilgendorfi that co-exist and present in Connecticut (Aug 8).
- Interviewed by Ed Stannard of the Hartford Courant Newspaper about bees and wasps (Aug. 9).
- Presented a webinar and lecture on Delusional Infestation sponsored by Georgia University. Attendees included numerous pest management businesses, academic institutions throughout the southeast as well as institutions and individuals in India and Canada (Aug 9).
- Interviewed by Sean Adams WCBS 880 Radio, New York about the predation of hammerhead worms on the invasive Asian jumping worms (Aug 10).
- Spoke about bed bug biology and management to service personnel and staff at St. Mary's Home, West Hartford (Sept. 6).
- Interviewed about Asian jumping worms for the Winstead Citizen and Windsor Journal (Sept. 7),
- Interviewed about the spotted lanternfly, Lycorma delicatula by the Hearst Connecticut Media Group (Sept. 7).
- Guest speaker via Zoom on arthropods of medical concern in the northeast, particularly the brown recluse and other medically significant spiders to staffs from poison control centers in Delaware, Pennsylvania, New York, and the New England states as part of their ECHO (Extension for Community Healthcare Outcomes) conference. Video of the talk was forwarded to groups in Canada, Australia, and India (Sept 19).
- Interviewed by Robert Miller reporter from the Danbury News Times about the Spotted Lanternfly, Lycoma delicatula (White), it's distribution in Connecticut and feeding damage (Oct. 2).
- Interviewed via Zoom by Susan Raff WFSB Channel 3 about brown marmorated stink bugs Halyomorpha halys, Western conifer seed bugs Leptoglossus occidentalis, and multi-colored Asian lady beetles Harmonia axyridis entering citizens homes (Oct. 3).
- Interviewed in person by Kevin WNBC CT about brown marmorated stink bugs and why they were entering citizens homes (Oct. 3).

- Interviewed about insects and plants of the Autumn by Harlan Levy of the West Hartford digital paper WeHa (Oct. 3).
- Interviewed by Kent Pierce, Channel 8 News about stink bugs and why there were more this year (Oct. 5).
- Interviewed by Abby Weiss of Hearst Media, CT about stink bugs and how to manage them in buildings (Oct. 5).
- Presented a talk on Asian jumping worms via zoom as part of the Cornell University New York State IPM program. The talk was published on YouTube https://youtu.be/n6yEsO4bcls?si=NUPkmh3VgrpiEUtc (Oct. 6).
- Interview by Alice Park journalist for Time Magazine about a current issue of bed bug infestations in Paris prior to the 2024 summer Olympics which the city is hosting (Oct 6).
- Spoke about managing bed bugs at two senior residences under Berlin Senior Housing. She spoke first at Marjorie Moore, then Percival Heights senior residences (Nov. 8).
- Delivered a 2-hour lecture about Delusional Infestation to the UMass Extension Pesticide Education group. The talk was then forwarded to the Colorado State University Extension services (Nov. 15).
- Presented a talk on jumping worms to the Hardy Plant Society (Nov 29).
- Attended a two-day virtual workshop sponsored by the National Academies of Sciences, Engineering, and Medicine on mitigating arboviral threats and strengthening public health preparedness (Dec. 12-13).
- Attended a webcast sponsored by the National Academies of Sciences, Engineering, and Medicine on assessment of the impact of social media on the health and wellbeing of adolescents and children (Dec. 13).
- Delivered a virtual talk on bed bugs to the Connecticut Hospital Association (January 3).
- Presented a talk at the University of Connecticut in Storrs, to the Connecticut Entomological Society about Delusional Infestation (January 19).
- Presented a virtual talk about bed bugs to the Region 1 Ledge Light Health District and Senior Center Network (January 25).
- Interviewed by Edward Stannard from the Hartford Courant about Asian jumping worms (Feb. 1). A subsequent article was published on February 11th titled, “Scary, invasive and destructive worms are in CT”
- Presented a talk on bed bugs and their management to the Hartford Schools (March 6).
- Interviewed by Ed Stannard from the Hartford Courant about the spotted lanternfly, Lycorma delicatula (March 13).
- Interviewed by Harlan Levy (reporter) about spring arthropods, particularly exotic ticks and ground nesting bees (March 14).
- Presented a talk on jumping worms at the 4-H Education Center, Auerfarm in Bloomfield (March 18).
- Presented a talk about jumping worms to the Colchester Garden Club (45 attendees) (March 25).
- Interviewed by Ed Stannard of the Harford Courant about self-protection from ticks (March 27).
- Live interviewed about ticks and Lyme disease on the Chaz and AJ, WPKN Morning Radio Show (April 2).
- Interviewed on the lone star, Gulf coast, and black legged ticks found in Connecticut by Channel 8 TV (April 2).
- Springer Nature published the 356-page book edited by Dr. Ridge with collaboration from 19 other authors titled “The Physician’s Guide to Delusional Infestation” (April 6).
- Delivered a talk about jumping worms to the KNOX farmer training program in Hartford (April 11).
- Interviewed by Kayla Blanton, freelance journalist on how to manage multicolored Asian lady beetles that enter buildings (April 19).
- Participated in the Woodbridge Town Earth Day celebrations with a Station table display (April 27).
- Introduced students to careers in science for half a day at Amity Senior High School in Woodbridge, CT with Dr. Kelsey Fisher (May 1).
- Hosted two groups from “The Future Farmers of America,” visited the insect information office (May 2).
- Delivered a talk about jumping worms to the Connecticut Orchid Society (May 8).

- Delivered a talk on bed bugs to the staff of the River Valley Services, State of Connecticut, Department of Mental Health and Addiction Services (DMHAS) (May 9).
- Spoke about bed bugs to patients at Bridges Healthcare Services, Milford, CT (May 28).
- Interviewed by Alleah Red WFSB Channel 3 News about the recently introduced Joro spider (June 5).
- Interviewed by Shanice Rhule, CT Public Radio about the Joro spider and native spiders found in Connecticut (June 5).
- Interviewed by Kevin Gaiss, NBC News about the Joro spider (June 6).
- Live interviewed on WTIC Radio about the Joro spider (May 7th).
- Live interviewed on the Chaz and AJ Morning Radio Show about the Joro spider (June 10).
- Presented a talk on field and farm safety for newly hired station staff (June 10).
- Presented a talk on jumping worms to the Tolland Garden Club (June 20).
- Talked about the function of the Insect Information Office to two tour groups from the International Festival of Arts and Ideas (June 28).

ROCHA, RAQUEL

- Participated at the Connecticut Agricultural Expo 2023
- X Brazilian Mycology Conference
- 62nd Annual Meeting of the Society of Nematologists
- Federal University of Ceara – Brazil
- Yale Plant Molecular Biology Seminar Series
- Served as guest speaker at UConn class "Success in the Sciences"
- UConn Plant Science & Landscape Architecture Seminar Series
- Presented at the CAES Postdoctoral Symposium
- CT Vegetable & Small Fruit Growers' Conference

RUTLEDGE, CLAIRE E.

- Conducted training for Wasp Watcher citizen-scientists in how to monitor Cerceris fumipennis colonies for emerald ash borer and other invasive buprestids in Portland, CT (3 adults) (July 12)
- Assisted organization and running of the Connecticut Tree Protection Association's summer meeting (500 attendees) (July 20)
- Presented the lecture 'Invasive insects in Connecticut' to the Orchard Valley Garden Club in Southington, CT, (30 adults) (July 25)
- Met with collaborator Dr. Jian Duan of USDA ARS Beneficial Insect Introduction Laboratory and his staff to conduct field work in our long-term study sites in Plymouth, Cromwell and East Windsor, CT
- Presented the poster 'Hope for Connecticut's Ash Trees: An Update on Biological Control of Emerald Ash Borer' at Plant Science Day, Hamden, CT (August 2).
- Assisted Oliver Kelsey, who completed his Plant Health Fellowship in Dr. Rutledge's laboratory, to presenthis talk 'Response of Understory Vegetation in the Wake of EAB Infestations' at the PHF seminar at Jones Auditorium, New Haven, CT (70 attendees) (August 3)
- Participated in an 'Expert Elicitation' with the European Food Safety Authority, on the biology and risk of Agrilus planipennis and A. anxius. (August 21, 23 &25).
- Presented the talk 'The Spotted Lanternfly' at the New Canaan Library. It was co- sponsored by Planet New Canaan, New Canaan Conservation Commission, New Canaan Land Trust and the New Canaan Nature Center. (80 Adults) (August 3)
- Interviewed by Andrew DaRosa of Hearst Media on spotted lanternfly in Connecticut, September 7, resulting in the article 'Why are lanternflies being spotted more in Connecticut? They're hungry.' September 8, CT Insider https://www.ctinsider.com/news/article/spotted-lanterflies-invasive-ct-summer-fall-18354555.php,

- Helped to administer the oral portion of the Arborist Licensing Exam at Lockwood Farm, Hamden CT (September 13)
- Gave a 5 minute on-air interview with Brian Shactman of the 'Brian & Company' morning show on station WTIC about spotted lanternfly, (September 15)
- Presented information on spotted lanternfly and emerald ash borer at the Tree Wardens Association of Connecticut Annual Picnic, Clinton, CT, (50 adults) (September 15))
- Gave a lecture to the Tree Warden School on insects that attack trees, CAES, New Haven, CT (40 adults (September 21,)
- Participated as a poster judge in the first annual post-doctoral student symposium, CAES, New Haven, CT,
- Presented 'Spotted Lanternfly in Connecticut', Greenwich Audubon Center, Greenwich, CT (20 adults) (September 30).
- Taught the class 'Insects that Attack Trees' and the following 'Tree Conditions Laboratory' for the Connecticut Tree Protective Association's Arborist 101 course. (45 adults) (October 19, 26)
- Presented the poster 'Impact of Emerald Ash Borer invasion stage and post-release time on the persistence and impact of introduced Emerald Ash Borer larval parasitoids' the annual meeting of The Entomological Society of America in National Landing, MD (November 5-8)
- Assisted in administration of the oral portion of the Arborist's License Exam, CAES New Haven, CT (December 13)
- Presented a talk titled 'Spotted Lanternfly in Connecticut' to the Small Fruit and Vegetable Conference at the University of Connecticut, in Storrs (127 adults) (January 7)
- Presented a talk titled 'Small trees get eaten too: Insects attacking trees' to the Greater New Haven Bonsai Society, New Haven, CT (12 adults) (January 7)
- Presented the keynote talk 'Hope for Connecticut Ash Trees' at the Connecticut Tree Protective Association's Annual Meeting, Farmington, CT (700 adults) (January 18)
- Taught the class 'Insects that Attack Trees' and the following 'Tree Conditions Laboratory' for the Connecticut Tree Protective Association's Arborist 101 course. (45 adults) (February 8 & 22)
- Presented a lecture on 'Spotted Lanternfly Research at Earthplace' with Dr. Kelsey Fisher, CAES, at Earthplace, Westport, CT (10 youth, 10 adults) (February 15)
- Presented a talk titled 'Southern Pine Beetle and the Fate of Pitch Pine' to the Forest Health Workshop, Jones Auditorium, New Haven, CT (75 adults) (March 12)
- Was an examiner for the oral portion of the Arborist Licensing Exam (3 candidates) (March 13)
- Presented a talk titled 'Spotted Lanternfly' to the Connecticut Farm Winery Education Symposium, Jones Auditorium, New Haven, CT (55 adults) (Match 26)
- Presented the talk 'Biosurveillance: Using a native wasp to catch an invasive beetle' to the Master Gardeners' class on live-stream (70 adults) (March 31).
- Presented a talk titled 'Spotted Lanternfly in Connecticut' to the Master Gardener's class Norwich, CT (50 adults) (April 9)
- Attended the on-line symposium 'Spotted Lantern Fly Field Ops Meeting' presented a talk titled 'Spotted Lanternfly research in Connecticut' to the symposium (102 adults) (April 17 &18)
- Met with Elizabeth Kolbert, the Pulitzer Prize winning author of 'The Sixth Extinction', at a field site in Kent, CT to discuss the biological control program for emerald ash borer in Connecticut (April 19).
- Served as a score keeper at the Connecticut Tree Protective Association's annual Tree Climbing Competition (50 attendees)
- Presented the talk 'New Insects in Connecticut' to the Harwinton Garden Club (30 attendees) (May 10)
- Had a table display about emerald ash borer at the Connecticut Environthon at Lockwood Farm, Hamden, CT (120 youth, 30 adults)) (May 23)
- Gave a talk about Spotted Wing Drosophila to the Connecticut Pomological Society (50 attendees) (June 11) at Holmberg's Orchard in Gales Ferry

- Held individual trainings for citizen scientists in Mansfield (June 27), Old Lyme (June 28), and East Hartford (June 29)

SALVAS, MICHELLE

- explained ongoing research testing cultivar resistance to Boxwood Blight to Bloomfield Agriscience Freshman (21 attendees) (November 1).
- participated in the course "Identification of Plant-Parasitic Nematodes" given at the National Plant Protection Organization, Wageningen, The Netherlands (June 24-28).

SCHULTES, NEIL P.

- conducted joint experiments with Dr. Timothy McNellis at the Dept. of Plant Pathology and Environmental Microbiology at Pennsylvania State University (July 5-15).
- served as a judge for oral and poster presentations and along with RAQUEL ROCHA, PH.D., and RAVI PATEL, PH.D., served as judges for poster presentations at the CAES Postdoctoral Symposium (September 22).
- 85th Northeast Tree Fruit IPM Working Group at Lake George, NY Oct 25
- Sussex Symposium of Plant Biology at Yale University, October 20, 2023
- presented a poster "Is amino acid synthesis necessary for epiphytic growth of Erwinia amylovora on apple flower stigmas" at the Sussex Symposium of Plant Biology at Yale University on (~75 attendees) (October 20); served as a judge for the oral and poster presentations in the First Annual CAES Postdoctoral Fellow Research Symposium, (October 22); and presented a talk "Growth of Erwinia amylovora amino acid auxotrophs on the apple stigma" at the Northeast Tree Fruit Integrated Pest Management Working Group in Lake George, NY (40 attendees) (November 24-25).
- gave the first of a three lecture series on "Genetically Modified Plants in Agriculture" in the Yale University course Sci030 (13 students) (November 17); attended the Connecticut Pomological Society annual meeting in Middletown, CT (50 attendees) (November 28).
- Presented 3 lectures on "Genetically Modified Plants in Agriculture" to Science Course Sci 031 at Yale University Dates Nov 17; Dec 1 & 8, 2023.
- gave a seminar titled "Fire blight: the scourge of apple production" to undergraduate biology and chemistry students at Quinnipiac University (25 attendees) (March 5).

SHABTAI, ITAMAR

- gave an oral presentation "Probing the Spatial and Chemical Distribution of MAOM in the Rhizosphere" at the 2023 ASA-CSSA-SSSA International Annual Meeting in St. Louis, MO (October 30)

SHEPARD, JOHN J.

- Was interviewed about invasive mosquito species and the range expansion of mosquitoes in North America by Edward Riccuti for an article in PCT Magazine (July 20 & 26).
- Participated Board of Directors meeting of the Northeastern Mosquito Control Association via Zoom (August 17) (13 participants).
- Presented on the " Statewide Monitoring Program for Mosquito-borne Viruses in Connecticut" for the Joint LHD-IP-Infectious Diseases meeting of the CT Dept. of Public Health via Teams (August 30) (127 attendees).
- Presented the invited seminar Statewide Monitoring Program for Mosquito-borne Viruses in Connecticut" to an Entomology (Capstone) class at the University of St, Joseph, West Hartford, CT, (November 13).
- Participated Board of Directors meeting of the Northeastern Mosquito Control Association (December 3).

- Presented the invited talks “Arbovirus Activity in Connecticut, 2023” and “Jamestown Canyon Virus: Key Mosquito Species in the Northeast” at the 69th Annual Meeting of the Northeastern Mosquito Control Association, Mystic, CT, (December 4-6) (approx. 165 attendees).
- Presented the the lecture “Mosquito Biology, Ecology, and Behavior” (February 8) for the course, BIO 561 - Special Topics Seminar, at Southern Connecticut State University.
- Participated in an Executive Board meeting of the Northeastern Mosquito Control Association (via Zoom, February 27).
- Presented the lecture, “Mosquito & Arbovirus Surveillance” (March 7) for the course, BIO 561 - Special Topics Seminar, at Southern Connecticut State University .
- Presented the lecture “Mosquito Control and Prevention of Mosquito-Borne Disease” (March 21) for the course, BIO 561 - Special Topics Seminar, at Southern Connecticut State University.
- Co-organized, with Dr. Goudarz Molaei and Ms. Noelle Kahlil, a Vector-borne Disease Symposium & Workshop and presented the talks “Surveillance for Mosquito-borne Viruses in Connecticut: Reporting of Results" and “Identification of Key Mosquito Species in Connecticut” (March 22).
- Presented the lecture "Jamestown Virus Comes into View: Understanding the Threat from an Underrecognized Arbovirus" as part of the CAES Seminar Series (April 3);
- was interviewed about the challenges and experiences faced in a mosquito/mosquito-borne disease surveillance program by Johanna Ravenhurst, a Ph.D. candidate from the University of Massachusetts, Amherst (April 11).
- Spoke to two groups of FFA Students about the state Mosquito Trapping and Arbovirus Surveillance Program (May 2; approx. 60 students);
- Addressed media members about the state Mosquito Trapping and Arbovirus Surveillance Program and demonstrated mosquito trap types at a press conference for the Milford Health Department’s 2024 Mosquito Kick-off (May 9).
- Discussed the Mosquito Trapping and Arbovirus Surveillance Program and evaluated trap placement locations with members of the Preventive Medicine Unit on the US Naval Submarine Base in Groton (June 10);
- Was interviewed about the identification of the first West Nile virus positive mosquitoes in CT for 2024 and tips to prevent mosquito bites and reduce mosquitoes around the home by Matt McFarland from WFSB TV 3 (June 27) and WTNH TV 8 (June 28).

SMITH, VICTORIA L.

- Interviewed by Abby Weiss, of Hearst CT Media, concerning spotted lanternfly (July 5, 2023); was interviewed by Debra Aleksinas, of the Lakeville Journal, concerning spongy moth (July 6, 2023) ;. participated (via Zoom) in a webinar, sponsored by USDA-APHIS-Plant Protection and Quarantine, concerning post-entry quarantine regulations (July 12, 2023); was interviewed by Mark Sudol, of News 12 Connecticut, concerning spotted lanternfly (July 13, 2023); participated (via Teams) in a webinar concerning the Plant Pathogen Diagnostic Certification Program (July 18, 2023); participated in the mid-year meeting of the Cooperative Agricultural Pest Survey, held in the Jones Auditorium (July 18, 2023); participated (via Teams) in the quarterly call of the Eastern Plant Board (July 25, 2023); participated in the CT Nursery and Landscape Summer Meeting, with a presentation titled “BOLO: Spotted Lanternfly and Box Tree Moth”, held at Monrovia Nursery in Granby (July 26, 2023); participated (via Teams) in the business meeting of the Eastern Plant Board, held in Little Rock, Arkansas (July 31, 2023).
- Interviewed by Rachel Wachman of the Record Journal regarding spotted lanternfly (August 3, 2023); was interviewed by Brendan Crowley of the Connecticut Examiner regarding spotted lanternfly (August 4, 2023); participated in a webinar concerning Asian Longhorned beetle (August 7, 2023); was interviewed by Rich Kirby of Connecticut Patch regarding spotted lanternfly (August 12, 2023); participated in a press conference with Senator Richard Blumenthal, along with Kelsey Fisher, Hany Dweck, and Claire Rutledge, held at East River Park in East Hartford, regarding federal funding for spotted lanternfly research and outreach (August 30, 2023).

- Interviewed by Alicia Tang, of the Greenwich Sentinel, regarding spotted lanternfly (September 11, 2023).
- Interviewed by Bob Miller of the Danbury News Times about spotted lanternfly (October 2, 2023); participated in the Horticultural Inspection Society Eastern Chapter 2023 Interstate Inspection Meeting, held at the Niagara Crossings Hotel and Spa in Lewiston, NY, concerning box tree moth (October 2-5, 2023); participated in the Invasive Insect Certification Program, sponsored by UMass, held via Zoom (October 10-11, 2023); traveled to Sandwich, MA, with personnel from USDA-APHIS-Plant Protection and Quarantine and from Massachusetts and Rhode Island, to observe box tree moth; participated in the National Plant Board Safeguarding Meeting regarding box tree moth, held at the Residence Inn/Downtown Marriott in Cincinnati, OH (October 24-25, 2023) .
- Participated in the annual meeting of the US Forest Service Cooperators, held at the Asian Longhorned Beetle Eradication Headquarters in Worcester, MA, with a presentation on CT Forest Conditions Update (November 4-5, 2023); participated in the annual meeting of the CT Pomological Society, held at the Middletown Elks Club in Middletown, CT, with a Spotted Lanternfly Update (November 28, 2023).
- Participated in a webinar, sponsored by the US EPA Center for Integrated Pest Management, on beech leaf disease (December 5, 2023); was interviewed by students from the Mill River Park Collaborative, about spotted lanternfly (December 7, 2023); participated in a national task force, with representatives from USDA-Plant Protection and Quarantine, Oregon Dept. of Agriculture, Ohio Dept. of Agriculture, and Virginia Dept. of Agriculture and Consumer Services, to develop best management practices, FAQ's, model regulations, and pest alerts, on box tree moth, held on the Venture Campus of North Carolina State University, Raleigh, NC (December 10-13, 2023).
- Attended the National Plant Disease Diagnostic Network/Boxwood Blight Insight Group symposium on boxwood blight (virtual) (January 17, 2024); attended the winter meeting of the Connecticut Tree Protective Association, held at the Aqua-Turf in Southington (January 18, 2024); participated in SiteOne University, with a presentation titled "Spotted Lanternfly and Box Tree Moth: BOLO", held at The Waters Edge in Darien (January 23, 2024); participated in SiteOne University, with a presentation titled "Spotted Lanternfly and Box Tree Moth: BOLO", held at Casa Mia at the Hawthorn in Berlin (January 24, 2024); participated in the Connecticut Nursery and Landscape Association Winter Symposium, with a presentation titled "CAES Update: Spotted Lanternfly and Box Tree Moth", held at the Aqua-Turf in Southington (January 25, 2024); attended the University of Connecticut Extension Bedding Plant Meeting, held in the Jones Auditorium (January 30, 2024).
- Participated in the 10th annual Spotted Lanternfly Symposium, sponsored by Cornell University and Penn State University, held virtually via Zoom (February 28-29, 2024).
- Completed a virtual course sponsored by the US EPA Center for Integrated Pest Management titled "Protecting Boxwoods Against Blight and The Box Tree Moth" (March 5, 2024); was interviewed by students of the Mill River Park Collaborative about spotted lanternfly (March 7, 2024); attended the 2024 Connecticut Farm Winery Education Symposium, sponsored by the CT Dept. of Agriculture, CAES, and the CT Farm Wineries, held in the Jones Auditorium (March 26, 2024); completed Authorized Certifying Official recertification, sponsored by USDA-APHIS-Plant Protection and Quarantine Export Services (March 26, 2024); completed Re-Export Training, sponsored by USDA-APHIS-Plant Protection and Quarantine Export Services (March 27, 2024).
- Participated in the 98th annual meeting of the Eastern Plant Board, held at the Hilton Burlington Lake Champlain in Burlington, VT (April 1-4, 2024); was awarded the Distinguished Service Award by the Eastern Chapter of the Horticultural Inspection Society (April 4, 2024) ; was interviewed by Brooke Griffin of Fox 61 News, concerning spotted lanternfly (April 23, 2024).
- Participated in a webinar sponsored by the US EPA Center for Integrated Pest Management titled "Managing fungal diseases for ornamental plants (May 7, 2024); was interviewed by WTNH Channel 8 concerning spotted lanternfly (May 8, 2024).

STAFFORD, KIRBY C. III

- Participated in the visit and training of Yale Medical Microbiology Fellow Dr. Bruce Rottmann (June 20)
- Interviewed on ticks and the Lyme disease vaccine by Bloomberg News (July 19)
- Interviewed by reporter Eric Boodman about the new Lyme Shield System with a Lyme disease vaccine rodent targeted bait (July 26)
- Presented a talk on tick management for the Tick Academy (October 12)
- Presented a talk on the history of CAES titled "Birth of an Idea: A History of the Connecticut Agricultural Experiment Station" for the luncheon seminar series (October 18)
- Participated in a meeting of the Pollinator Advisory Committee (April 17)
- Participated in a meeting of the NEVBD-Training Evaluation Center as an Advisory Board member (April 24)

STEBBINS, SUMMER E.

- with RILEY DOHERTY and Madison Manke, gave an aquatic plant workshop to 7-9 year olds for the Ledyard Parks and Recreation Department (85 attendees) (July 26); with Madison Manke, gave a talk titled "Invasive Aquatic Plants in Connecticut" to the Aquarion Water Company (25 attendees) (July 31). with MS. RILEY DOHERTY, gave an invasive aquatic plant workshop to Bridgeport middle school students as part of the Trout in the Classroom program at the Beardsley Zoo (15 attendees) (May 3); gave a talk titled "West Lake Aquatic Plant Survey Results" to the West Lake Health Committee and various West Lake Associations at the Guilford Community Center (50 attendees) (May 11); with MS. RILEY DOHERTY, attended the Northeast Arc Users Spring Conference at University of Rhode Island (May 16).
- with RILEY DOHERTY gave an aquatic plant workshop to the Four Oakes Day Camp in Redding (20 attendees).
- hosted The Northeast Aquatic Plant Management Society Plant Camp at Camp Hazen, Chester, CT (40 attendees) (September 13); gave a talk titled "Using GIS to Map Invasive Aquatic Plants in Connecticut" at the Northeast Arc Users Group conference in New Haven, CT (40 attendees) (October 16); attended the North American Lake Management Society conference in Erie, PA gave a talk titled "Using GIS to Map Invasive Aquatic Plants in Connecticut" (40 attendees) (October 23).
- presented virtual talk titled "Using GIS to Map Invasive Aquatic Plants in Connecticut" to the CT DEEP Bureau of Water Protection & Land Reuse GIS Workgroup (20 people) (November 1).
- with RILEY DOHERTY gave a GIS workshop to a group of Sound School high school students to teach them how to utilize free ArcGIS online tools for their environmental justice project (15 students) (March 6).
- gave an aquatic plant identification workshop to the Essex Land Trust at the Essex Town Hall (30 attendees) (April 3); presented on invasive aquatic plant management to the Farmington River Watershed Association at CAES (5 attendees) (April 17); with JEREMIAH FOLEY, PHD., met with the Northeastern University Hydrilla Hunters and tested out their autonomous vessel on the Connecticut River (April 18); gave an aquatic plant identification workshop as part of a CT DEEP training program at the American Jobs Center in Waterbury (20 attendees) (April 24); gave two greenhouse tours to educate elementary school students on invasive aquatic plants as part of the St. Thomas Day School STEAM Festival (24 attendees) (April 25).
- gave a talk titled "Hydrilla in the Connecticut River" at the Aquatic Nuisance Species Task Force meeting in Saratoga Springs, NY (50 attendees) (May 8); gave a hydrilla identification workshop to the Friends of Lake Quonnipaug in Guilford, CT (30 attendees) (May 11); gave an aquatic plant management workshop to the Amston Lake Association in Amston, CT (25 attendees) (May 18).
- joined the UConn Invasive Plant Certificate Advisory Board and attended the inaugural virtual board meeting. (June 24).

STEVEN, BLAIRE

- participated in the Gordon Research Conference on Applied and Environmental Microbiology at Mount Holyoke College, South Hadley, MA and presented a talk titled "The Free Assembly of the Microbiome in the Axenic Mosquito" (130 attendees) (July 16-21)
- presented talk entitled "Expanding the metabolic repertoire of the host: The role of bacterial insecticide degradation in mosquito resistance" at the Pioneer Valley Microbiology Symposium, University of Massachusetts Amherst (30 scientists and 100 students in attendance) (March 2).

STONER, KIMBERLY A.

- Spoke at a press conference at the CT State Capitol about the importance to farmers, farmworkers, and farming communities of bills being considered in the state legislature creating a climate decarbonization roadmap and strengthening environmental justice (June 5)
- Interviewed along with Maya van Rossum, Delaware Riverkeeper, about Green Amendments to state constitutions and the Connecticut Environmental Rights Amendment by Melinda Tuhus for her program, "The Forest and the Trees" on WPKN radio (June 27)
- Staffed a table at the CT Green Expo at Edgerton Park in New Haven, representing CT NOFA (September 9)
- Participated as a member of the Steering Committee in a retreat of the Working Lands Alliance at the DeKoven House in Middletown (September 19)
- Staffed a table at the Gather New Haven Harvest Festival, representing CT NOFA (October 1); was interviewed by WNHH New Haven Independent Radio about the CT Environmental Rights Amendment and entomology (October 3)
- Participated in a meeting of the Working Lands Alliance Steering Committee (October 17)
- Organized and led a forum on the Farm Bill for CT NOFA and the CT Climate Crisis Mobilization (October 22)
- Met with CT Senator Martin Looney as part of a Climate, Coffee, and Conversation organized by the League of Conservation Voters (October 25).
- Participated in a Pollinator Advisory Committee Meeting (March 5)
- Presented the talk, "Why Do We Use So Much Pesticide?" to the Durham Garden Club, with 20 attendees at the Durham Public Library (March 18)
- Presented a workshop, "Use Your Voice and Vote to Advocate for What You Want" at the CT NOFA Winter Conference at Eastern CT State University with 10 attendees (March 23)
- Presented a workshop "The Green Amendment" by Zoom in the NOFA Interstate symposium (March 30).

TAERUM, STEPHEN J.

- led a virtual workshop at the Northeastern Organic Farming Association Massachusetts chapter spring meeting titled "Microbial Predators in Soil: Hunting for Healthy Soil Ecosystems" (48 adults) (July 27).
- presented a talk titled "Protist associates help shape plant microbiomes" at the 2023 Sussex Symposium at Yale Unvierstiy (70 attendees) (October 20), and participated in a grant planning meeting with the soil predators working group in Portland, OR (6 attendees) (October 25-29).

TAMEZ, CARLOS

- attended the EPA National Pesticide Workshop for training in the updated multi-residue mega-method titled "QuECHERSER" at the USDA ARS Eastern Regional Research Center in Wyndmoor, PA. July 31 – August 4, 2023

TITTIKPINA, NASSIFATOU

- attended the 34th International Association for Food Protection (IAFP) annual meeting in Long Beach (California) from 14th to the 17th July 2024. She was a recipient of the Travel Award for employees working for food and health agencies in North America. She presented a poster on the increase of PAHs levels in soybean after exposure to wildfire nanoparticles.

TRIPLETT, LINDSAY R.

- led a data analysis workshop for the Plant Health Fellows program (10 adults) (July 24); participated in a meeting of the Bacteriology committee of the American Phytopathological Society (21 attendees) (July 25); and participated in a meeting of the Soil Predators Working Group (8 adults) (July 26).
- participated in a meeting of the Academic Unit Leaders Forum of the American Phytopathological Society (18 participants) (August 1); organized and moderated the Plant Health Fellows final symposium (60 adults) (August 3), and participated in a federal grant panel. participated and led discussion in a Microbiomes Think-a -thon workshop (35 adults) (August 12). Organized and led a meeting of the APHIS Widely Prevalent Bacteria committee (7 participants) (August 13). Gave an oral presentation titled "Persistence of protist-associated bacteria in rhizosphere communities" at Plant Health 2023 in Denver, CO (55 adults) (August 13); co-authored a poster presentation titled "Higher Streptomycin Persister Populations by RES-Xre Toxin-Antitoxin (TA) Mutations in Pseudomonas syringae and Modified TA Complex Interaction" (70 adults) (August 15).
- hosted two representatives from the Office of Public Management on a tour of the CAES New Haven Campus (October 6), hosted an orientation session for new scientists at CAES (5 attendees) (October 6); participated in a meeting of the Centennial Executive Committee of the Hamden Garden Club (22 attendees) (October 12), co-authored a poster with student Alex Carabetta titled "All together now: the relationship between predatory protists and bacterial multicellular structures" at the Sussex Symposium (70 attendees) (October 20); spoke on CAES research opportunities at a summer internship symposium at Quinnipiac University, along with Kelsey Fisher (19 attendees) (October 24); participated in a grant planning meeting with the soil predators working group in Portland, OR (6 attendees) (October 25-29)
- hosted a visit from seminar speaker Charles Yarish, Ph.D. of GreenWave (November 7), presented three class lectures titled, "Non-self recognition and response in plants", "Recognition suppression and the plant-pathogen arms race", and "The plant as a holobiont" for the class Advances in Plant Molecular Biology at Yale, and led literature discussion of four journal papers (13 adult students) (November 10 & 17), and represented CAES at the Annual Meeting of the Working Lands Association in Hartford (48 attendees) (November 15).
- conducted Responsible Conduct of Research Training for all CAES scientific staff (95 attendees) (January 10).
- represented CAES at the February meeting of the State Commission on Human Rights and Opportunities, where they voted to approve the 2021-2023 Affirmative Action plan (36 attendees) (February 14); and presented a lecture titled "A furious cannonNADe: nucleotide signaling in plant defense" at the Yale Botany Seminar Series (19 attendees) (February 19).

- hosted discussions with Jamie Smith at the Department of Agriculture and the group of Jana Milucka at the Max Plank Institute-Bremen to discuss potential shared initiatives in workforce development and symbiosis, respectively (5 attendees) (March 13).
- conducted Mentor Training for research mentors in the Plant Health Fellows program (12 attendees) (May 10), and gave welcoming remarks at the CT Envirothon at Lockwood Farm (75 attendees) (May 23).
- met with graduate program coordinators at the University of New Haven to discuss formal hosting of graduate students (3 adults) (June 4); co-coordinated and led 5 activities for the 2024 Plant Health Fellows REEU program: Orientation and Safety Training (June 10), planting a group field plot (June 17), a Field Trip to Enko Chem (June 20), a Zoom career panel with graduate students (June 24), and a science communication workshop (10 adults) (June 24); coordinated the tour for the International Festival of Arts and Ideas and presented a talk titled “CAES Then and Now” to attendees (26 adults) (June 28).

WANG, YI

- participated in a collaborative symposium on Nano-enabled Agriculture Symposium at UMass Amherst (July 25).
- gave an invited talk in the Asa Gray Biological Seminar Series at Utica University titled "Nano-enabled agriculture: Agro-nanomaterials and their effects in plant nutrition, metabolic profiling, and disease suppression"(30-40 attendees) (April 17).
- presented a poster on Nanoscale Sulfur for Plant Nutrition, Disease Suppression, and Food Safety at the Gordon Research Conference at the Southern New Hampshire University between June 23 and 28.

WARD, ELISABETH

- was interviewed for the Yale School of the Environment Annual Report (July 6)
- presented a talk and guided walk on tree identification for the Connecticut Tree Warden School (47 participants) (September 7)
- presented a guest lecture titled “Plant mycorrhizal associations and their effects on carbon and nitrogen dynamics in forests” in Dr. Helen Poulos’s Forest Ecosystem Ecology class at Wesleyan University (20 participants) (November 8)
- presented a guest lecture titled “Using plant mycorrhizal associations to link forest composition to carbon and nitrogen dynamics” in Dr. Marlyse Duguid’s Forest Dynamics class at Yale University (30 participants) (November 16)
- presented an invited seminar titled “Linking plant mycorrhizal associations to soil organic matter dynamics in forests: The role of ericoid mycorrhizal plants and fungi” at the New York Botanical Garden (30 participants) (December 21)
- presented an invited guest lecture in Plant Ecology at Connecticut College titled “Factors promoting understory plant invasions following forest disturbances” (10 participants) (February 21)
- presented a talk titled “Competition between regenerating oaks and invasive plants in irregular shelterwood harvests: The role of forest soils” at the annual CAES Forest Health Monitoring Workshop (65 participants) (March 12)
- presented an invited talk in the seminar “Discussions in Leadership with Forestry Professionals” led by Gary Dunning (Executive Director, The Forests Dialogue) and Terry Baker (CEO, Society of American Foresters) at The Yale School of the Environment (15 participants) (April 2)
- presented an invited talk at Wesleyan University titled “Introduction to the types of mycorrhizal fungi and their role in forest ecosystem processes” (30 participants) (April 26)
- interviewed by The New York Botanical Garden for a blog post featuring Journal of Ecology article on plant mycorrhizal effects on soil carbon and nitrogen in forests (June 17)

WARD, JEFFREY

- was interviewed about forest health by Robert Miller, Danbury News-Times (August 29).
- spoke of forest management and succession at Master Woodland Manager Module 2: Forest Ecology field workshop in North Madison (18 attendees) (September 16)
- lead "The Edible Forest Walk" at Great Mountain Forest in Norfolk along with Matt Gallagher (GMF Forester) (37 attendees) (October 14)
- interviewed about invasive bamboo by Jamila Young of the Journal Inquirer (October 19)
- spoke on assessing post-defoliation tree health and management recommendations at "Oak defoliation wood tour" in Cornwall (17 attendees) (November 3)
- spoke on "Slash walls influence on forest regeneration" at the 27th Forest Health Monitoring Workshop in New Haven (60 attendees) (March 12)
- spoke on "Influence of deer browse on stump sprouting success" at the 2024 Society of American Foresters annual meeting in Burlington, VT (70 attendees) (March 28)
- spoke about impact of tree diseases on forest dynamics at Naugatuck State Forest for Yale Forest Health class (15 attendees) (April 19)
- lead a "Forestry in Practice" walk discussing how forest management influences wildlife and carbon sequestration at White Memorial Foundation (WMF) in Goshen with Mike Berry, WMF Forester (19 attendees) (May 4)
- spoke on impact of diseases and insects on forest dynamics for Connecticut Forest and Park Association's Master Woodlands Managers Partner's in Naugatuck (21 attendees) (June 1)
- lectured on "Deer browse and the biodiversity crisis" for the Greenwich Land Trust (24 attendees) (June 6)
- interviewed about forest dynamics by Darcy Dennett (Firefly Filmworks) for a documentary about Peoples State Forest (June 10)
- spoke with Great Mountain interns on forest management with an emphasis on regeneration (4 attendees) (June 13)

WEIDMAN, SUMMER

- gave an aquatic plant workshop to 7-9 year olds for the Ledyard Parks and Recreation Department (85 attendees) (July 26)
- gave a talk titled "Invasive Aquatic Plants in Connecticut" to the Aquarion Water Company (25 attendees) (July 31).
- gave an aquatic plant workshop to the Four Oakes Day Camp in Redding (20 attendees)
- gave a talk entitled "Using GIS to Map Invasive Aquatic Plants in Connecticut" at the Northeast Arc Users Group conference in New Haven, CT (40 attendees) (October 16)
- attended the North American Lake Management Society conference in Erie, PA gave a talk entitled "Using GIS to Map Invasive Aquatic Plants in Connecticut" (40 attendees) (October 23)
- presented virtual talk entitled "Using GIS to Map Invasive Aquatic Plants in Connecticut" to the CT DEEP Bureau of Water Protection & Land Reuse GIS Workgroup (20 people) (November 1)
- gave two Invasive Aquatic Plants Workshops at the Envirothon at Goodwin College (50 attendees) (January 13)
- gave an update on "CAES OAIS and Hydrilla in the CT River" at a virtual meeting sponsored by the Connecticut River Conservancy (30 attendees) (January 29)
- gave an invasive aquatic plant workshop as part of the Three Rivers Community College Environmental Issues Seminar (25 attendees) (February 21)
- gave a presentation entitled "Pachaug Pond - Aquatic Vegetation Survey 2023" to the Pachaug Pond Weed Control Association at the Griswold Town Hall (30 attendees) (February 28)
- gave a GIS workshop to a group of Sound School high school students to teach them how to utilize free ArcGIS online tools for their environmental justice project (15 students) (March 6)

- gave an aquatic plant identification workshop to the Essex Land Trust at the Essex Town Hall (30 attendees) (April 3)
- presented on invasive aquatic plant management to the Farmington River Watershed Association at CAES (5 attendees) (April 17)
- gave an aquatic plant identification workshop as part of a CT DEEP training program at the American Jobs Center in Waterbury (20 attendees) (April 24)
- presented an invasive aquatic plant workshop with SUMMER STEBBINS for the Eightmile River Wild & Scenic Watershed and the Salmon River Watershed Partnership at the East Haddam Town Hall (May 1) (20 attendees)
- gave a talk titled "Hydrilla in the Connecticut River" at the Aquatic Nuisance Species Task Force meeting in Saratoga Springs, NY (50 attendees) (May 8)
- gave a hydrilla identification workshop to the Friends of Lake Quonnipaug in Guilford, CT (30 attendees) (May 11)
- gave an aquatic plant management workshop to the Amston Lake Association in Amston, CT (25 attendees) (May 18)

WHITE, JASON C.

- along with DR. QUAN ZENG participated in a Zoom call with collaborators in Italy and Spain regarding a joint USDA grant proposal (July 3); gave remote presentation titled "Nanotechnology-enabled agriculture: A path to global food security?" to a Workshop on Novel Fertilizers and Plant Nutrition at the University of Delaware (July 5); participated in a Zoom call with a journalist to discuss the filming of a podcast at the 113th Annual CAES Plant Science Day (July 5); hosted the monthly CAES J-Visa recipient meeting (July 7); along with DR. CHRISTIAN DIMKPA and DR. SHITAL VAIDYA, hosted a Zoom call with collaborators at Johns Hopkins University to discuss progress on a joint USDA nanoscale phosphorus project (July 7); participated in a Zoom call with collaborators at the University of Texas El Paso and the University of Rhode Island to discuss a new USDA funded proposal (July 7); participated in a Zoom call with collaborators at the Colorado School of Mines and Johns Hopkins University to discuss a joint grant proposal (July 7); along with DR. YI WANG participated in a Zoom call with collaborators at the University of Massachusetts to discuss progress on a joint USDA proposal on nanoscale sulfur (July 7); hosted the monthly NSF Center for Sustainable Nanotechnology (CSN) Nanochemistry-Plant working group Zoom call (July 11); participated in the weekly CSN all-hands Zoom call (July 12); participated in a workshop at Carnegie Mellon University to begin proposal preparation for a NSF Science and Technology Center (July 17-20); gave a presentation by Zoom titled "Nanobiotechnology-based Strategies for Enhanced Crop Stress Resilience" to The International Conference on Sustainable and Applied Nanotechnology for Agriculture and Health (SANTAH) (July 19); along with collaborators from the University of Minnesota met by Zoom with research staff from WinField United - Land O'Lakes Inc. to discuss nanotechnology and agriculture (July 19); met by Zoom with collaborators at the University of Minnesota and Katana AgriScience to discuss nanotechnology and agriculture (July 20); spoke by Zoom with collaborators at Rutgers University to discuss a joint grant proposal (July 21): along with 10 CAES staff travelled to the University of Massachusetts Amherst for the UMass-CAES Nano-enabled Agriculture Symposium and gave a presentation titled "Nanotechnology-enabled Agriculture Research at the CAES" (July 25); gave a Zoom presentation titled "Nanotechnology-enabled agriculture: A path to global food security?" at the 2023 International Symposium on the Advances of Plant Nanobiotechnology; Huazhong Agricultural University, Wuhan, Hubei Province (July 26); participated by Zoom in the PhD proposal defense of a student at the University of Massachusetts Amherst (July 27); participated in the NSF CSN monthly Faculty call (July 27); and participated in a Zoom call with colleagues at the University of Minnesota, Katana AgriScience and OTB Ventures Australia to discuss nanotechnology and agriculture (July 31)
- along with SARA THOMAS, PH.D., SARA NASON, PH.D., and NUBIA ZUVERZA-MENA participated in a Zoom call with collaborators from the University of Minnesota and Yale University to discuss progress on a joint NIEHS grant on PFAS phytoremediation (August 1); along with CHRISTIAN DIMKPA, PH.D.,

and SHITAL VAIDYA, PH.D., hosted a Zoom call with collaborators at Johns Hopkins University to discuss progress on a joint USDA nanoscale phosphorus project (August 1); participated remotely in the Ph.D. dissertation defense of Eric Ostovich of the University of Wisconsin Milwaukee (Dr. White was on his committee) (August 1); met by Zoom with scientists at the environmental engineering firm AECOM to discuss PFAS remediation (August 3); met by Zoom with colleagues at the University of Minnesota and Katana Agriscience to discuss collaborative work (August 3, 18, & 21); met by Zoom with collaborators at the NSF Center for Sustainable Nanotechnology (CSN) to initiate a SWOT analysis of programs and projects (August 4): along with YI WANG, PH.D., participated in a Zoom call with collaborators at the University of Massachusetts to discuss progress on a joint USDA proposal on nanoscale sulfur (August 4); along with YI WANG, PH.D., and CHAOYI DENG, PH.D., gave a tour of Lockwood farm to two Yale graduate students (August 4); along with SARA NASON, PH.D., participated in a Teams meeting for the PFAS testing Laboratory Capacity and Capability discussion group (August 8); hosted the monthly CSN Nanochemistry-Plant working group call (August 8); participated in a Zoom call with the Sand County Foundation to discuss the nomination of Terry Jones for the 2023 Leopold Conservation Award (August 8); participated by Zoom in a planning meeting for the NIEHS SRP R01 Annual Meeting (August 8 & 31); participated in the Northeastern Regional Association of State Agricultural Experiment Station Directors (NERA) Multistate Activities Committee meeting (August 9); along with SHITAL VAIDYA, PH.D., travelled to Knoxville, TN, to participate in the 2023 USDA/NIFA Nanotechnology Grantees Conference and gave two platform presentations titled "Biodegradable PolymerNanoparticle Composites for Controlled Release and Targeted Delivery of Phosphorus During Plant Growth" and "Nanoscale Sulfur for Plant Nutrition, Disease Suppression, and Food Safety" (August 9-11); participated in the monthly CSN Faculty meeting (August 10); travelled to American Chemical Society (ACS) Fall 2023 Conference, San Francisco, CA, and gave a platform presentation titled "Nanoscale soil amendments to decrease toxic metal accumulation in and toxicity to food crops" (August 13-17); along with YI WANG, PH.D., and CHAOYI DENG, PH.D., met with colleagues at the University of Hamburg (Germany) to discuss collaborative work (August 15 & 31); met with an undergraduate student from Post University that is interested in doing a research internship at CAES (August 18); participated in a Zoom call with colleagues from Auburn University and Johns Hopkins University to discuss a collaborative grant proposal (August 18 & 21); along with NUBIA ZUVERZA-MENA, PH.D., participated in a Zoom call with colleagues at Rutgers University and the New Jersey Institute of Technology to discuss progress on a joint USDA grant focused on micro-nanoplastics (August 21); along with SHITAL VAIDYA, PH.D., participated in a Zoom call with collaborators at the Johns Hopkins University to discuss progress on a joint USDA proposal on nanoscale phosphorus (August 22); participated in the weekly CSN all hands call (August 23); participated by Zoom in a CSN Faculty strategic planning meeting (August 24); along with CHRISTIAN DIMKPA, PH.D., and CHAOYI DENG, PH.D., hosted three graduate students from the University of Minnesota for seven days (August 28-31); participated by Zoom in the Ph.D. Dissertation defense of Shang Gao of the University of Massachusetts (Dr. White was on his committee) (August 29); met by Zoom with a Senior Editor from Nature Nanotechnology to discuss the field of nano-enabled agriculture (August 30); along with YI WANG, PH.D., participated in a kick off meeting with collaborators from Louisiana State University to start planning on a recently funded grant (August 31); hosted the monthly CAES J-Visa recipient meeting (August 31).

- met with Professor Saion Sinha of the University of New Haven and of 12-15 Molecular Diagnostics to discuss collaborative research (September 1); met by Teams with staff of the Department of Consumer Protection Division of Drug Control to discuss the Adult Use Cannabis testing program (September 1); along with SARA THOMAS, PH.D., SARA NASON, PH.D., and NUBIA ZUVERZA-MENA, PH.D., participated in a Zoom call with collaborators from the University of Minnesota and Yale University to discuss progress on a joint NIEHS grant on PFAS phytoremediation (September 5); hosted Caitlin Peruccio of Representative Rosa DeLauro's Washington DC staff and gave her a tour of the Station and of several programs (September 6); participated by Zoom in the weekly all hands call for the NSF Center for Sustainable Nanotechnology (CSN) (September 6, 13, & 20); met by Teams with Diwa Ratnam of Katana Agriscience to discuss collaborative work (September 7); met by Teams with collaborators of the University

of Minnesota and Katana Agriscience to discuss collaborative experiments (September 7 & 22); met by Zoom with collaborators at the University of Minnesota to discuss a collaborative PFAS remediation proposal to 3M (September 7); hosted Professor Julia Kuzovkina of the University of Connecticut and a group of Masters students in Plant Science that are taking a "Leadership in Extension and Public Engagement" (September 8); along with YI WANG, PH.D., participated in a Zoom call with collaborators at the University of Massachusetts to discuss progress on a joint USDA proposal on nanoscale sulfur (September 8); participated in the PhD candidacy exam of Leopoldo Posada Escobar of the University of Maryland Baltimore County (Jason White is on his PhD committee) (September 11); along with SARA NASON, PH.D., participated in a Teams meeting for the PFAS testing Laboratory Capacity and Capability discussion group (September 12); along with CHRISTIAN DIMKPA, PH.D., and SHITAL VAIDYA, PH.D., hosted a Zoom call with collaborators at Johns Hopkins University to discuss progress on a joint USDA nanoscale phosphorus project (September 12); hosted the monthly CSN Nanochemistry-Plant working group call (September 12); gave an invited lecture titled "Nanoenabled agriculture: A path to global food security in a changing climate" at the University of Massachusetts Stockbridge School of Agriculture and met with both faculty and graduate students to discuss collaborative work (September 18); met with staff of the Yale School of Public Health to discuss joint funding (September 19); participated by Teams in the first meeting of the Rodenticide Working Group chaired by Representative Joe Gresko of Stratford (September 19); hosted Chris Connors, Ph.D., of the University of Connecticut Technology Commercialization Services office for a CAES Seminar (September 20); participated in the Farmland Preservation Advisory Board meeting (September 21); participated in the Multistate Activities Committee (MAC) meeting of Northeastern Regional Association of State Agricultural Experiment Station Directors (NERA) (September 21); hosted Lorrie Jones, granddaughter of former CAES scientist Donald Jones (September 21); participated in the monthly CSN Faculty meeting (September 22); gave a welcome message to the first annual CAES Postdoctoral Symposium (September 22); along with NUBIA ZUVERZA MENA, PH.D., and TRUNG BUI, PH.D., participated in a monthly USDA grant meeting on micro-nanoplastics with collaborators at Rutgers University and the New Jersey Institute of Technology (September 25); met by Zoom with Professor Howard Fairbrother of Johns Hopkins University to discuss collaborative research (September 25); along with staff of the Department of Analytical Chemistry met by Teams with staff of the Department of Energy and Environmental Protection (DEEP) to discuss PCB sample analysis (September 25); along with NUBIA ZUVERZA MENA, PH.D., hosted an undergraduate student from Central Connecticut State University that is interested in a CAES research internship (September 26); travelled to Milwaukee, Wisconsin, and participated in the bi-annual in person CSN all staff meeting (September 27-29).

- along with SARA THOMAS, PH.D., SARA NASON, PH.D., and NUBIA ZUVERZA-MENA, PH.D., participated in a Zoom call with collaborators from the University of Minnesota and Yale University to discuss progress on a joint NIEHS grant on PFAS phytoremediation (October 3); along with CHRISTIAN DIMKPA, PH.D. and SHITAL VAIDYA, PH.D., hosted a Zoom call with collaborators at Johns Hopkins University to discuss progress on a joint USDA nanoscale phosphorus project (October 4); met by Teams with representatives of the agrichemical company Mosaic to discuss funding and research (October 5); participated by Zoom in the weekly all hands call for the NSF Center for Sustainable Nanotechnology (CSN) (October 4 & 25); represented CAES at Jones Family Farms where Terry Jones was presented with the Leopold Conservation Award (October 4); met by Teams with collaborators at the University of Minnesota and Katana Agriscience Corporation to discuss collaborative research (October 5 & 19); along with MICHAEL LAST hosted representatives from OPM and OFA during the CAES New Staff Meet and Greet event (October 6); participated in the monthly CSN Faculty meeting (October 6); met with staff from the Chief States Attorney's office to discuss upcoming testimony as a the State Chemist (October 6); traveled to the University of Parma in Parma Italy and gave several lectures on sustainable nanotechnology and agriculture (October 9-13); met by Zoom with collaborators at Guangdong University of Technology to discuss joint research projects (October 12); gave a presentation by Zoom titled "Nanoenabled agriculture: A path to global food security in a changing climate" to the University of Minnesota, 9-9-9 Workshop on Science and Engineering in Agriculture and Biology (October 16); met by Teams with

Professor Saion Sinha of the University of New Haven and of 12-15 Molecular Diagnostics to discuss collaborative research (October 17); met by collaborators at the University of California Irvine to discuss collaborative research on the USDA Closer to Zero initiative (October 17); hosted the quarterly CAES Board of Control meeting at the Valley Laboratory (October 18); provided testimony as the State Chemist for the Chief States Attorney's office in Bridgeport Superior Court (October 18); participated in the monthly board meeting of the International Phytotechnology Society (October 19); hosted and gave a CAES tour to Diwa Ratnam of Katana Agriscience Corporation (October 19); traveled to the University of Delaware and gave a seminar to the Department of Plant and Soil Sciences titled "Nano-enabled agriculture: A path to global food security in a changing climate" (October 19-20); participated in MS Thesis presentation and defense by Lucas Casabury, a master's student in the Plant and Soil Sciences Graduate Program (Jason White was on his committee) (October 23); along with the Department of Analytical Chemistry hosted Professor Saion Sinha of the University of New Haven and of 12-15 Molecular Diagnostics and his team for a product demonstration (October 24); participated in the PhD Dissertation defense of Gurpal Singh at the University of Massachusetts (October 26); participated in the CAHNR Dean's Advisory Board at the University of Connecticut (October 26); hosted the quarterly meeting of the CAES Safety Committee (October 27); participated in a Zoom call with collaborators at the University of Massachusetts to discuss progress on a joint USDA proposal on nanoscale sulfur (October 27); traveled to St. Louis and gave a presentation titled "Nanobiotechnology-based strategies for enhanced crop resilience" at the 2023 ASA, CSSA, SSSA International Annual Meeting (October 29-31); and along with NUBIA ZUVERZA-MENA, PH.D. and TRUNG BUI, PH.D., participated in a monthly USDA grant meeting on micro-nanoplastics with collaborators at Rutgers University and the New Jersey Institute of Technology (October 30)

- met by Teams with representatives of the agrichemical company Mosaic to discuss funding and research (November 1); participated by Zoom in the weekly all hands call for the NSF Center for Sustainable Nanotechnology (CSN) (November 1, 15, & 29), along with CHRISTIAN DIMKPA, PH.D. and SHITAL VAIDYA, PH.D., hosted a Zoom call with collaborators at Johns Hopkins University to discuss progress on a joint USDA nanoscale phosphorus project (November 1 & 21); met by Teams with collaborators at the University of Minnesota and Katana Agriscience Corporation to discuss collaborative research (November 2 & 16); hosted the monthly CAES Jvisa recipient meeting (November 3); participated in the bi-monthly CSN Faculty Zoom call (November 3 & 17); traveled to Athens, Greece and gave a presentation titled "Sustainable Agriculture: Nano-enabled strategies for food security in a changing climate" at the University of Athens as part of a Sustainability Masterclass (November 5-9); traveled to Marina del Rey, California to present a lecture titled "Nanobiotechnology-based strategies for enhanced crop stress resilience" at the 12th Annual Sustainable Nanotechnology Organization Conference (November 10-12); met by Zoom with CSN Faculty to discuss the future of the Center's nanochemistry-plant work (November 13); along with PH.D.s PHILIP ARMSTRONG, DOUG BRACKNEY, ANDREA GLORIA-SORIA, MEGAN LINSKE, GOUDARZ MOLAEI and SCOTT WILLIAMS, participated in a Zoom call with colleagues at the University of Parma in Parma, Italy, and discussed ways to collaborate on vector borne disease research (November 14); hosted the monthly CSN nanochem-plant Zoom call (November 14); along with SARA NASON, PH.D., participated in the monthly PFAS Laboratory Working Group call (November 14); participated in the annual meeting of the CAES Experiment Station Associates and gave a Director's Report (November 15); participated in the monthly Farmland Preservation Advisory Committee meeting (November 16); along with CT DCP staff participated in an audit of the Adult Use Cannabis Program sampling and analysis for mold (November 17); along with staff in the Department of Analytical Chemistry, welcomed Lauro Pilotto from the University of Udine as a visiting graduate student; Laura will be at CAES until May 2024 (November 17); met by Zoom with collaborators at the University of California (Irvine, Santa Barbara) to discuss work on a new collaborative USDA grant (November 21); along with PH.D.s TRUNG BUI, CHRISTIAN DIMKPA, SHITAL VAIDYA and YINGXUE (CHARLIE) YU, visited the laboratories of 12-15 Molecular Diagnostics (November 22); along with LEIGH WHITTINGHILL, PH.D., hosted Prof. Amy Harder (Associate Dean for Extension) and Stacey Stearns of the UConn CAHNR to discuss collaborative programs (November 27); met by Zoom with a student and teacher at Edison High School in Alexandria, VA to discuss a science fair project using nanoclay

(November 27); traveled to the University of Rhode Island and gave a lecture titled "Nano-enabled agriculture: A path to global food security in a changing climate" to a Bionanotechnology class (November 28); met by Zoom with a collaborator at Johns Hopkins University to discuss joint experiments (November 29); and along with YI WANG, PH.D., met by Zoom with collaborators at Louisiana State University and the University of Auckland in New Zealand to discuss a new USDA collaborative project (November 30).

- along with Yi Wang, Ph.D. met by Zoom with collaborators at the University of Massachusetts to discuss a progress of a USDA collaborative project (December 1); participated by Zoom in the bi-monthly faculty call for the NSF Center for Sustainable Nanotechnology (CSN) (December 1, 15); met by Teams with collaborators at the University of Minnesota and Katana Agriscience Corporation to discuss collaborative research (December 1, 7, 21); along with Nubia Zuverza-Mena, Ph.D., Sara Nason, Ph.D., and Jasmine Jones, attended 2023 NIEHS Superfund Basic Research Program (SRP) Annual Grant Recipient Meeting in Albuquerque NM (December 3-6); hosted a Zoom call with collaborators from the University of Birmingham UK to discuss a collaborative grant proposal (December 8); along with CAES VICE DIRECTOR, LINDSAY TRIPLETT, PH.D., met with the Minister of Agriculture of Jamaica and his colleagues, discussed CAES research programs, and opportunities for collaboration (December 11); participated in a Teams call with a large number of colleagues from the European Union to discuss a potential European Horizon grant submission (December 12); along with CHRISTIAN DIMKPA, PH.D. and Shital Vaidya, Ph.D., hosted a Zoom call with collaborators at Johns Hopkins University to discuss progress on a joint USDA nanoscale phosphorus project (December 12); met by Teams with the CT Commissioner of Agriculture to discuss PFAS testing of agricultural soils (December 12); hosted the monthly CSN Nanochem-plant working group call (December 12); met by Teams with staff from the Department of Consumer Protection Division of Drug Control to discuss the Adult Use Cannabis program (December 12, 13); along with Blaire Steven, Ph.D., participated in a Zoom call with colleagues at the University of Delaware and the National Research Council of Italy to discuss collaborative research on a new USDA project (December 13); participated in the weekly CSN all hands Zoom call (December 13); along with Raja Muthuramalingam, Ph.D., CHRISTIAN DIMKPA, PH.D., and Nubia Zuverza-Mena, Ph.D., participated in a Zoom call with collaborators at the Brazilian Agricultural Research Corporation and discussed future collaborative research (December 14); attended the Bond Commissioner meeting at the Legislative Office Building and secured funding for the CAES New Haven greenhouse renovation project (December 15); travelled to the University of Minnesota in Minneapolis MN to meet with collaboratives and discuss joint research projects (December 18); participated in a Teams call with Representative Gresko of Stratford to discuss issues of relevance to the Environment Committee (December 19); hosted the monthly CAES jvisa recipient meeting (December 20); hosted the quarterly CAES Safety Committee meeting (December 21); participated in a Zoom call with collaborators at Johns Hopkins University and discussed joint research (December 21); along with Susanna Kerio, Ph.D., participated in a Teams call with Prof. Ali Nikbakht of Isfahan University of Technology in Iran and discussed future collaborative research (December 22); and along with Department of Analytical Chemistry staff, hosted an undergraduate student from the University of Rhode Island and gave a tour and description of nanotechnology programs (December 22).
- along with SARA NASON, PH.D., NUBIA ZUVERZAMENA, PH.D., Trung Bui, Ph.D., and JASMINE JONES participated in a Zoom meeting with collaborators at Yale University and the University of Minnesota for a joint NIEHS grant (January 2); met by Teams with staff of The Mosaic Company to discuss collaborative work (January 2); met by Teams with Department of Consumer Protection Division of Drug Control to discuss testing within the Adult Use Cannabis program (January 3); met by Zoom with a colleague at the University of Minnesota to discuss a collaboration with Land o' Lakes (January 3); along with CHRISTIAN DIMKPA, PH.D. and SHITAL VAIDYA, PH.D., hosted a Zoom call with collaborators at Johns Hopkins University to discuss progress on a joint USDA nanoscale phosphorus project (January 4, 16, & 30); participated in the USFA NIFA Closer to Zero working group and providing a briefing on CAES activity (January 4); attended the monthly Laboratory Preparedness Advisory Committee (LPAC) meeting at the Department of Public Health (January 8); along with NUBIA ZUVERZA-MENA, PH.D.,

Mandeep Kaur, Ph.D., and Trung Bui, Ph.D. participated in a monthly group meeting with collaborators at Rutgers University and the New Jersey Institute of Technology (NJIT) and discussed joint research on micro-nanoplastics in agricultural soils (January 8); along with SARA NASON, PH.D. and JASMINE JONES participated in the monthly PFAS testing Teams call (January 9); hosted the monthly CSN Nanochem-plant working group call (January 9); participated in the weekly NSF Center for Sustainable Nanotechnology (CSN) all hands call (January 10 & 31); participated by Zoom in the bimonthly faculty call for the NSF (CSN) (January 12 & 26); along with CHRISTIAN DIMKPA, PH.D., participated in the inaugural American National Standards Institute (ANSI) web meeting to develop protocols for the safety assessment of nanomaterials as fertilizers (January 16); met by Teams with a staff member from Congresswoman Rosa DeLauro's office to discuss the Closer-to-Zero program of USDA and FDA (January 16); participated in a USDA AFRI project meeting with collaborators at Columbia University and the University of California Santa Barbara (January 16); along with MICHAEL LAST and LINDSAY TRIPLETT, PH.D., hosted the first quarter meeting of the CAES Board of Control at the CT Farm Bureau (January 17); attended the 6th International Conference on Agriculture for Sustainable Development at the National Rice Research Institute in Cuttack India and gave a presentation titled "Nanobiotechnology based strategies for enhanced crop stress resilience" (January 17-24); met with the Commissioner Bryan Hurlburt of the Department of Agriculture to discuss PFAS testing in farm soils (January 29); participated in a Teams call with staff from the National Nanotechnology Coordination Office to discuss an upcoming webinar (January 30); and hosted the CAES J-Visa Recipient meeting (January 31).

- met by Zoom with collaborators at the University of Birmingham to finalize a joint grant submission (February 2); gave a presentation titled "Nanometrology for Food, Agriculture, and the Environment: Nano-enabled Agriculture" for the National Nanotechnology Initiative Nanometrology Webinar Series: Nanometrology for Food, Agriculture, and the Environment (February 2); met by Teams with Convergent Bio to discuss an NSF SBIR grant submission (February 5, 21, & 28); along with SARA NASON, PH.D., NUBIA ZUVERZA-MENA, PH.D., and Trung Bui, Ph.D., participated in a Zoom meeting with collaborators at Yale University and the University of Minnesota for a joint NIEHS grant (February 6); met by Zoom with Christopher Connors, Ph.D. of the UConn Technology Commercialization Office to discuss CAES patent and IP policies (February 6); met by Zoom with Professor Saion Sinha of the University of New Haven to discuss collaborative research (February 6); met with Joseph Doktorski of ABSciex to discuss laboratory instrumentation (February 7); participated in the weekly NSF Center for Sustainable Nanotechnology (CSN) all hands call (February 7 & 21); met by Teams with Representative Bryan Lanoue of the CT State Legislature to discuss the PFAS Farm Soil Testing Program (February 8); participated in the monthly CSN Faculty call (February 9); traveled to the New Jersey Institute of Technology to meet with collaborators and give a seminar titled "Nano-enabled agriculture: A path to global food security in a changing climate" (February 12); hosted the monthly CSN Nanochem-plant working group call (February 13); participated in a Zoom call with collaborators at the University of Texas El Paso and the University of Rhode Island to discuss progress on a joint USDA grant (February 13); met by Zoom with Rebecca Klaper, Ph.D. of the University of Wisconsin Milwaukee to discuss collaborative research (February 14); met by Zoom with Greg Lowry, Ph.D. of Carnegie Mellon University to discuss a joint grant proposal (February 14); gave a presentation titled "The Chemistry of Nanoparticle-Plant Interactions…and Nano-enabled Agriculture" at the weekly CSN meeting (February 14); participated in Farmland Preservation Advisory Board meeting (February 15); along with CHRISTIAN DIMKPA, PH.D., hosted a Zoom call with collaborators at Johns Hopkins University to discuss progress on a joint USDA nanoscale phosphorus project (February 20); along with YI WANG, PH.D., and WASHINGTON DA SILVA, PH.D., met with collaborators at the University of Aukland in New Zealand to discuss collaborative research (February 20); met by Zoom with scientists at Convergent Bio and OCP to discuss collaborative research (February 22); along with NUBIA ZUVERZA-MENA, PH.D., Mandeep Kaur, Ph.D., and Trung Bui, Ph.D., participated in a monthly group meeting with collaborators at Rutgers University and the New Jersey Institute of Technology (NJIT) and discussed joint research on micro-nanoplastics in agricultural soils (February 26); gave a podcast for the Mosaic company's podcast series (February 27); met by Zoom with Hongda Chen, Ph.D., of USDA NIFA and Cristina Sabliov, Ph.D., of LSU to discuss a special issue of the Journal of

Nanoparticle Research (February 27); traveled to the University of Minnesota for the Ph.D. Defense of Tana O'Keefe and to meet with staff at Land o' Lakes regarding collaborative research (February 28).

- along with SARA NASON, PH.D., NUBIA ZUVERZA-MENA, PH.D., and Trung Bui, Ph.D. participated in a Zoom meeting with collaborators at Yale University and the University of Minnesota for a joint NIEHS grant (March 5 & 26); met by Teams with Convergent Bio scientists to discuss collaborative research (March 6, 7, 18, 19, 21 & 22); participated in the weekly NSF Center for Sustainable Nanotechnology (CSN) all hands call (March 6 & 20); along with YI WANG, PH.D. met by Zoom with Prof. Baoshan Xing to discuss a collaborative grant 27proposal (March 6); met by Zoom with Prof. Soledad Peresin of Auburn University to discuss a collaborative grant proposal (March 7); participated in the monthly CSN Faculty call (March 8); along with CHRISTIAN DIMKPA, PH.D., CARLOS TAMEZ, PH.D., NASSIFATOU TITTIKPINA, PH.D., and MEGHAN CAHILL travelled to the FDA LFFM annual meeting in Houston, Texas (March 11-14); hosted the monthly CSN Nanochem-plant working group call (March 12); along with CHRISTIAN DIMKPA, PH.D. hosted a Zoom call with collaborators at Johns Hopkins University to discuss progress on a joint USDA nanoscale phosphorus project (March 12 & 19); participated in the NERA Multistate Activities Committee meeting (March 15); participated in the annual Board meeting of the Environment and Human Health, Inc. (EHHI) (March 16); met by Zoom with an undergraduate student of Purdue University to discuss sustainable agriculture (March 19); along with CHAOYI DENG, PH.D. met with Prof. Rebecca Klaper of the University of Wisconsin Milwaukee and students to discuss collaborative research (March 19); met with Ana Fidantsef of the UConn Technology Commercialization Office to discuss joint projects and IP (March 20); along with CHRISTIAN DIMKPA, PH.D. met with representatives the nano-enabled agriculture company DG International (March 20); met by Teams with staff of DCP Drug Control to discuss the adult use cannabis testing program (March 21); met with collaborators in Italy and India to discuss the upcoming International Phytotechnologies Conference in Calicut India (March 25); spoke by Zoom with Prof. Jorge Gardea-Torresdey of the University of Texas El Paso to discuss collaborative research (March 25); spoke by Zoom with Prof. Om Parkash Dhankher of the University of Massachusetts to discuss collaborative research (March 25); spoke with senior administrators at UConn on how to align CAES and UConn research programs (March 25); met with Prof. Vasilis Vasiliou of Yale University and Prof. Philip Demokritou of Rutgers University to discuss a joint grant proposal on plastics (March 26); met by Zoom with collaborators at Columbia University to discuss a joint Closer to Zero USDA research project (March 26); along with CHRISTIAN DIMKPA, PH.D., YI WANG, PH.D. and MILA PAVLICEVIC, PH.D., met with a prospective Yale Conservation Scholar that could spend the summer at CAES (March 27-28); gave a Director's update at the Experiment Station Associates meeting (March 28), and, along with CHRISTIAN DIMKPA, PH.D., TERRI ARSENAULT, and RICHARD CECARELLI, spoke by Teams with UConn Extension and others about industrial hemp growth this summer (March 28).
- along with SARA NASON, PH.D., NUBIA ZUVERZA-MENA, PH.D., and Trung Bui, Ph.D., participated in a Zoom meeting with collaborators at Yale University and the University of Minnesota for a joint NIEHS grant (April 2); along with CHRISTIAN DIMKPA, PH.D., hosted a Zoom call with collaborators at Johns Hopkins University and Stonybrook University to discuss progress on a joint USDA nanoscale phosphorus project (April 2 & 16); participated in the weekly NSF Center for Sustainable Nanotechnology (CSN) all hands call (April 3, 10, & 17); met by Teams with Convergent Bio scientists to discuss collaborative research (April 3 & 17); spoke by Zoom with collaborators at the University of Minnesota to discuss grant opportunities (April 3); along with CHRISTIAN DIMKPA, PH.D., and staff of the Department of Analytical Chemistry hosted the CT Department of Consumer Protection (DCP) Commissioner Bryan T. Cafferelli and staff for a tour of the adult use cannabis testing laboratory and a discussion of mutual interest in the program (April 4); participated in the USDA Closer-to-Zero meeting and gave an update on CAES programs (April 4); participated in the quarterly University of Connecticut CAHNR Deans Advisory Council meeting at the Storrs campus (April 4); hosted the monthly CAES J-Visa recipient meeting (April 5); hosted US Senator Richard Blumenthal for a press conference focused on ticks and tickborne diseases (April 6); hosted the CSN monthly Nanochem-Plant call (April 9); hosted the quarterly CAES Safety

Committee meeting (April 10); gave a lecture titled "Nano-enabled agriculture: A path to global food security in a changing climate" by Zoom to the University of New Haven graduate course Introduction to Nanobiotechnology (April 10); travelled to Calgary, Alberta Canada to participate in the closing meeting of the Thrive Accelerator course and gave a presentation on nano-enabled agriculture (April 11-12); spoke by Teams with a UConn student to discuss CAES and nano-enabled agriculture research (April 15); participated in a Board meeting of the International Phytotechnology Society (April 16); spoke by Zoom with UConn extension staff and a hemp farmer about having a hemp demonstration plot on a CAES farm (April 16); participated in an "All Commissioners" Teams call (April 18); along with SARA NASON, PH.D., and NUBIA ZUVERZA-MENA, PH.D., participated in a Teams call with CT DEEP staff to discuss soil sampling for PFAS analysis (April 19); participated in the monthly CSN Faculty call (April 19); gave a presentation by Zoom titled "Nanobiotechnology-based Strategies for Enhanced Crop Resilience" at the NanoFlorida 2024 International Conference (April 20); visited the Institute of Materials Science at the University of Connecticut to give a presentation titled "Nano-enabled agriculture: A path to global food security in a changing climate" and met with faculty and graduate students to facilitate new research collaborations (April 26); along with NUBIA ZUVERZA-MENA, PH.D., and Mandeep Kaur, Ph.D., met with collaborators at Rutgers University and NJIT to discuss project on a joint USDA grant (April 29); along with CHRISTIAN DIMKPA, PH.D., NUBIA ZUVERZA-MENA, PH.D., and MILA PAVLICEVIC, PH.D., met with collaborators at the University of Texas El Paso and the University of Rhode Island to discuss progress on a collaborative USDA grant (April 30); along with CHRISTIAN DIMKPA, PH.D., NUBIA ZUVERZA-MENA, PH.D., and MILA PAVLICEVIC, PH.D., met with representatives of Mosaic, Inc. to discuss a research project (April 30); and along with CHAOYI DENG, PH.D., and HINA ASHRAF, PH.D., attended the semi-annual CSN All Hands meeting at Johns Hopkins University in Baltimore MD (April 30-May 1).

- participated in the weekly NSF Center for Sustainable Nanotechnology (CSN) all hands call (May 1, 8, 15, & 22); participated in a Zoom call with colleagues at the University of Minnesota and Land o' Lakes/Winfield United to discuss collaborative research (May 3); along with SARA NASON, PH.D., NUBIA ZUVERZA-MENA, PH.D., and TRUNG BUI, PH.D., participated in a Zoom meeting with collaborators at Yale University and the University of Minnesota for a joint NIEHS grant (May 7); along with NUBIA ZUVERZA-MENA, PH.D., and MILA PAVLICEVIC, PH.D., met with collaborators at the University of Texas El Paso and the University of Rhode Island to discuss progress on a collaborative USDA grant (May 7); participated in a Zoom call with collaborators at the University of Birmingham and others in the EU about a joint grant proposal to the Horizon 2020 program (May 9 & 24); along with JASMINE JONES participated in the monthly CT PFAS Analysis Working Group call (May 14); hosted by Zoom the monthly CSN Nanochemistry-Plant Working Group call (May 14); along with YI WANG, PH.D., participated in a Zoom call with colleagues at Louisiana State University and the University of Auckland to discuss collaborative research (May 14); held a Teams call with the University of Connecticut Technology Commercialization Services group (May 14 & 17); along with CHRISTIAN DIMKPA, PH.D., hosted a Zoom call with a post-doctoral candidate from the University of Tehran (May 15); met by Teams with Convergent Bio scientists to discuss collaborative research (May 15); participated in the bi-monthly Farmland Preservation Advisory Board meeting (May 16); hosted a Teams call with collaborators at Rutgers University (May 16); participated in the monthly CSN Faculty call (May 17); along with SUSANNA KERIO, D.SC., spoke by Zoom with a potential visiting post-doc from the University of Eastern Finland (May 20); spoke by phone with Paul Johnson of Focus-Cuba about a potential trip to initiate outreach and collaborative research programs in Cuba (May 20); participated in the NERA Multi-state Activities Committee meeting (May 20); along with CHRISTIAN DIMKPA, PH.D., hosted a Zoom call with collaborators at Johns Hopkins University and Stonybrook University to discuss progress on a joint USDA nanoscale phosphorus project (May 20); hosted the quarterly CAES Board of Control meeting (May 21); participated in a Zoom meeting with colleagues at Columbia University to discuss collaborative research on a joint USDA project (May 21); hosted the monthly CAES j-visa recipient meeting (May 24); along with CHAOYI DENG, PH.D., and HINA ASHRAF, PH.D., hosted a Zoom meeting with colleagues at the University of Wisconsin to discuss collaborative research (May 28); presented welcome remarks to

a group of students and faculty from Albertus College being hosted by SUSANNA KERIO, D.SC., and other CAES scientific (May 31); and participated in a Zoom call with colleagues at the University of Rhode Island to discuss a micro-nanoplastics workshop at the upcoming Sustainable Nanotechnologies Organization (SNO) meeting in November (May 31).

- met by Teams with the University of Connecticut Technology Commercialization Services group to discuss CAES intellectual property (June 3); participated in a Zoom call with collaborators at Carnegie Mellon University and the University of California Riverside to discuss an Engineering Research Center proposal (June 3, 10); along with NUBIA ZUVERZA-MENA, PH.D., and MANDEEP KAUR, PH.D. participated in a Zoom meeting with collaborators at Rutgers University to discuss a joint USDA grant (June 3, 24); travelled to the University of Connecticut with 26 CAES scientific staff and visitors to have a day-long symposium with faculty at the Institute of Material Science (June 4); participated in the weekly NSF Center for Sustainable Nanotechnology (CSN) all hands call (June 5, 12, 19); travelled to Washington DC to give an invited presentation entitled "Nano-enabled agriculture: A path to global food security in a changing climate" to the National Academies of Sciences, Engineering, and Medicine's Committee on the Quadrennial Review of the National Nanotechnology Initiative (June 5-7); hosted the monthly CSN Nanochem-Plant working group Zoom call (June 5); along with NUBIA ZUVERZA-MENA, PH.D. and TRUNG BUI, PH.D., participated in a Zoom meeting with collaborators at Yale University and the University of Minnesota for a joint NIEHS grant (June 11); along with CHRISTIAN DIMKPA, PH.D. and HINA ASHRAF, PH.D., hosted a Zoom call with collaborators at Johns Hopkins University and Stonybrook University to discuss progress on a joint USDA nanoscale phosphorus project (June 11); met by Zoom with 12-15 Molecular Diagnostics to discuss collaborative work (June 12); met by Zoom with the USDA NIFA Closer to Zero working group (June 12); met by Zoom with a University of Maryland Baltimore County graduate student interested in CAES nanotechnology and agriculture research (June 12); along with CHAOYI DENG, PH.D., met by Zoom with collaborators at the University of Wisconsin to discuss a joint publication on copper sulfide (June 13); hosted the CAES Board of Control Finance Committee meeting (June 14); met with collaborators at Columbia University to discuss a joint USDA Closer-to-Zero research project (June 14, 18); along with CHRISTIAN DIMKPA, PH.D. met by Teams with a reporter to discuss the state of CT Cannabis and Hemp programs (June 17); met by Zoom with UMass Amherst Professor Jaime Pinero and a graduate student to discuss collaborative research (June 17); along with NUBIA ZUVERZA-MENA, PH.D. and MILA PAVLICEVIC, PH.D. met with collaborators at the University of Texas El Paso and the University of Rhode Island to discuss progress on a collaborative USDA grant (June 20); attended and served as a Co-Chair for the 2024 Nanoscale Science and Engineering for Agriculture and Food Systems Gordon Research Conference at Southern New Hampshire University (June 23-28); and participated in the proposal defense of a PhD student at the New Jersey Institute of Technology (June 28)

WHITTINGHILL, LEIGH

- gave a talk titled "Effects of annual compost additions to an agricultural green roof on growing media organic matter and nutrient content over time" at the Ecological Society of America 2023 annual conference in Portland, OR (10 attendees) (August 8)
- presented a virtual talk titled "The effect of annual compost additions to green roof media on cut-and-come-again lettuce production" at the Green Roofs for Healthy Cities Green Infrastructure Research Symposium (34 attendees) (October 25)
- gave a talk titled "Nutrient Management on Urban Farms: Research Collaborations with Common Ground" at the Common Ground annual Farm and Garden Conference in New Haven, CT (35 attendees) (November 11)
- gave a virtual webinar at the CT NOFS winter conference titled "Determining fertilizer needs for small scale production" (March 20)
- gave an invited lecture to the Longhill Garden Club in Trumbull titled "Small Plastic Pool Container Production in Urban Agriculture" (37 attendees) (April 22)

- presented an invited talk titled “Green roof technology in urban agriculture: Lessons in production and environmental impact” at the Green Roofs for Healthy Cities Urban Agriculture Virtual Symposium (15 participants) (May 14)
- presented collaborative research poster titled “Cut-and-come-again lettuce production: lessons learned from research in three different urban production systems” at the Urban Food Systems Symposium in Columbus, OH (June 11)
- presented talk titled “Urban Agriculture Research Collaborations with Common Ground and Yale Farm” to summer interns of Common Ground High School and Yale Farm (12 attendees) (June 26).

WILLIAMS, SCOTT C.

- interviewed by Maryn McKenna from Wired Magazine about CAES research regarding the efficacy of the systemic pesticide treatment of wild white-tailed deer for tick management (Ticks and the Diseases They Carry Are Spreading. Can This Drug Stamp Them Out? | WIRED) (July 12)
- interviewed by Cindi Jacobson about CAES involvement with the Connecticut Wildlife Action Plan (July 17)
- spoke virtually at the Entomology and Ecology Team meeting of the Division of Vector-Borne Diseases of the Centers for Disease Control and Prevention about CAES’s work on systemic acaricidal treatment of wildlife reservoirs for tick management (September 12)
- gave invited presentation to members of the New England Regional Center of Vector-borne Diseases about past experiences with reservoir-targeted vaccine efforts against *Borrelia burgdorferi* and potential research avenues moving forward (December 5) (15 attendees)
- Gave invited lecture titled “Overabundant white-tailed deer as dispersers of exotic plant seeds” for the Avon, CT Public Library seminar series (21 attendees) (March 21)
- gave a lecture to graduate students at Southern Connecticut State University’s Medically Important Arthropods course on Integrated Tick Management Strategies (May 2)
- interviewed by outdoor writer and Killingworth native Ed Ricciuti on highlights of a recent publication on the effectiveness of fall application of synthetic pyrethroids on emerging spring nymphal blacklegged ticks while avoiding impacting beneficial insects (May 6)
- presented invited lecture titled “Mysterious Wildlife of Guilford” as part of a lecture series co-sponsored by the Guilford Free Library and Shoreline Village Connecticut (103 attendees) (May 7)
- interviewed by Associate Press reporter Michael Stobbe on the status of 2024 tick abundances (May 9)
- participated in the CDC-funded Northeast Center for Excellence in Vector Borne Diseases Boot Camp in Scarborough, Maine (May 21-23) and gave the Keynote Address titled “Systemic Acaricidal Treatment of Reservoir Hosts for Tick Management” (May 22) (25 attendees) and gave invited lecture on integrated tick management (May 22) (25 attendees)
- interviewed by Joe Tucci of Hearst Connecticut Media on how to repel animals from gardens and aggressive interactions during the breeding season (May 30)
- gave invited lecture to the lunch wellness seminar for Conning Insurance Asset Management titled “Tick Management in Residential Areas” (75 attendees) (June 13)
- interviewed by Abby Weiss from the Connecticut Insider on tick ecology and the current status of ticks in Connecticut (June 27)

YU, YINGXUE (CHARLIE)

- presented oral presentation “Transport of Biodegradable Nanoplastics Affected by Weathering and Proteins in Unsaturated Porous Media” at the American Geophysical Union Annual Conference, San Francisco, CA (December 11-15) (50 attendees)
- presented lecture titled “Fate and transport of emerging contaminants: Micro- and nanoplastics and more” at the 2024 W4188 Multi-State Hatch Meeting at the Desert Research Institute in Las Vegas, NV (50 attendees) (January 3–5)

- presented lecture titled “Biodegradable plastic mulch for specialty crop production” at the UConn Extension Vegetable & Small Fruit Growers’ Conference at University of Connecticut (100 attendees) (January 9)
- presented “Transport of Biodegradable Nanoplastics in Unsaturated Porous Media” at the European Geosciences Union Annual Assembly (50 attendees) (April 15)
- presented “Fate and Transport of Emerging Contaminants: Micro- and Nanoplastics” at the University of Bern, Institute of Geological Sciences, Rock-Water Interaction Group at Bern, Switzerland (15 attendees) and visited the laboratories of the Rock-Water Interaction Group (April 25–26).
- presented talk “Transport of Biodegradable Nanoplastics Affected by Weathering and Proteins in Unsaturated Porous Media” at the 61st Annual Meeting of The Clay Minerals Society (50 attendees) (June 3–7)

ZARRILLO, TRACY

- Organized and co-chaired an online meeting of leading New England bee experts to discuss a collaborative project which will synthesize what is known about New England bees (July 20).
- Interviewed by Kathy Connolly from the blog Zip06 about the state of Connecticut bees (Aug 2); met with Max McCarthy of Rutgers University, Victor DeMasi, and Faith Novella of Earthplace to search for the endangered bee species Andrena parnassiae in a quarry in Bethel (Aug 20); attended a meeting about sharing CAES bee data to a new initiative called the Symbiota “Bee Library Portal” which will expose our bee collection to a larger community of bee researchers (Aug 31).
- Attended a virtual meeting with researchers from the University of Massachusetts, Pennsylvania State University, University of Georgia, and the USDA Forest Service to discuss our collaboration regarding bees in eastern forests (Sep 6); was invited to become a member of the Invertebrate Taxa Team for the upcoming 2025 revision of the Connecticut State Action Wildlife Plan by Terwilliger Consulting, Inc. and CT-DEEP and attended a virtual training webinar to learn about the project (Sep 26); attended a viewing of the film “My Garden of a Thousand Bees” hosted by the Glastonbury Pollinator Pathway at the Welles-Turner Memorial Library and was available to answer questions about Connecticut wild bees after the film (approx. 20 attendees) (Sep 28); was interviewed by Susan Freinkel about the rediscovery of Andrena rehni in Connecticut for Smithsonian Magazine (Sep 29).
- Interviewed by Ms. Lauren Owens Lambert of National Geographic and Reuters about the rediscovery of Andrena rehni in Connecticut (Oct 11); attended a virtual meeting with Dr. Neil Cobb and Dr. James Dorey to discuss progress on the Tundra to Tropics manuscript (Oct 24); attended a virtual meeting with Ms. Casey Johnson of the University of Rhode Island to discuss progress on the NRCS pollinator habitat project (Oct 26)
- Presented an invited talk titled “The Connecticut wild bee monitoring program” in a symposium called “Using statewide surveys to assess the conservation status of US pollinators” at the annual meeting of the Entomological Society of America held at the Gaylord National Resort and Convention Center in National Harbor, MD (approx. 50 attendees) (November 7); was invited to become a member of the Connecticut Wildlife Action Plan Invertebrate Taxa Team and participated in a virtual meeting to discuss invertebrate species of greatest conservation need in Connecticut (November 13); visited the Hymenoptera collection at the Museum of Comparative Zoology at Harvard to confirm identification of bee species relevant to Connecticut (November 17).
- Participated in a virtual meeting with Ms. Casey Johnson of the University of Rhode Island to discuss an NRCS pollinator habitat project (December 1); was interviewed by Ms. Tabitha Baker of the University of Connecticut’s journalism program about bee decline and climate change (December 4); participated in a virtual meeting with Dr. Neil Cobb of the Biodiversity Outreach Network to discuss the ‘Tropics to Tundra’ wild bee project (December 4); participated in a virtual meeting of the Invertebrate Taxa Team for the upcoming Connecticut State Wildlife Action Plan to discuss invertebrate species of greatest conservation need in Connecticut (December 5).

- Participated in a meeting with DR. KELSEY FISHER and DR. MEGAN LINSKE to discuss a collaboration investigating the effects of acaricide application on pollinators (January 5); was visited by Ms. Casey Johnson and Ms. Emma Tondre of the University of Rhode Island to provide instruction on native bee identification (January 11); attended an online wasp identification course given by the Frost Entomological Museum, Pennsylvania State University (15-26 January); participated in a virtual meeting with Dr. Neil Cobb of the Biodiversity Outreach Network to discuss the 'Tropics to Tundra' wild bee project (January 28); was invited by Dr. Marta Wells of Yale University to mentor an undergraduate student who is interested in doing pollinator research (January 30).
- Attended a CT-SWAP meeting to discuss next steps for the 2025 update to the Connecticut State Wildlife Action Plan (July 11); was interviewed by William Hobbs of Estuary Magazine about native bees in Connecticut (July 19).
- Interviewed and photographed at Dovehill Farm in Moosup, CT by Ms. Lauren Owens Lambert of Smithsonian Magazine (June 3); hosted a lab visit from Mr. Victor DeMasi who came to review the specimens in her Bombus collection (June 6); participated in the 2024 Rhode Island BioBlitz as the taxonomic expert on the Hymenoptera team at the Norman Bird Sanctuary in Newport, Rhode Island (June 7-8); participated in a meadow establishment project created by Pete Picone of CT-DEEP called "Taking Action for Habitat by Working Hands On: Sowing Native Seeds and Creating Native Meadows" (June 11).

ZENG, QUAN

- Special session oral presentation "All yeasts considered: Understanding the role of yeast in host-microbe interactions" at the Plant Health 2023. 08/2023
- Special session oral presentation "Pollinators' role in flower microbiome development" 08/2023
- Invited seminar "Bacterial Interspecies Communication within Soybean Rhizosphere", Department of Plant Science and Landscape Architecture, University of Connecticut, September 22rd, 2023.
- Invited keynote presentation for the Korean Society of Plant Pathology Annual Conference in Jeju Island, Korea, 10/2023
- Served as guest lecturer and laboratory instructor, Department of Plant Science and Landscape Architecture, University of Connecticut, November 8th, November 22rd, 2023.
- Connecticut Pomological Society Meeting participation, December 2023
- Invited seminar, Department of Plant Pathology, Washington State University. 01/2024
- New Hampshire Association of Apple Growers participation, February 2024
- Maine Apple Grower Association participation, February 2024
- Gave two talks at the Maine Apple Grower Association Meeting, Lewiston, ME, March 20, 2024.

ZUVERZA-MENA, NUBIA

- presented five talks during this period. The 1st one titled: "PFAS bioremediation using hemp plants" at the NIH Tribal Health Research Office (THRO) - Tribal Advisory Committee (TAC) meeting (Durham, NC, June 27, 2024); the 2nd presentation "Engineered nanomaterials with PFAS affinity to enhance phytoremediation" and 3rd talk "Sustainable nanocarrier formulations to promote plant health" were both given at the 12th Sustainable Nanotechnology Organization (SNO, Marina del Rey, CA, November 11th, 2023); the 4th and 5th oral presentations "Hemp phytoremediation of PFAS and degradation of PFAS in harvested hemp: A comprehensive PFAS remediation trial at the former Loring Airforce Base" and "Micro-nanoplastics influence on the uptake of environmental pollutants by lettuce" were both presented at the American Chemical Society (ACS 2023, August 15th; Environmental Division - Field Applications of Developed and Emerging PFAS Treatment Technologies, and Division of Environmental Chemistry-Processes and Risks of Micro-and Nano-Plastics in the Environment).

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 for the period July 1, 2023 – June 30, 2024.

Source of Sample	Numbers of samples analyzed
Department of Agriculture	271
Department of Consumer Protection	1360
Department of Energy and Environmental Protection	49
FDA, Health Depts., Cities/Towns, Misc. Foundations	39
Proficiency Test Samples	51
University Research Collaborators	1531
CAES Departments	686
Grand Total	**3,987**

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

a. Animal Feeds:

- Analysts: John Ranciato, Terri Arsenault, Kitty Prapayotin-Riveros, Meghan Cahill, Craig Musante, and Carlos Tamez
- Goal: To assure products comply with stated label guarantees and that levels of aflatoxins and pesticides, 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 the NSFDX data exchange portal.

Results: From July 1, 2023, to June 30, 2024, we received 57 feed and associated grain samples for analysis of Aflatoxins (B1, B2, G1, G2), Fumonisin (FUM) and Deoxynivalenol (DON), 20 feed samples for macro minerals (Ca, K, Mg, Na, P, S) and moisture, 26 animal feed samples for pesticides analysis, and 31 samples for proximate (protein, fat, and fiber) analysis. Joint funding with the DoAg has been acquired from the FDA to facilitate inclusion in the Animal Feed Regulatory Program Standards (AFRPS) and the Laboratory Flexible Funding Model (LFFM); 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. In addition, protein by combustion, and fat by gravimetric extraction, were brought under scope in January of 2021. Acid Hydrolysis, sometimes needed to supplement fat by gravimetric extraction, was brought under scope as of April, 2023. Pesticide testing of food was accredited to the ISO standard under the MFRPS program in 2016. Samples were analyzed by the methods for aflatoxin extraction, QUECHER for FUM and DON extraction, and quantitation (by LC-HRMS) in feed as part of the AFRPS. All samples were officially logged out with no aflatoxins detected. The reporting limit for each aflatoxin component (B1, B2, G1, and G2) is 1 ug/kg.

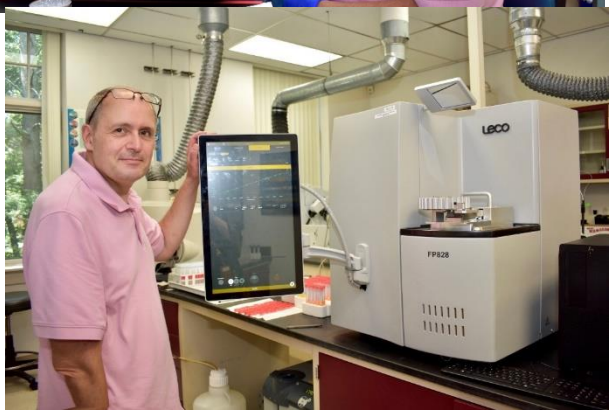
22 samples found Deoxynivalenol (DON), and 1 sample found Fumonisin (FUM). They are all lower than the Guidance level: Guidance level for Deoxynivalenol is 5000 ug/kg and guidance level for Total Fumonisin (FB1 + FB2 + FB3) is 30000 ug/kg.

These samples were also analyzed for protein, fat, and fiber and no samples failed. From July 1, 2023, through June 30, 2024, a total of 27 animal feed samples were analyzed for pesticide residues. Of these, only one sample was contained a pesticide, chlorpropham. No residues were found over tolerance guidelines.

Of the 19 animal feed samples for macro minerals there is 1 sample listed as Rabbit, 1 sample listed as Guinea pig, and 2 samples listed as Hamster. Additionally, there is 1 sample listed as Ferret and 2 samples



listed as Duck. One sample is categorized under Gamebird Species as 'other'. There are 13 samples labeled as 'Other', program has continued to allow for providing safer feed products for pets and other domesticated animals in the state.



b. fertilizer:

- Analyst: John Ranciato
- Goal: To assure products comply 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, 2023, to June 30, 2024, we received 41 samples for macronutrients, including nitrogen, phosphorus, and potassium. No samples failed for nitrogen.This program ensures that farmers are provided with appropriately labeled and guaranteed nutrient-fertilizer inputs.

c. Analysis of seaweed samples:

- Analysts: Terri Arsenault, Craig Musante, Meghan Cahill, Michael Ammirata, and Carlos Tamez
- 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 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, 2 samples were received for analysis of moisture content, pesticides by both liquid and gas chromatography with mass spectrometry (LC-MS; GC-MS), and select heavy metals (As, Cd, Cr, Cu, Hg, Ni, Pb, Se) by inductively coupled plasma mass spectrometry (ICP-MS). Results are reported to DoAg Aquaculture staff for a decision on regulatory action. All pesticides, and heavy metals were within acceptable limits for sales of the product.

d. Analysis of hemp samples:

- Analysts: Terri Arsenault and Kitty Prapayotin-Riveros

- Goal: To determine the tetrahydrocannabinol (THC) content of hemp grown by state farmers prior to the sale of the product

- Summary: Hemp is defined as *Cannabis sativa L* with less than or equal to 0.3% total delta-9 THC. The state plan requires that each hemp variety is tested within 30 days of harvest. From July 1, 2023, to June 30, 2024, a total of 174 preharvest samples were submitted for analysis. These samples were analyzed by gas chromatography with flame ionization detection. The analysis was brought under the scope of accreditation in January of 2021 and ongoing proficiency is demonstrated by successfully passing the University of Kentucky hemp proficiency testing annually. Only one sample of the submitted samples (0.6%) exceeded the allowable amount of THC. These data are reported back to the Department of Agriculture which has regulatory authority over the disposition of the crop.

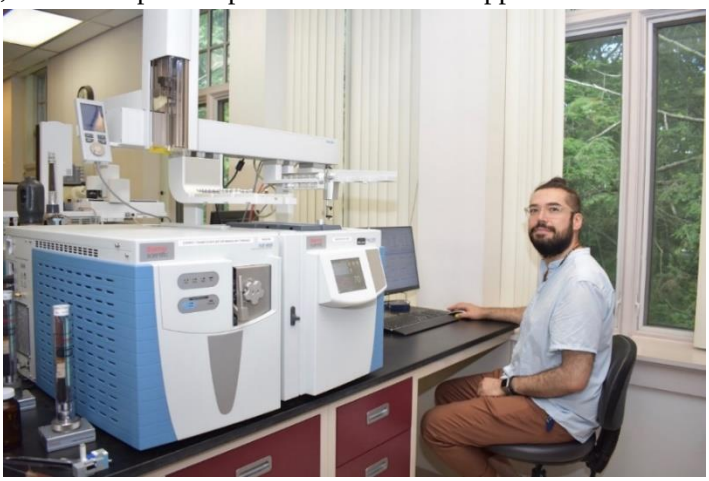
- **2. ANALYSES ON BEHALF OF CONNECTICUT DEPARTMENT OF CONSUMER PROTECTION, FOOD AND STANDARDS DIVISION**

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 and heavy metals in human food:

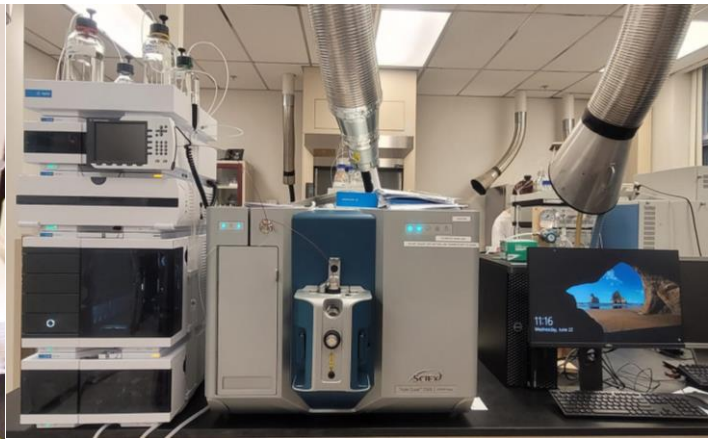
- Analysts: Carlos Tamez, Michael Ammirata, Terri Arsenault, Kitty Prapayotin-Riveros, Meghan Cahill, and Craig Musante

- Summary: As part of the Manufactured Food Regulatory Program Standards (MFRPS) and Laboratory Flexible Funding Models (LFFM), 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 surveillance samples are collected by DCP Inspectors and results are published in periodic Station Bulletins available by mail and at https://portal.ct.gov/CAES. From July 1, 2023, through June 30, 2024, a total of 100 samples of human food were analyzed for pesticide residues. Of these samples, 14 (14%) contained a total of 12 residues. Of these 14 samples, no violations were found. There were 12 different pesticide active ingredients found at an average concentration of 0.078 ug/g. From July 1, 2023, through June 30, 2024, a total of 92 samples (1,032 sub-samples) total of human food (there are three main categories: apple juice, with multiple samples for brands like Apple & Eve and Juicy Juice; a broad selection of spices and herbs from brands such as Great Value, Stonemill, and McCormick, including cinnamon, black pepper, and cumin; and an assortment of freeze-dried fruits from Good & Gather and Trader Joe's, featuring strawberries, mango, and blueberries) were analyzed for heavy metals. 68 out of 92 samples (74 %) found various of elements such as total Arsenic, Cadmium, Lead, Mercury. From July 1, 2023, through June 30, 2024, a total of 25 samples of human food were analyzed for Melamine and analogs from a variety of protein powders featuring flavors like cinnamon, chocolate, and



vanilla from brands like Body Tech, Isopure, KOS, RYSE, Orgain, and Vega. Products ranged from whey to plant-based proteins. There was no Melamine found in these products.

- With US FDA funding and support, the Department has received and expanded 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 toxic elements contamination. A recent important highlight of our work with DCP was the revelation of the presence of an insecticide, carbofuran in imported fresh asparagus produce. Carbofuran is banned for use in the United States. This work resulted in the foreign processor of the produce being added to the "red list" attachment of FDA's Import Alert 99-05, *Detention Without Physical Examination Of Raw Agricultural Products for Pesticides*. This is a significant accomplishment requiring sample analytical package from DAC to be reviewed by multiple regulators within the FDA.

b. Miscellaneous samples:

- Analysts: Mike Ammirata, John Ranciato, Carlos Tamez, Meghan Cahill, and Craig Musante,
- Summary: From July 1, 2023, to June 30, 2024, 94 consumer complaint samples were submitted by CT DCP, New Haven Health Department, Stratford Health Department, Bristol Police Department, South Central Health District, and Department of Energy and Environmental Protection for analysis, including Lead Analysis, Pesticide Analysis, Toxic Elements, Elemental Analysis, Foreign Material in Food, Mold Analysis, and Ethylene Glycol. For some samples, we rely on the expertise in other CAES Departments, including Plant Pathology & Ecology, Entomology, and Forestry & Horticulture. Samples during the current period included Turmeric, rice, pasta, chili powder, cumin powder, baby powder, rice cracker, Canela Cinnamon Tea, eggs, Tomato Juice, soil contamination, and fruit punch (analysis for antifreeze).

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

Alcoholic beverages sold must be registered and labeled correctly. This requires knowledge of the ethanol content of products. In addition, the laboratory supported efforts by liquor control to prevent adulteration of bar bottles. Conductivity meters were calibrated and verified for use by inspectors. Research has shown that the conductivity of branded alcohol is very consistent within the brand. A difference between an authentic brand and an opened bottle may mean the bottle was refilled with a cheaper liquor or otherwise adulterated.

- Analyst: Terri Arsenault
- Goal: To provide percent ethanol content for label registration and taxation purposes.

- Summary: We analyzed 2 samples (tequila) for ethanol content. Results were submitted to DCP in support of product label registration.

4. ANALYSES ON BEHALF OF DEPARTMENT OF CONSUMER PROTECTION, DRUG CONTROL DIVISION

a. Analysis of marijuana products:

- Analyst: Anuja Bharadwaj and Terri Arsenault
- Goal: To develop and validate methods for analyzing marijuana products for various cannabinoids.

- Summary: Since the legalization of adult use of marijuana in July 2021, there has been a need to develop a program for the analysis of marijuana products to assess them for their cannabinoid contents, as per label claims. The legislation imposes strong requirements for product safety. Products will have to be lab tested and for strict packaging and labeling standards. To begin with, the cannabinoids analyzed are Cannabidiolic acid (CBDA), Cannabidiol (CBD), Cannabinol (CBN), delta-9 Tetrahydrocannabinol (THC) - the primary psychoactive constituent of *Cannabis sativa*, and Tetrahydrocannabinolic acid (THCA), among others. In addition, the program will test the products for pesticides, mycotoxins, terpenoids, and heavy metals. The Dept of Consumer Protection (DCP) will submit the samples to DAC, and the data will be reported back to the DCP.

This new program is work in progress; the initial plan is to develop a method using High-Performance Liquid Chromatography-UV for the analysis of cannabinoids such as CBDA, CBD, THC, and THCA. The Agilent 1200 HPLC system is used for this purpose. Simultaneously, a method is being developed for cannabinoid testing using a different technique, namely Gas-Chromatography Mass Spectrometry (GCMS).

This program will ensure that products comply with the stated labels for the different cannabinoids. During the period between July 1, 2023, and June 30 2024, 64 samples of marijuana products were analyzed and reported out to DCP.

Average THC Percentage (Flowers and Vapes):

- The average THC content by percentage for products like flowers and vapes is approximately **21.12%**.

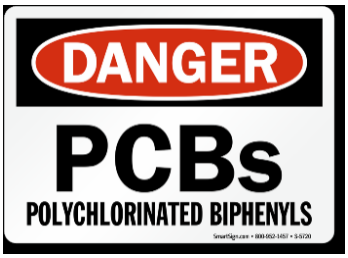
Average Total THC Per Container (Gummies and Other Packaged Products):

- For products measured by total THC content per package or container (such as gummies, bursts, bars, etc.), the average THC content is about **206.55 mg**.

Average THC Content for Individual Gummies:

- For individual gummies from the "Curaleaf Classic Bites Raspberry" series, the average THC content per gummy is **21.37 mg**.

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



a. Analysis of PCBs (polychlorinated biphenyls):

- Analysts: Michael Ammirata and 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, 2023, to June 30, 2024, 45 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. Eight samples were positive for PCB. The findings are reported to DEEP for assessment of continued regulatory compliance or to establish remediation criteria. In addition, a proficiency test was completed as part of this program.

b. Analysis of pesticides:

- Analysts: Carlos Tamez and 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.
- Summary: From July 1, 2023, to June 30, 2024, 6 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.

6. ANALYSES ON BEHALF OF MUNICIPAL AND FEDERAL AGENCIES

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

- Analysts: Craig Musante, Terri Arsenault, Kitty Prapayotin-Riveros, John Ranciato, Carlos Tamez, Meghan Cahill, Christian Dimkpa, and Jason C. White.
- Summary: The Department of Analytical Chemistry continued 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. During the past year, we continue to implement the FDA ORA Partners Portal (ORAPP). Some of the samples in this initiative included actionable import samples. We successfully uploaded five dried fruit samples for pesticides analysis, there were imported from Canada. Three out of five samples found 13 different pesticides, though without violations.

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: Carlos Tamez, Terri Arsenault, Craig Musante, Meghan Cahill, and Mike Ammirata
- Summary: From July 1, 2023 through June 30, 2024, Department staff analyzed 26 samples for multiple health departments and police departments in Connecticut, including repeated entries from Stratford Health Department, New Haven Health Department, South Central Health District, and others like Norwalk Police Department and Bristol Police Department.

Among these, Sample 23-53368 from Norwalk Police Department, investigated for antifreeze (Ethylene glycol) in juice punch. Samples 8436 to 8441 from Stratford Health Department to do Lead analysis in eggs. Samples 8474 to 8481 from South Central Health District to do elemental analysis for soil investigation in community garden. Samples 8465 to 8471 from New Haven Health Department to do pesticides screening in soil.

- Impact: Analyses in support of these organizations can allow them to make decisions that will impact human health or have regulatory implications.

7. ANALYSIS OF CHECK SAMPLES

- Analysts: Terri Arsenault, Craig Musante, Meghan Cahill, Michael Ammirata, and Kitty Prapayotin-Riveros
- Summary: 19 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 investigation search. Research is often stimulated by our service work. When not in use, we leverage equipment as well as staff expertise to conduct research..

1. FOOD SAFETY

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

- Investigators: Carlos Tamez, Terri Arsenault, Michael Ammirata, Craig Musante, Meghan Cahill, John Ranciato, Christian Dimkpa, and Jason C. White
- Summary: We continue to participate in or lead several FDA coordinated research projects. This includes the use of high-resolution LC-MS and LC-MS/MS platforms for the screening of pesticides, toxins (fungal, plant) and poisons. During the past year, our assessment to maintain ISO Accreditation was successfully completed in March of 2024. During the year new ICP-OES and nitrogen determinator instruments were purchased, to beef up our analytical capability for inorganic and organic contaminants, respectively.

- 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: Detection of Melatonin in dietary supplements

- Investigators: Terri Arsenault, Carlos Tamez, Jasmine Jones
- Summary: Dietary supplements are used with increasing frequency and FDA has been working on guidelines to improve oversight. Melatonin supplements are frequently used as a sleep aid, but dietary supplements are not subject to the same manufacturing requirements as pharmaceuticals. To build laboratory capacity and increase testing, FDA provided financial support to laboratories willing to perform method extension and validation testing for this active ingredient. The laboratory purchased various types of dietary supplements, spiked them with melatonin, and demonstrated the method was acceptable across the entire range of analyte.
- Impact: Consumer should trust that dietary supplements meet the label guarantees for active ingredients, but this type of testing is not common. This work supports FDA attempts to provide more oversight of these widely used products.

Project 3: *Nanomaterials application in contaminant, environmental stress, and nutrient management in agricultural systems*:

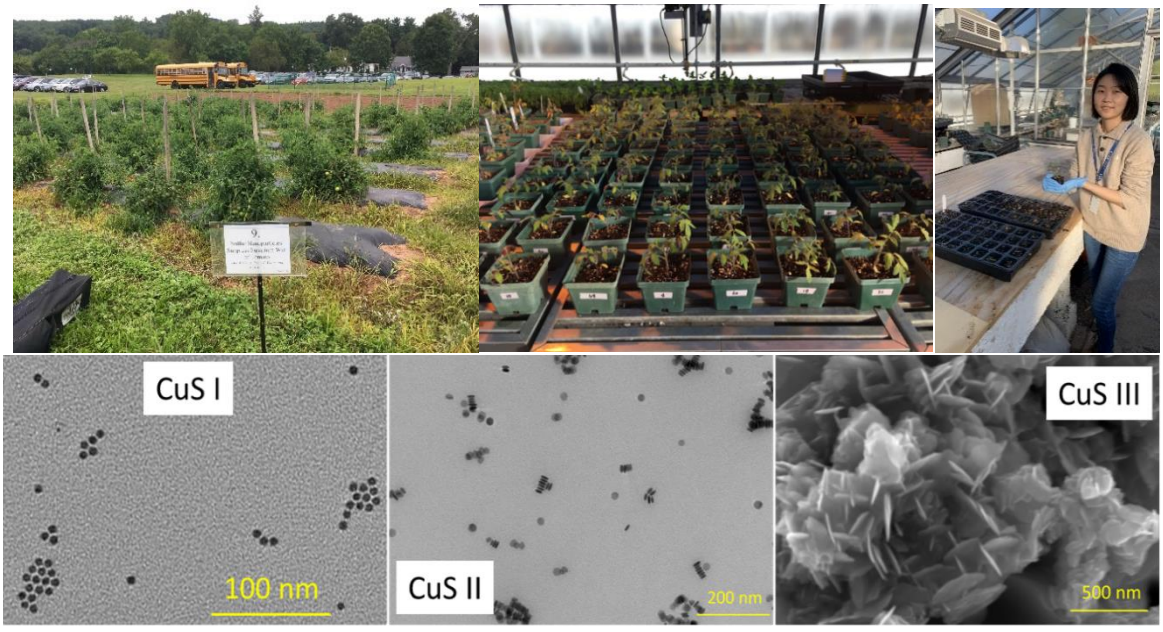
- Investigators: Nubia Zuverza-Mena, Craig Musante, Paul Aikpokpodion, Carlos Tamez, Yi Wang, Chaoyi Deng, Shital Vaidya, Jingyi Zhou, Milica Pavlicevic, Mandeep Kaur, Raja Muthuramalingam, Trung Bui, Jason C. White, and Christian Dimkpa

- 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, healthcare, cosmetics, pharmaceuticals, food processing, and agriculture. Our general work in this area is focused on two separate but related topics; initially on the implications of nanomaterial presence (by accident or design) in agricultural systems and, more recently, on the design and use of nanoscale nutrients as agricultural amendments to suppress plant disease, improve nutrient use efficiency, and, ultimately, increase yield. The presence of state-of-the-art analytical instrumentation has allowed us to continue to measure the uptake and translocation of these nanoparticles into plants. Studies on nanoparticle interactions in agricultural systems at the Department of Analytical Chemistry are conducted in collaboration with several partners, including John Hopkins University, University of Central Florida, North Dakota State University, Stony Brook University, University of Parma, Italy, Harvard University TH Chan School of Public Health, University of Massachusetts, the University of Texas El Paso, the US National Institute of Standards and Technology, The Center for Sustainable Nanotechnology at the University of Wisconsin-Madison, Hasselt University in Belgium, Peking University in China, The Ocean University of China, Zhejiang University, China Agricultural University, Jiangnan University, Nanjing Agricultural University, and the Chinese Academy of Sciences, among others.

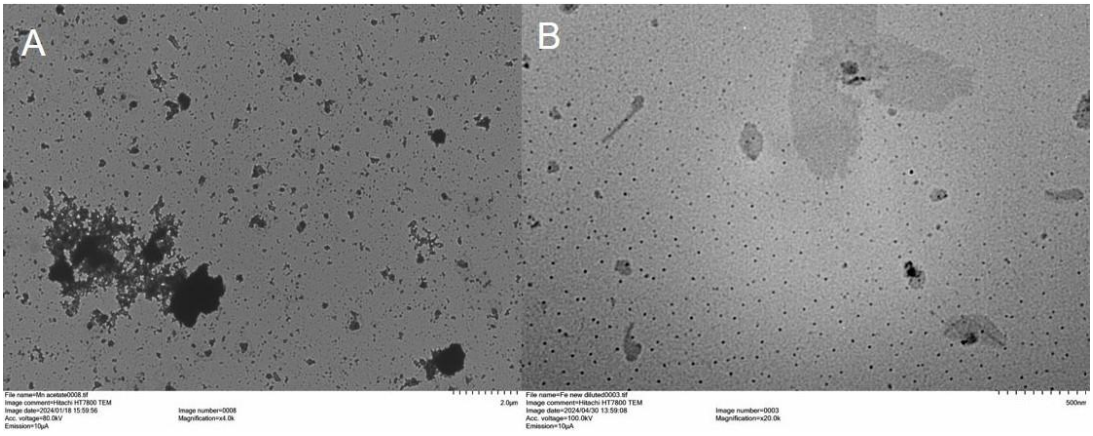
One such project involves use of nanoscale sulfur as a novel multifunctional agricultural amendment to sustainably increase yield and suppress crop disease. Collaborators on this project are colleagues at the University of Massachusetts. In this study, Pristine (nS) and stearic acid coated (cS) sulfur nanoparticles were added to soil planted with tomato (*Solanum lycopersicum*) at 200 ppm and infested with Fusarium oxysporum. Bulk sulfur (bS), ionic sulfate (iS), and healthy controls were included. Orthogonal endpoints were measured in two greenhouse experiments, including agronomic and photosynthetic parameters, disease severity/suppression, mechanistic biochemical and molecular endpoints including the time-

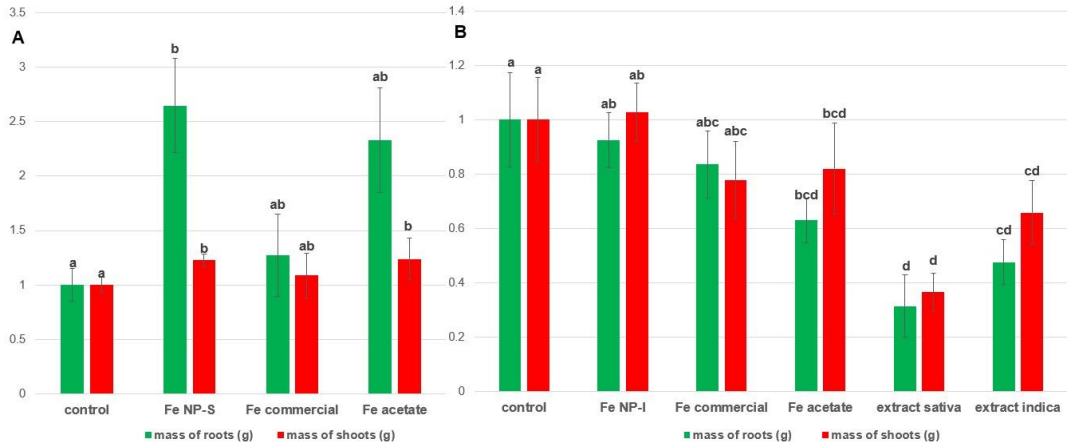
dependent expression of 13 genes related to two S bioassimilation and pathogenesis-response, and metabolomic profiles. Disease reduced plant biomass by up to 87%, but nS and cS amendment significantly reduced disease measured by AUDPC by 54 and 56%, respectively. An increase in planta S accumulation was evident, with size-specific translocation ratios suggesting different uptake mechanisms. In vivo two-photon microscopy and time-dependent gene expression revealed a nanoscale-specific elemental S bioassimilation pathway within the plant that is separate from traditional sulfate accumulation. These findings correlate well with time-dependent metabolomic profiling, which exhibited increased disease resistance and plant immunity related metabolites only with nanoscale treatment. The linked gene expression and metabolomics data demonstrate a time-sensitive physiological window where nanoscale stimulation of plant immunity will be effective. A field trial further confirmed the results. CS increased tomato yield up to 3.3~3.4-fold compared to the unamended controls in the healthy groups. In the infested treatments, CS significantly reduced disease severity compared to other treatments. Foliar and soil treatment with CS increased the marketable yield of tomato fruit from plants infected with Fusarium pathogen by 107 and 192% over diseased controls, respectively. In addition, more novel formulations of nano-agrochemicals have been designed and synthesized in lab which can efficiently suppress plant disease and improve plant growth.

Additionally, in an ongoing project conducted in collaboration with The University of El Paso and University of Rhode Island, hemp (*Cannabis sativa*) stems and leaves are being used to synthesize iron and manganese nanoparticles and evaluated as nano fertilizers in soybean. The size and charge of the nanoparticles in suspensions were 164 ± 47 nm; - 27 ± 0.16 nm (iron nanoparticles; Fe NPs) and 299 ± 68 nm; -26 ± 0.47 mV (manganese nanoparticles; Mn NPs). X-ray diffraction (XRD) analysis showed that both nanoparticles were in the form of 2+ and 3+ oxides. Nanoparticles were applied foliarly on 3-week-old soybean plants for a 3-week duration. Addition of "green" Fe NPs increased the biomass of soybean by 148 % (compared to the control) and by 137% (compared to commercial Fe NPs). Additionally, chlorophyll and antioxidant contents were increased by 123% and 126%, respectively (compared to control); which is significantly higher than in effects from corresponding salts (salts increased by 109% and 119% compared to control). Although addition of "green" Mn NPs did not significantly increase soybean biomass, chlorophylls content increased 120 % (compared to control), whilst antioxidant content increased 138% (compared to control). Similar to "green" Fe NPs, "green" Mn NPs were more efficient than commercial their counterpart and corresponding salts, particularly in elevating polyphenolic content (232 % increase with

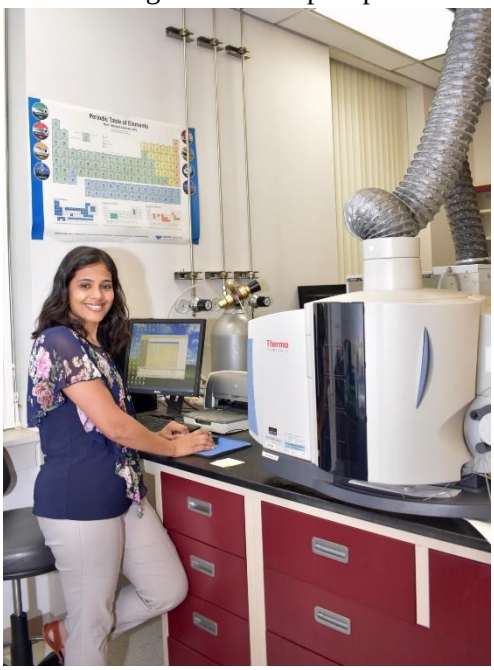


"green" Mn NPs; 158 % increase with commercial Mn NPs and 177 % increase with $MnNO_3$; compared to control). These results provide useful information for optimizing the synthesis of nanoparticles from hemp waste for use as nanofertilizers.

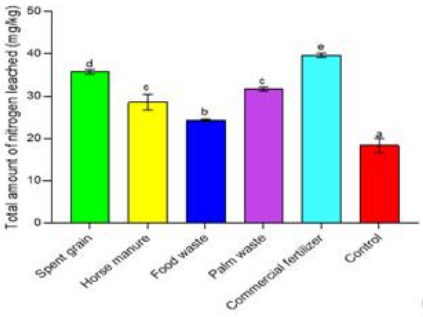




A project in partnership with John Hopkins University scientists assessed the use of polyhydroxyalkanoates (PHA) to improve plant bioavailability and reduce environmental P loss in plant-soil systems. Biodegradable polymer nanocomposites containing PHA and phosphorus sources were synthesized. Tomato was grown in soil amended with five P-sources, used as-is or embedded within the PHA. Correlation analysis identified treatments that maintain plant growth, improve bioavailable soil P, and reduce P loss. Three performance classes were identified: (i) micro- and nano-hydroxyapatite, which did not increase bioavailable P, plant P uptake, or change P in runoff/leaching compared to controls; (ii) monocalcium phosphate (MCP), dicalcium phosphate (DCP), calcium pyrophosphate nanoparticles (CAP), and PHA-MCP that increased P-uptake and/or bioavailable P but also increased P loss in runoff/leaching; and (iii) PHA-DCP and PHA-CAP, where increased bioavailable P and plant P-uptake were achieved with minimal P loss in runoff/leaching. In addition to identifying treatments that maintain plant growth, increase bioavailable P, and minimize nutrient loss, correlation plots also revealed that (i) bioavailable P was a good indicator of plant P-uptake; (ii) leached P could be predicted from water solubility; and (iii) P loss through runoff versus leaching showed similar trends. This study highlights that biopolymers can promote plant P-uptake and improve bioavailable soil P, with implications for mitigating the negative environmental impacts of P loss from agricultural systems Specifically, the reduction in P loss is critical for controlling the eutrophication of water bodies due to nutrient overload and for sustaining the dwindling global P resources.

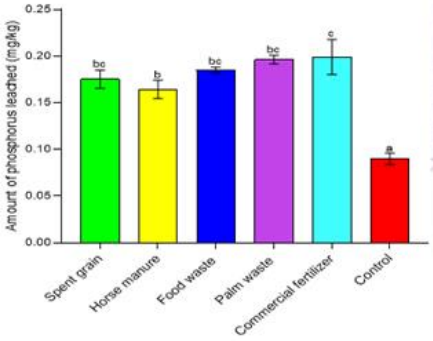


A conceptually similar project related to nutrient management was conducted to evaluate the role of cellulose nanofibers as nutrient delivery systems. Cellulose nanofiber-containing effluents obtained from the upcycling of 4 different agrowaste feedstocks (spent grain, horse manure, food waste, and palm waste,) using the nitro-oxidation process (NOP) were fortified with NPK (respectively at 50:17:33 mg/kg nanofiber) and applied in a lettuce-cropped soil. Leaching of the treated soil was conducted for 5 weeks to evaluate the rate of N, P, and K losses. Nutrient loss from soil treated with commercial fertilizer was significantly higher ($P \leq 0.05$) than that lost from soils treated with the NOP effluents. Depending on the agrowaste feedstock, N, P, and K losses in soils that received NOP effluent were reduced by between 9.8 and 39, 1.5 and 17.5, and 7.3 and 32.4%, respectively, relative to the commercial fertilizer. No significant difference was observed in the biomass yield of lettuce treated with commercial fertilizer vs. NOP effluents, except in the case of effluents from horse manure, which was significantly ($P \leq 0.05$) improved. Significantly higher ($P \leq 0.05$) N and P were retained in the post-harvest soil with the NOP treatments, compared to commercial fertilizer, while residual postharvest K was significant in the case of the spent grain NOP, and tended to be higher with the other NOPs, relative to commercial fertilizer. The levels of nutrients in the edible tissue were variably affected by the NOP treatment, compared to the commercial fertilizer. Levels of P, Ca, Mg, Mn, Zn, and S were significantly improved by spent grain NOP; Fe, Mn, and Zn by horse manure NOP; Ca, Fe, Mn, and Zn by food waste NOP; and K by palm waste NOP. Taken together, these findings indicate that cellulose nanofiber-containing NOP effluents can mitigate nutrient loss and enhance nutrient retention in soil, while serving as fertilizers for crop production, with no yield penalty compared to commercial fertilizers.



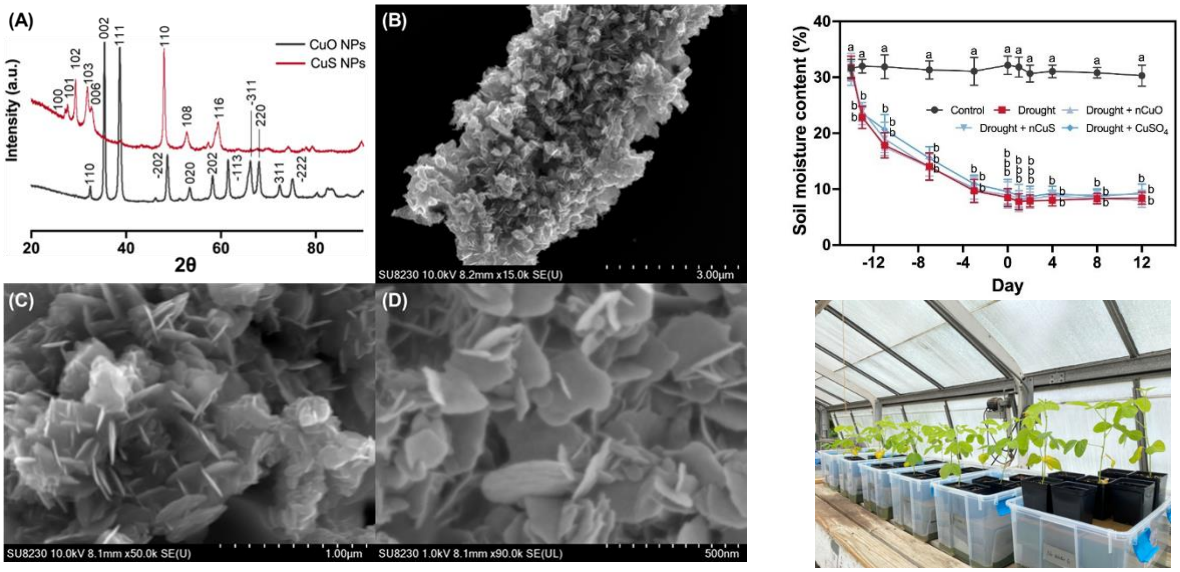
Postharvest nutrients in soils (mg/kg)

Treatment	N	P
Spent grain	2480[b]	67.89[c]
Horse manure	2500[b]	67.48[c]
Food waste	2590[b]	63.77[c]
Palm waste	2520[b]	66.25[c]
CF-Fiddle	2250[a]	59.52[b]
Control	2210[a]	51.61[a]



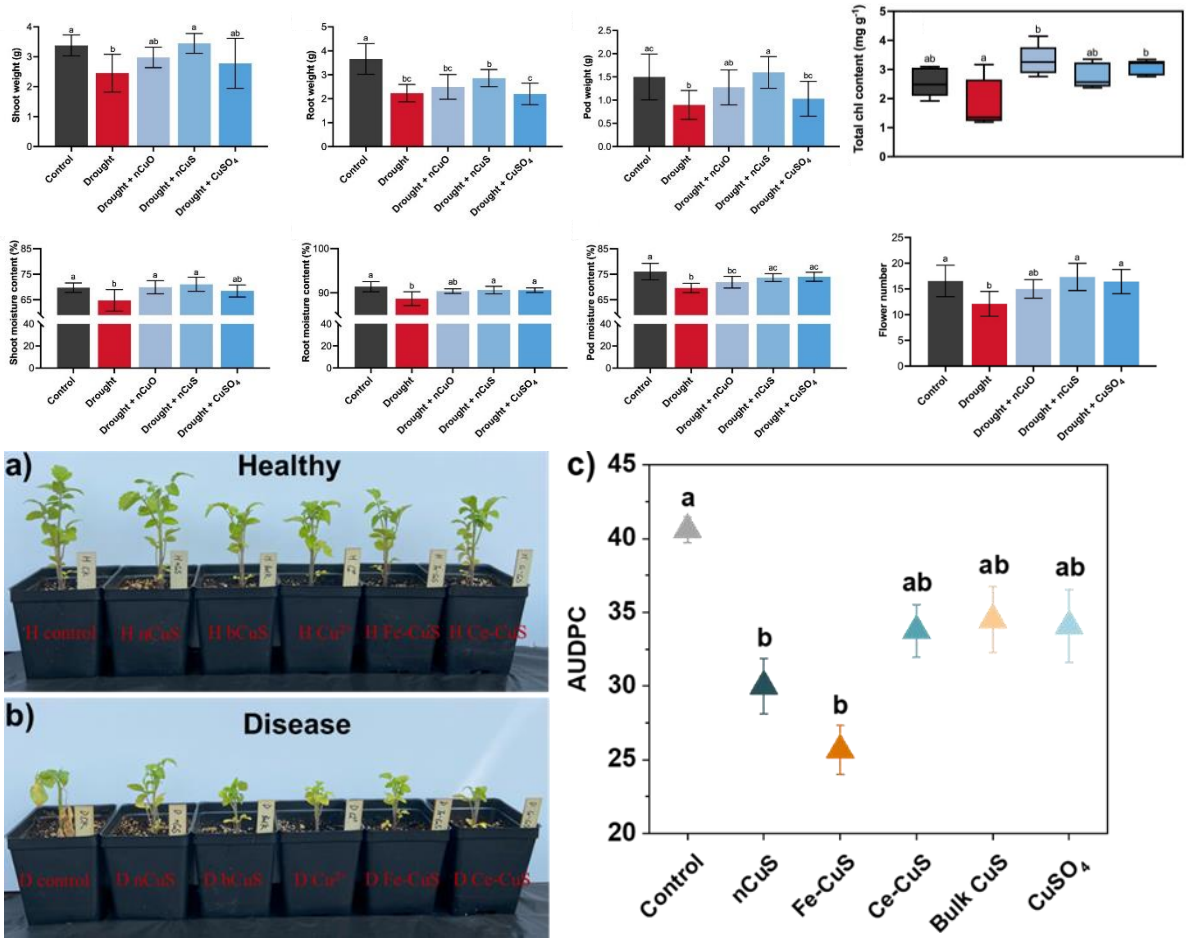
Under the auspices of the Center for Sustainable Nanotechnology, two nanoscale research projects are being conducted to explore the interactions between metal-based nanoparticles and tomato plants. The first study, now completed, investigated ferric oxide (Fe_3O_4) nanoparticles with varying surface charges to assess their impact on disease resistance in both healthy and *Fusarium oxysporum*-infected tomato plants. The second, ongoing project, focuses on copper sulfide (CuS) nanoparticles, aiming to determine whether they can enhance plant health and resistance to the same fungal pathogen. Preliminary results from the Fe_3O_4 study provide a foundation for the ongoing CuS research, where gene expression analysis is underway to uncover the molecular mechanisms driving disease suppression and nanoparticle interaction.

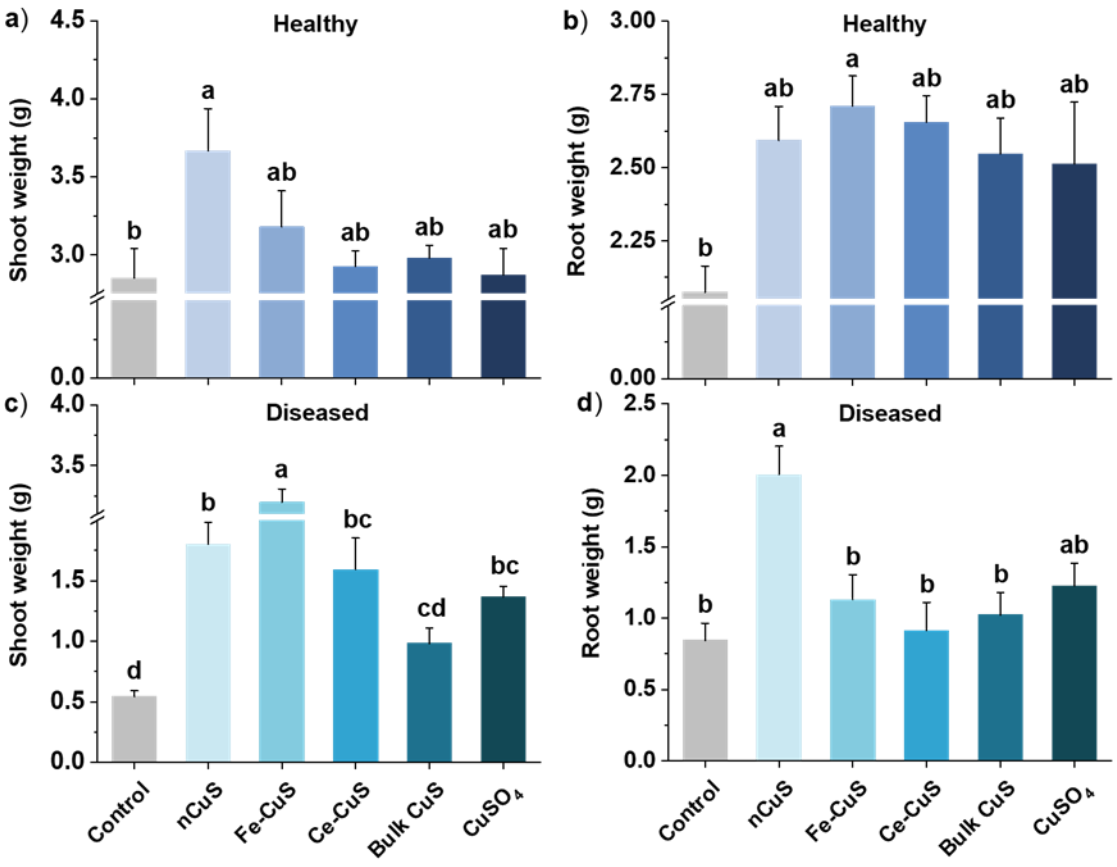
A related study investigated the effect of nano CuS (nCuS) on alleviating drought stress in soybean (*Glycine* max L.) during the reproductive stage. Herein nCuS was synthesized using a slow evaporation approach, with a molecular ratio between Cu and S at 8. The synthesized nCuS was characterized by XRD and showed the characteristic hexagonal structure, which aligns with the standard card of CuS. Additionally, the morphology of the synthesized CuS was analyzed by SEM, confirming the nanosized and the planar shape of the formed nCuS. Commercial copper oxide (CuO) nanoparticles (NPs), in-house synthesized copper sulfide (CuS) NPs, and copper sulfate ($CuSO_4$) were foliar applied at 10 mg Cu/L daily for one week to soybean that were exposed to water deficit at the onset of flowering, and plants were harvested 5 days after exposure. Drought inhibited flower production by 27% compared to the non-drought treatment. Both CuS NPs and ionic Cu mitigated the drought-induced inhibition of flower production, showing a 41.7% and 33.3% improvement. CuS NPs exhibited the most positive impact on restoring shoot biomass, pod biomass, and shoot moisture content, increasing values by 53%, 96%, and 10%, respectively, compared to the drought control plants. The Cu-based materials were able to maintain photosynthetic parameters under drought stress as well. Additionally, the reactive oxygen species scavenging enzyme activities were enhanced by Cu-based materials confirming the modulation of oxidative damage caused by the drought. These findings suggest that Cu-based materials modulate plant protective mechanisms against drought stress during the flowering stage, offering a potentially important nano-enabled strategy to promote biofortified climate resilient crops.



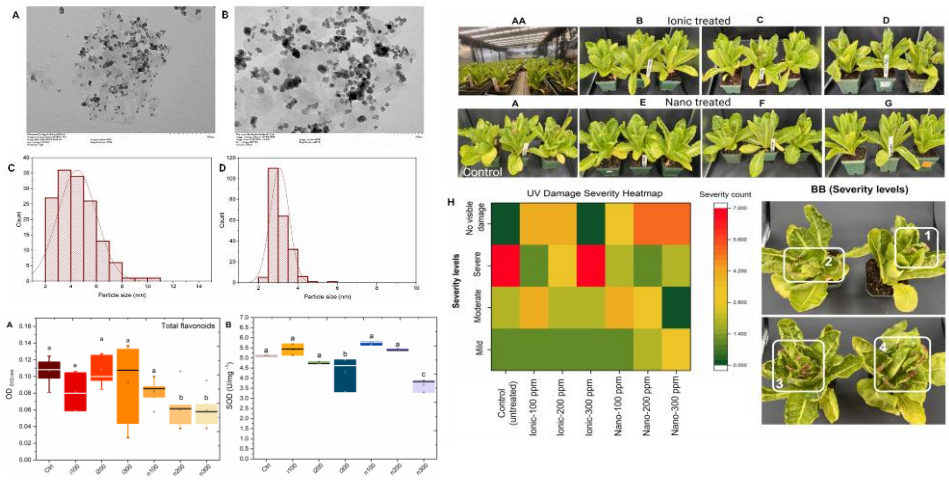
Another nanoscale research project is being conducted to investigate the effects of metal-based nanoparticles on tomato plants, specifically focusing on their potential for disease resistance. This study involves doped Fe and Ce copper sulfide (CuS) nanoparticles, which are being tested for their ability to treat *Fusarium oxysporum* infection in tomato plants. This ongoing project aims to assess whether these doped CuS nanoparticles can enhance plant health and resistance to the fungal pathogen. Preliminary findings from earlier experiments with CuS nanoparticles, combined with doped metal ions, are providing valuable insights into their potential as a treatment for Fusarium disease. Gene expression analysis and microscopy analysis are currently underway to explore the molecular mechanisms underlying the interaction between the nanoparticles and the plant's defense

response. Additionally, a mechanistic understanding of nanobiointeraction is being developed through an orthogonal investigation involving surface-modified and pristine sulfur nanoparticles (nS and cS). These nanoparticles, applied as multifunctional nanofertilizers, significantly improved tomato plant growth, with cS showing superior effects on shoot weight, leaf photosynthesis, and gene expression related to sulfur bioassimilation and signaling pathways. Time-dependent machine learning strategies are also being employed to explore metabolomic profiling and the impact of nanoparticle surface modification, offering new insights into the potential of sulfur nanoparticles for nanoenabled agriculture. Another study in parallel uses different types and sizes of microplastics to test their toxicity effects on the hydroponic growth of lettuce and bok choy. This research aims to assess how microplastic pollution influences plant growth, development, and nutrient uptake in hydroponic systems, providing a better understanding of the environmental risks associated with microplastic contamination in agriculture.





A related research uses Zn-Mn-Mg-Fe oxide nanoparticles to mitigate UV stress in plants This project focuses on the development of a novel nanoformulation comprising Zn-Mn-Mg-Fe oxide nanoparticles. These nanoparticles were synthesized and tested for their ability to mitigate UV-induced stress in plants. The results demonstrated that treated plants maintained normal morphology and physiological functions for four weeks under UV stress, outperforming both non-treated and ionic Zn-Mn-Mg-Fe mixture-treated controls.



Besides nanomaterials, research activities also include the study of contaminants of emerging concern such as micro/nanoplastics (MNPs) as well as per and polyfluoroalkyl substances (PFAS) in terrestrial system. Regarding plastics, ongoing studies suggest that the plastic size might influence the translocation of other contaminants into lettuce shoots. For example, nanoscale polystyrene increased the translocation factor of arsenic (As) from root to lettuce shoots, by a three-fold, but PS had no influence on the mobility of boscalid, an organic fungicide. Both As and boscalid were analyzed leveraging LFFM resources. Continuing studies will include testing more relevant plastics, such as polyvinyl chloride.

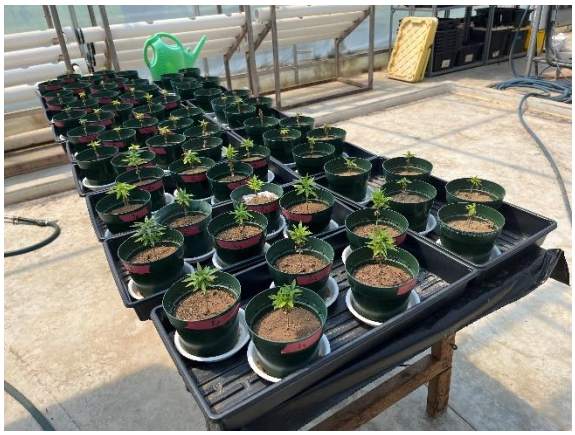
Lettuce plants being harvested after co-exposure to PS, As and boscalid, to test the impact of PS in the uptake of other environmental pollutants.

Work is ongoing to understand the effect of different types of microplastics like polyvinyl chloride (PVC) and polyethylene terephthalate (PET) in weathered, un weathered and incinerated forms on the translocation of environmental pollutants (As, Cr, Pb, PFOS and Boscalid) in Lettuce and Wheat in hydroponic and green house soil conditions.

Preliminary results showed significant decrease in shoot and root fresh weights and chlorophyll content of lettuce under the exposure PVCAEPs, and PVCUAEPs groups. Our findings indicated that co-exposure of PVC aged MP with EPs like heavy metals can significantly impact later uptake and toxicity which may result in an unknown risk to humans and other living beings. Continuing studies will include analyzing lettuce and wheat plant shoot and root samples for boscalid and PFOS

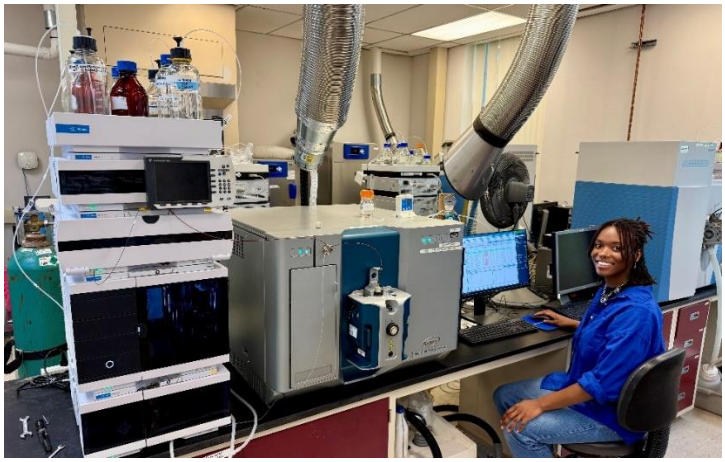
using LC/MS while microplastics quantification will be done by pyrolysis GC/MS. Also, antioxidative enzymes activities in lettuce and wheat, and hyperspectral analysis of MPs will be done. In near future, more work is to be done on the influence of incinerated PVC and PET in hydroponics and greenhouse soil conditions growing lettuce and wheat, respectively. These experiments will verify the role of different types of MPs and their ageing in translocation of environmental pollutants in edible plants. She is also working on samples prepared in different matrices like media, fresh water and cell lysates analyzing samples for HMs, boscalid and PFOS analysis.

Regarding PFAS, we are testing two strategies to deal with the presence of PFAS in soils. One is developing biochar-based materials to be used as soil amendments that can sorb PFAS and immobilize the molecules in soil. This will make PFAS unavailable or less bioavailable to be taken up by plants, thus containing PFAS mobility through the food chain. Another strategy is to extract PFAS from soil with the help of plants (phytoremediation). We are testing hemp plants as phytoextractors, as well as nanomaterials that can bind both to PFAS and plants, aiming to enhance phytoremediation. The analysis of PFAS in soil and plants has been done leveraging LFFM resources.



Hemp (*Cannabis sativa*) plants grown in PFAS-polluted soil amended with carbon-based nanomaterials to enhance soil phytoremediation.

Relatedly, a study titled Safe Sugar for All - Documenting and Mitigating Bioaccumulated heavy metal and PFAS Risk in Maple Sugaring Operations in Urban and Rural Syrup Production Systems investigates the potential presence of heavy metals and PFAS in maple sap, tests how those contaminants behave as sap is converted to syrup, and explores possible mitigation strategies. This project is funded by the USDA Agricultural Marketing Services and is being conducted in collaboration with Yale University and Dartmouth College. Heavy metals and PFAS are harmful for human health. Therefore, we want to understand if maple trees uptake these contaminants from their environments; what happens to contaminants when maple sap is boiled into syrup; and if it is possible to remove contaminants from maple syrup. Presently, soils are being collected in both urban and rural areas in Connecticut, Vermont and New Hampshire beneath maple trees and maple tree sap and collected soils are being tested for heavy metals, like lead, arsenic, cadmium, chromium and zinc. Analytical tests for PFAS are also being conducted in these soils. Next, sap samples will be collected from the same trees as the soil samples. Data are currently being accumulated and would be studied to help us understand certain risks and possibilities involved in tapping maple trees in contaminated bushes.



ADDITIONAL RESEARCH IN THE DEPARTMENT OF ANALYTICAL CHEMISTRY

2. Hemp Research

- Investigators: Terri Arsenault and Christian Dimkpa
  Summary: This ongoing project has a broad scope that includes (i) Testing various varieties of hemp to assess compliance with THC levels throughout the growing season and maximum potential yield of CBD and (ii) Assessing whether application of micronutrient such as copper (Cu) has any effect on the levels of CBD and THC in hemp plants grown under field conditions. Both objectives were incorporated in the current period where plants treated with various types of Cu compounds (copper oxide nanoparticles [NP], copper sulfate, and a sulfate control to determine if sulfate has any role in the copper sulfate outcomes) were harvested over a phenological period that spans when THC levels are normal and when they are expected to increase above 0.3%. Cu is used both as a pesticide and a nutritional product in crop production. Research has shown that Cu application can protect plants against disease progression. Hence, it is being used by hemp growers for that purpose. The specific goal was to determine whether Cu application can influence THC and CBD levels during this precautionary harvest window. Plants were sprayed with Cu on September 1, 2023, and plants were harvested on September 21, October 5, and October 19. Based on the control (nothing applied) treatment, it can be seen that early harvesting before end of September keeps the THC level at or below the 0.3% limit. However, harvesting later in October showed higher than 0.3% THC levels. The data further showed that copper sulfate at 100 ppm and to a slightly lesser degree copper oxide nanoparticles at 100 ppm can enhance THC production even further, especially in October, compared to the control. Taken together, it is evident that both time and Cu application can synergize to raise THC levels above 0.3%, thus creating problems for growers in terms of meeting the compliance limit. In contrast to THC, harvest time and Cu application benefitted CBD production, with copper sulfate and less so copper oxide nanoparticles, at 100 ppm causing the increases The production of

  Impact: These data indicate that both agrochemical application (in this case Cu) and time significantly affect the concentration of THC and CBD. The data is helpful to growers trying to maximize CBD production while maintaining conformance to the legal THC limit of 0.3% with regards to the type of Cu they might use as pesticide, and the best time to harvest their crop.

3. Detecting and reducing mycotoxin contamination in food

- Investigators: Raja Muthuramalingam, Carlos Tamez, Christian Dimkpa, and Jason White

As part of the food safety program of the FDA-LFFM, a new research is targeted at detecting and reducing mycotoxins contamination in food through three primary objectives: developing a portable, hand-held biosensor for rapid mycotoxin detection, synthesizing a nanoemulsion for controlling mycotoxin-producing fungi, and detoxifying mycotoxins using iron-based nanomaterials. Current work includes the initiation of biosensor fabrication, the synthesis of a preliminary nanoemulsion formulation aimed at fungal inhibition, and the preparation of a review article highlighting recent advancements in mycotoxin research while integrating findings from the ongoing work.

PUBLIC OUTREACH

Telephone/Internet Inquiries: We receive approximately 100 calls and emails from the public each year requesting information on issues such as pesticides in food and the environment, heavy metals in food, soils, and consumer products, and on the presence of unknown foreign materials in food and beverages. In some instances, we refer the caller to a more appropriate CAES department or state agency.

Station Bulletins: Three Station Technical Bulletins were by our department for the outgone year: These bulletins are available in printed form and on the CAES website: https://portal.ct.gov/CAES/Publications/Publications/Technical-Bulletins.

ADVANCES IN KNOWLEDGE

DEPARTMENT OF ENTOMOLOGY

Insect Information Office in the atrium of Jenkins-Waggoner Laboratory showing the wallpaper, part of the artwork installed called Plants & Insects: Excavating the Archives.

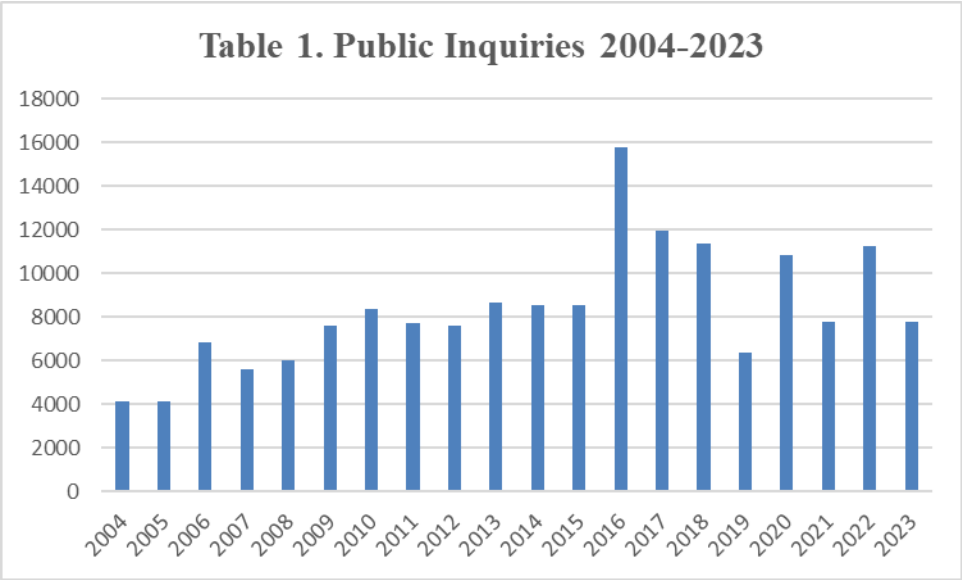
The Department of Entomology is involved in a variety of service, research, pest surveillance, and plant regulatory activities. The primary service activities are provided through the Insect Information Office (IIO). Staff in the IIO answer public inquiries across all social and economic strata about arthropods encountered in Connecticut. As needed, they will provide management suggestions on pest arthropods while preserving beneficial arthropods so reducing pesticide use in the state. 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, 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, Plant Protection Act surveys, and the U.S. Forest Service. 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 spongy moth defoliation (and any defoliation by other insects) and a spongy moth (formerly known as gypsy moth) egg mass survey. The results of our plant and forest surveys for 2021-2022 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 honeybee colonies for pests and disease. 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. The Insect Information Office is in the 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 and Katherine Dugas work in the New Haven insect information office (IIO). Records on the insect identification services date back to nearly the inception of the institution (1875). Public insect inquiries were reported in the first Annual Report of The Connecticut Agricultural Experiment Station published in 1877. The station offered 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."



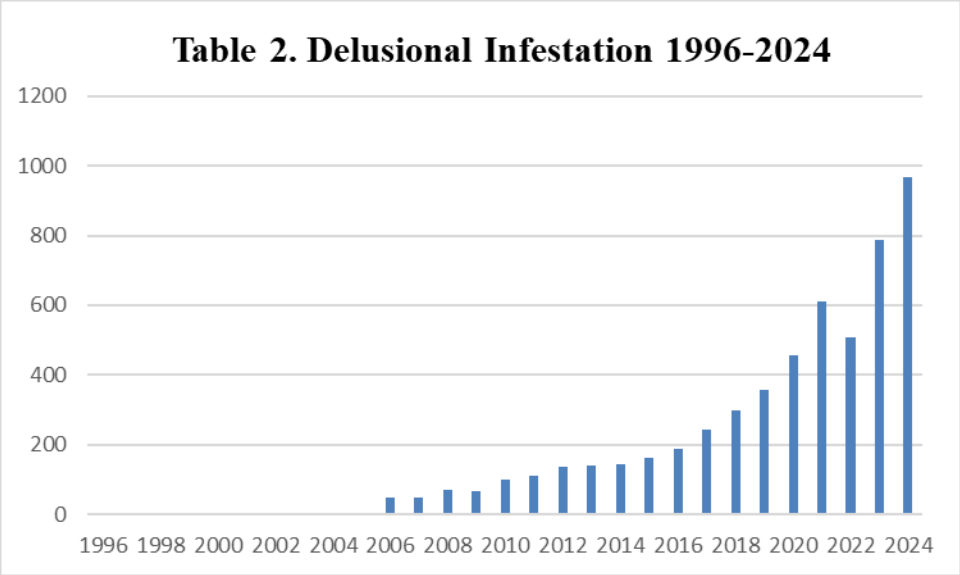
Since 2000 there has been a trend away from traditional forms of communication such as mail and in person citizen visits to smartphones and emails. These are currently the most common forms of communication used by the public to submit inquiries. Smartphones and emails are 62% while visitors and mails are 38%. Since the onset of the COVID-19 pandemic these two forms of contactless communication have been the principal way citizens have communicated with the IIO.

The impact of the IIO include public education to reduce pesticide use and promote non-chemical management of nuisance arthropods, protection of public health, conservation of natural habitats and species, protection of agriculture, and protection of urban structures and other buildings. The office directly 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, native American tribes, state government, and the media. Between July 1, 2023, and June 30, 2024, the IIO received 7802 requests for information (Table 1).

Natural resources (these include forestry, nursery, agriculture, manmade structures, and urban and suburban gardens) at 45% and man and medical issues at 46% were the most active inquiries while food and undetermined 5% and 4% respectively remained relatively low.

There were 811 categories of inquiries that included insects, arachnids, animals, pesticides, insect damage, general entomology, and horticulture. Delusional Infestation (DI) cases dramatically increased due to citizen self-reporting searches on the internet. Since 2006/2008 DI inquiries have steadily climbed from 47 (2006), 50 (2007), 69 (2008), 66 (2009), 99 (2010), 110 (2011), 135 (2012), 139 (2013), 144 (2014), 162 (2015), 189 (2016), 243 (2017), 300 (2018), 357 (2019), 456 (2020), 609 (2021), 508 (2022) to 787 (2023), 967 (2024) (Table 2). These are time consuming somatic and psychiatric cases requiring multiple phone calls, emails, and client visits. These often involve collaboration with medical professionals and family members. DI continues to remain high in part due to two leading drivers of DI, stress and depression. These are closely followed by undiagnosed underlying somatic conditions known as "Secondary DI." "Primary DI," which is true psychiatric illness is in the experience of the IIO very rare.

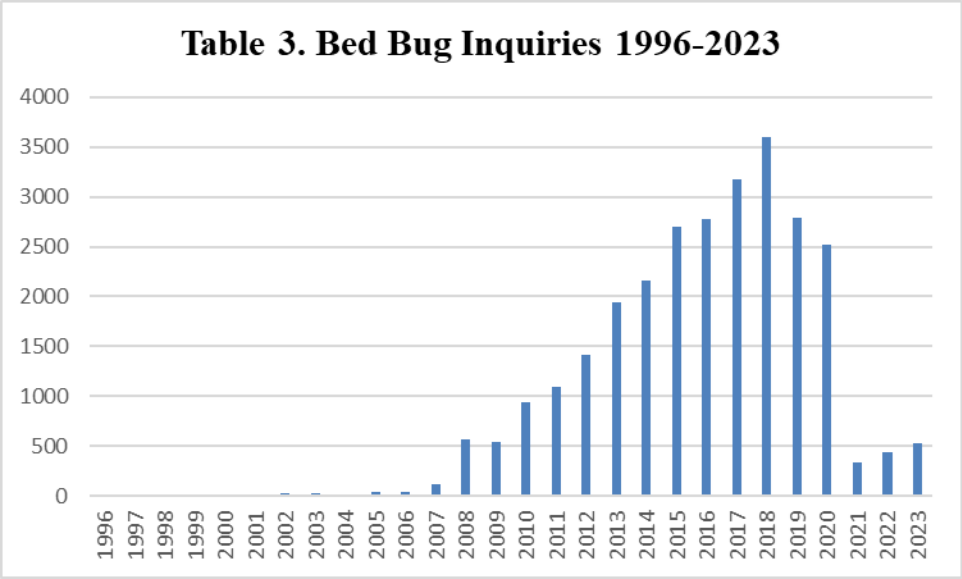
Table 2. Delusional Infestation 1996-2024



Spongy moth formerly known as the "Gypsy moth," Lymantria dispar activity was again quiet across most of Connecticut during the 2023-24 year. As like last year it was a very wet spring and summer. This promoted the pathogenic fungus Entomophaga maimaiga, the principal pathogen which manages spongy moth populations. Human feeding bed bug Cimex lecturlarius inquiries following a collapse in inquiries during the Covid-19 pandemic have continued to steadily rise each year with 533 inquiries this year (Table. 3).

Jumping worm inquiries remained active during the fall of 2023 as adults emerged. During the spring and early summer of 2024 jumping worm calls precipitously dropped, because of possible drowning from a series of severe rain events. Between January and August of 2024, meteorological data showed it was the second wettest period since records began.

A mild winter and a wet spring favored ticks. Inquiries for these continued to be elevated during the spring and early summer of 2024. Additionally, we saw a great deal of damage by sawflies and four-lined plant bugs during the spring. High-volume rainstorms flushed organic material from soils. This led to the soils becoming sandier. This favored elevated nesting activity of ground nesting solitary bees and wasps. Calls about management of these insects were up.



CAPS Survey and Outreach Programs: The Cooperative Agricultural Pest Survey (CAPS) and Plant Protection Act Section 7721 (PPA 7721) (formerly the Farm Bill), supported by the USDA-APHIS-PPQ provides support for pest survey and educational outreach on the identification and risks posed by 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 2021, the CAPS program conducted a Nursery Pest Survey looking for hardwood tree pests. Additional Vegetable Crops Pest Survey is supported by funding from the Plant Protection act, as well as the funding of the Forest and Agricultural Pest Outreach Program with a focus, in part, on the spotted lanternfly. The program also provides guidance on the management and control of detected invasive pests. By raising awareness of invasive pests, we hope to increase public awareness of pest management options and early reporting of potential new pest sightings to federal or state authorities.

Bird & Butterfly Garden: The Bird & Butterfly Garden is a partnership of the Federated Garden Club of Connecticut, the Spring Glen Garden Club of Hamden, and The Connecticut Agricultural Experiment Station. Most maintenance and improvements to the garden are done by farm manager Richard Cecarelli and his staff. The garden is normally open to the

public Monday-Friday 8:30 a.m.-4:00 p.m., 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*.

Meetings, Conferences, and Interns:

Following an international virtual symposium on Delusional Infestation (DI) held during the annual meeting of the Entomological Society of America in November, 2020 and organized by Ridge, Ph.D. It was agreed the book “Physicians Guide to Delusional Infestation” be written for the medical profession. All the speakers as well as Lyle Buss, Ph.D. of the University of Florida became co-authors. In April 2021, the book was accepted for publication by Springer Nature with a planned for 18,000 volume distribution

throughout the world to academic and medical institutions. The book is published as of April 2024. DOI: 10.1007/978-3-031-47032-5

Victoria Smith, Ph.D. sponsored the Forest Health Monitoring Workshop. This annual workshop brings together personnel from CAES, UConn, USDA, US Forest Service, and anyone else with an interest in the health of the forests of CT. There were presentations on forest management, beech leaf disease, emerald ash borer, urban forests, and spongy moth defoliation.

The program and links to presentations from the Workshop may be found at Forest Health Monitoring Workshop 2024. The Workshop for 2024 is scheduled for March 12, 2024.

A symposium on Spotted Lanternfly (SLF), a newly invasive pest in Connecticut, was sponsored by a CAES Board of Control grant to Claire Rutledge, Ph.D. and by the Connecticut Farm Wine Development Council. The speakers included Dr. Melody Keena of the Northeastern Forest Research Station USDA, FS speaking on SLF biology. Victoria Smith, Ph.D., State Entomologist CEAS, and Erica Willey APHIS PPQ, speaking on the regulatory status of SLF in CT and its current distribution in Connecticut. Dr. Flor Acevado of Pennsylvania State University speaking on SLF management in vineyards. Nicole Carrier of APHIS PPQ shared information on a newly invasive beetle, the grape vine borer *Xylotrechus pyrrhoderus*,(Coleoptera: Cerambycidae). This potential pest has been detected in central Massachusetts. At the end of the morning there was a panel discussion held with all the speakers and Jamie Jones of Jones Family Farm of Shelton. There were 35 attendees, and CEU's were awarded to 29 participants from Connecticut Department of Energy and Environmental Protection. The symposium was greatly facilitated by help from Niklas Lowe, a durational worker supported by a CAES BOC grant, and Kelly Fairbrother.

Interns and Students Hosted in Entomology

Dr. Doug Brackney

- Michael Sekyere, a master's student at the University of Bridgeport, joined the lab in the spring of 2023 and defended his master's thesis in the spring of 2024. His thesis examined the role of hemocytes in basal lamina repair.
- Kaitlyn Maurais, Yale School of Public Health master's student completed her thesis in Dr. Brackney's laboratory examining the eco-epidemiology of Eastern Equine Encephalitis virus.

Dr. Hany Dweck

- Dr. Qi Xue is a postdoctoral Scientist in the lab since February 1, 2024. Qi has a first author manuscript under review in BMC Biology.
- Kazi Sifat Hasan,, is a Seasonal Research Assistant . So far, Kazi has two manuscripts under review in BMC Biology and MicroPublication Biology. Kazi Joined the lab on February 6, 2024.
- Raghav Bharadwaj is a high school student from North Haven High School. Raghav joined the lab during the summer of 2024. He continues to come to the lab when there is no school.

Dr. Kelsey E. Fisher

- Kira Goldman, a recent graduate from University of Connecticut, did her senior thesis work in my lab on monarch butterfly larval feeding preferences
- Paul Kraut, a recent graduate from Weslyean University, did his senior thesis work in my lab on beech leaf disease

- Servesgwara Varaprasad Sharma Kasula, a MS student at the University of New Haven, completed an internship looking at the spatial distribution of bioswales in New Haven,
- Emma Donahey, an undergraduate student at Iowa State University and SCSU Plant Health Fellow worked on a project related to milkweed germination.
- Karena Kulakowski, an undergraduate Biology student at Central Connecticut State University, worked on a project investigating the impact of mowing milkweed on monarch butterfly success.
- Bria Fielding, a recent Southern Connecticut State University graduate, completed an internship during the Spring 2023 semester, where she assisted with analyzing wing metrics of monarch butterflies collected across the world from 2016-2020 to determine migrant status.
- Lauren Conner, a master's student at Western Connecticut State University, joined the lab in May 2023. Her work analyzes plant and insect biodiversity in New Haven bioswales.
- Alina Filandro, an undergraduate Biology student at Quinnipaic University, joined the lab in May 2023. Her work investigates migrant status of monarch butterflies collected worldwide with wing metrics.

Dr. Andrea Gloria-Soria

Hosted and advised thesis of Emily Newton, senior in Forensic Science at The University of New Haven (Started January, 2024). Emily tested the use of long-read technology to identify the blood-hosts of field-collected mosquitos.

- Hosted and advised internship of Naveena Peesa, master student at the University of New Haven (Started June, 2024). Naveena's project focused on using bioinformatics to characterize viral insertions in the genome of Aedes mosquitos collected in the Southwest Indian Ocean.
- Hosted and advised internship of Skylar Arent from Albertus Magnus College. Skylar assists with molecular genetics and is conducting a research project to determine host preference on mosquitoes from the Culex pipiens complex (Started May 30, 2023).
- Hosted and advised internship of Rachael Pelligrini from Albertus Magnus College. She has been assisting with molecular genetics and research projects on mosquitoes (Started June 30, 2023).
- Hosted and advised internship of Jack Brophy from Albertus Magnus College. He has been assisting with molecular genetics and research projects on mosquitoes (Started February , 2024).

Dr. Goudarz Molaei

- Hosted and advised Emily Siegel, a graduate student at the University of New Haven. She assisted with passive tick surveillance and research projects on ticks and mosquitoes. (2023-2024).
- Hosted and advised Urbina Yarida Espinosa at the University of New Haven. She assisted with passive tick surveillance and research projects on ticks and mosquitoes (2023).
- Hosted and advised internship of Ravali Krishna Vennapu of the University of New Haven. She assisted with the eastern equine encephalitis project (2024).
- Hosted and advised internship of Jay Solanki of the University of New Haven. He assisted with the eastern equine encephalitis project (2024).
- Hosted and advised Inva Fero, a student of Post Universit in waterbury, CT.. She assistedwith passive tick surveillance and research projects on ticks and mosquitoes (2023).
- Hosted Lorelei Sandlad, a graduate student at the University of New Haven. She assisted with passive tick surveillance and research projects on ticks (2023-2024).
- Hosted Abigail Chang, a graduate student at the University of New Haven. She assisted with passive tick surveillance and research projects on ticks (2023-2024).
- Hosted Kristy Lok, a graduate student at the University of New Haven. She assisted with passive tick

surveillance and research projects on ticks (2023).

- Hosted Shalini Kumari, a graduate student at the University of Bridgeport. She assisted with research projects on ticks and mosquitoes (2024).
- Hosted , a graduate student at the University of Bridgeport. She assisted with research projects on ticks and mosquitoes (2024).
- Hosted Rabina Baiju, a graduate student at the University of Bridgeport. She assisted with research projects on ticks and mosquitoes (2024).
- Hosted Syney Jones, a graduate student at the Yale School of Public Health. She assisted on research projects at the Passive Tick and Tick-borne Disease Surveillance Program (2024).
- Hosted Alexa Garbiel, a student at the University of New Haven. She assisted with the easten equine encephalitis project (2024).

Dr. Claire E. Rutledge

- Oliver Kelsey, a Plant Health Fellow, worked assisted with research into the impact of ash death from emerald ash borer on the understory vegetation in the forest. (2023)
- Kenneth Gessert, a past durational employee, visited for a week and assisted in the annual EAB survey (2023)
- Hosted Logan Moore, a rising senior at CCSU who helped with the annual southern pine beetle survey (2023)

John Shepard

- Mentored, hosted, and provided mosquito specimens to Randy Liu, Amity High School, for his research project, “Testing the Efficacy of an Applied Low-Voltage Textile Knit on Mosquito Blood-Feeding Prevention” November 2023 – March 2024

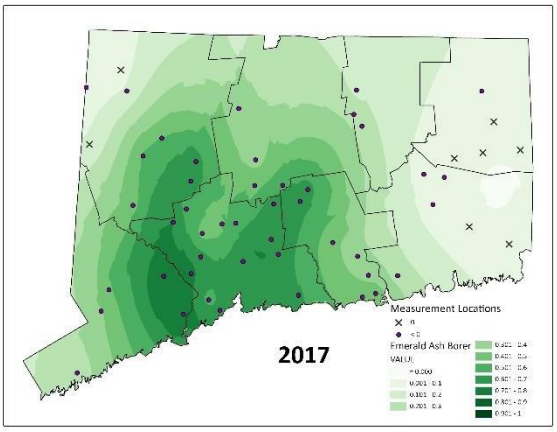
Tracy Zarrillo

- David P. Mantack, an undergraduate student at Southern Connecticut State University, completed an internship in Spring 2024, where he was trained in wild bee identification, insect curation, and collection techniques.

RESEARCH ACTIVITIES

Biosurveillance for Exotic Buprestidae and the Wasp Watcher Program

(Dr. Claire E. Rutledge and Collaborators – The Wasp Watchers, UConn Master Gardeners)



The wasp watcher program began in the spring of 2010. Cerceris fumipennis is a native digging wasp that provisions its nest with adult Buprestidae, including emerald ash borer (EAB). 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 as a main tool for detecting and monitoring EAB in the state. We are in the 15th year of our Wasp Watcher program. Over the course of the program, we have trained 225 watchers. In 2023, 18 veterans returned, and 8 new watchers joined. Since 2010, Watchers have collected over 15,000 beetles and detected EAB in 43 new towns. We have also used this system to examine the native buprestid fauna ofConnecticut and have detected over 70 species of beetles with this tool. We have amassed one of the largest collections of buprestids in the country with over 35,000 specimens.

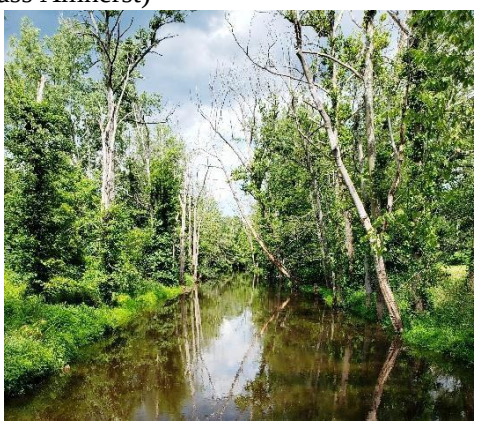
Southern Pine Beetle

(Dr. Claire E. Rutledge and collaborators Dr. Alicia Bray, Central Connecticut State University; Caroline Kanaskie, University of New Hampshire; DEEP Department of Forestry)

The southern pine beetle (SPB) has been moving north from the southeastern United States for the past 20 years due to climate change. The beetle reached Connecticut in the summer of 2014 and was first detected in 2015. The beetle is of concern in Connecticut because one of its favored hosts, the pitch pine, is locally rare and is vulnerable to eradication by this tree-killing beetle.

Classical Biological Control of Emerald Ash Borer

(Dr. Claire E. Rutledge with collaborators Dr. Jian Duan, USDA-ARS; Dr. Roy van Driesch, UMass Amherst; Dr. Juli Gould, USDA-APHIS; Dr. Nichole Quinn, UMass Amherst)



Following the detection of emerald ash borer (EAB) in Connecticut, the determination was made to join the USDA APHIS/PPQ biological control program for EAB. In May 2013, releases began of the gregarious endoparasitoid, *Tetrastichus planipennisi* and the egg parasitoid *Oobius agrili* in Middlebury and Prospect, CT. In 2016, we were able to add another species of parasitoid to the releases, *Spathius galinae*. This parasitoid is a gregarious ectoparasitoid of EAB with a much longer ovipositor than *T. planipennisi*. This means that they can parasitize larvae that are feeding in areas of the tree with much thicker bark. The parasitoids are shipped from the USDA APHIS EAB-rearing facility in Brighton, Michigan. Releases have been made in 17 towns and 7 counties in Connecticut.

Since those first releases, we have been documenting the progress of the biological control agents. We have confirmed that the wasps have established in the environment, thus displaying the ability to synchronize with their hosts and to tolerate the climate. Both T. planipennisi and S. galinae have spread at least 14 km

from their release sites, an important factor in success of a program. We have documented the phenology of the parasitoids, as well as the host to improve our release schedules and timing of recovery efforts. In 2021, we embarked on a project to understand the impact of the biological control program on the ability of ash forests to regenerate in the wake of the emerald ash borer invasion. Looking at sites where parasitoids were released and comparing them to nearby control sites, we have found that release sites had larger surviving ash than control sites. However in both release and control sites we have found both species of larval parasitoids parasitizing emerald ash borer, including sites in which the emerald ash borer density is currently very low. In addition, we are seeing regeneration in all areas, with many small ash saplings and seedlings as well as basal sprouts from EAB killed trees. Future work will continue to document the long-term recovery of ash in Connecticut's forest, and the contribution to that regeneration from our introduced biological control agents.

Spotted Lanternfly

Spotted lanternfly, or SLF, is a recently invasive pest from southeastern Asia. It was first discovered in Pennsylvania in 2014, and populations were found in Greenwich CT in 2020. Since that time it has spread into state, and is particularly abundant in coastal Fairfield and New Haven Counties. Due to its ability to hitchhike on vehicles, it often invades new areas along highways and railroad tracks. In 2023-2024 my laboratory was involved in four different areas of study with SLF. Two in collaboration with colleagues in the Entomology Department and described elsewhere, and the other two are described below.

Phenology of Spotted Lanternfly in Connecticut

Dr. Claire Rutledge, Dr. Melody Keena (US FS), Dr. Robert Trotter (US FS)

We are collecting data to complete a phenological model for SLF. In particular, understanding the impact of climate the ability of SLF to complete their protracted life cycle, and the potential limits of its distribution in North America. We are also using respirometry to understand diapause in overwintering eggs.

Mating Behavior and Consequences for Fecundity in Spotted Lanternfly

Dr. Claire Rutledge, Dr. Melody Keena (US FS)

Mating is a critical part of an insect's life cycle and many pest management strategies rely on understanding and disrupting mating behavior. Male SLF are unusual in that they can lose a piece of their genitalia during the mating process. Most species in which male insects exhibit such behavior, the loss of a body part serves to stop their mate from remating. This secures their paternity, albeit at the cost of their ability to mate again. However, in SLF we know that females are able to mate more than once, even after having mated with a male that has sacrificed his claspers. A series of SLF dissected in the fall of 2023 showed that the majority of females were mated, as shown by the presence of sperm, and some had mated at least twice, as shown by the presence of male claspers. About half the males examined had lost their claspers, but we did not know if that indicated their mating status. We are planning intensive, laboratory observations in the upcoming field season to understand how often males mate, and if the loss of claspers is 1. usual and 2. prevents future mating by that male. This work will inform future management strategies.

Spotted Wing Drosophila Parasitoids

Dr. Claire Rutledge, Dr. Richard Cowles, Dr. Jamie Pinero (UMass, Ahmerst), Dr. Matthew Buffington (SEL)

Spotted wing drosophila (SWD) arrived in Connecticut in the fall of 2011 and immediately began disrupting small fruit untangled, and release of an approved specialist parasitoid of SWD, Ganapsis kimorum (Hymenoptera: Figitidae) has begun. In addition, a relative of the approved parasitoid, Leptopilina japonica (Hymenoptera: Figitidae), has adventitiously been introduced into North America, and has been rapidly spreading without assistance. In summer 2024, we surveyed small fruit crops in Connecticut and Massachusettes to assess which species of parasitoids are already present, and if it is appropriate to introduce G. kimorum to the state in 2025. Over 2,000 parasitoids from 15 locations and 10 different types of fruit have been reared and are awaiting identification. Future work will focus on introduction of the parasitoid (if necessary) and creating strategies to help growers maximize their impact.

Checklist of the Bees of Connecticut and Conservation Status Assessments

Ms. Tracy Zarrillo, Dr. Kimberly Stoner, Dr. John Ascher (National University of Singapore), and Bruce Young of NatureServe

There are 386 species of bees documented for Connecticut. Four species are currently listed as species of conservation concern in Connecticut: *Bombus affinis*, listed as a species of Special Concern in Connecticut and federally listed as an Endangered Species; *Bombus ashtoni*, listed as a species of Special Concern in CT; *Bombus terricola*, listed as Threatened in CT, and *Epeoloides pilosula*, listed as Endangered in CT. Subnational conservation ranks were given to 124 bee species by CAES in cooperation with CT-DEEP and NatureServe. Of the 124 bee species assessed, 21 were designated S1 (critically imperiled), four were designated S1/S2, seven were designated S2 (imperiled), seven were designated SX (extirpated from Connecticut), and 37 species were designated SH (known from historical records but still hope for recovery). *Bombus terricola* (S1/S2) continues to persist in Litchfield County.

Habitat Enhancement Project at Robbins Swamp Wildlife Management Area

Ms. Tracy Zarrillo and Peter Picone (CT-DEEP)

Ecological restoration is a long-term investment which can increase insect and wildlife diversity in an otherwise degraded habitat, however such restorations often lack information on the responses of target taxa to the improvements. The Connecticut Department of Energy and Environmental Protection is in the process of converting some state land that was previously held in agriculture, specifically corn, to pollinator habitat. One such restoration began in June of 2021 at Robbins Swamp Wildlife Management Area in Falls Village in Canaan in a 14-acre field that had been planted in corn. The field was cleared of invasive non-native plants using spot treatments of herbicide and mechanical pulling and was seeded with native wildflowers and grasses. Surveys of wild bees and vegetation are conducted once per month from April to September to evaluate how plant and bee species diversity change over time. Nine of the sixteen species of bumble bees reported for Connecticut have been documented at Robbins Swamp WMA, including the state listed *Bombus terricola*, and two other species of conservation concern, *Bombus ternarius* and *Bombus fervidus.* Other bee species of note found at Robbins Swamp WMA include the specialist mining bees *Andrena distans* (obligate of *Geranium* pollen), *Andrena erigeniae* (obligate of *Claytonia* pollen), and *Andrena erythrogaster* (obligate of *Salix* pollen).

Assessing Pollinator Response to Isolated Plantings of Eco-type Host Flowers in Agricultural Settings

Ms. Tracy Zarrillo

State and federal agencies (CT-DEEP, DOT, NRCS), land conservation organizations, private landowners, farmers, and pollinator conservation groups (Pollinator Pathways) are investing time and money creating pollinator habitat and meadows throughout the state. While pollinator habitat restorations have good intentions, care must be taken to ensure they achieve their desired results. Assessing the ability of these habitats to attract and support native bees can support the success of these efforts. One aspect of many of these projects is the use of native plants. In response to demand for locally adapted native plants, ecotypic flower seed is being developed as a new commodity in Connecticut. Ecotype seeds are seeds grown from a parent stock that have genetically evolved over time to be adapted to the environment of a particular ecoregion. Ecotype seeds could be used by nurseries, farmers, state agencies, land trusts, landscapers, and private landowners to help increase native habitat in Connecticut. However, we have limited information about which bee species are supported by these native plants, or if the bee species are equally attracted to these native plants throughout the state. Some of the native flower species being grown for seed are hosts of specialist bees. Knowing which bee species are attracted and where they can be supported by certain flower species can help guide flower species selection for commercial development.

Assessing Plant and Pollinator Response to the New England Pollinator Partnership in Connecticut and Rhode Island

Ms. Tracy Zarrillo with collaborators Dr. Steve Alm and Ms. Casey Johnson of the University of Rhode Island

Wild native bees provide an estimated $3 billion annually in pollination services in the U. S. However, native bees have declined in recent decades with habitat loss and land use intensification. The Farm Bill has invested in a range of incentive-based conservation programs on agricultural land to mitigate recent bee declines while providing multiple other benefits for agriculture and surrounding environments. However, documentation that these programs have achieved their desired outcome of increasing wild native bees in the landscape is lacking. In this 3-year project, at least twenty Farm Bill conservation plantings in CT and RI will be surveyed for wild bees once per month from June through September. Bee and plant species richness will be documented for each site over the course of the season and the relationship between plant diversity and bee species richness will be quantified. The information from this research will help develop seed mixes specific to Connecticut and Rhode Island.

Honey Bees at Ornamental Nurseries Collect Most of their Pollen from Outside the Nurseries

Pollen is the main source of protein, fats, and many micronutrients for honey bees, and it also has the potential to be a major route of exposure to pesticides. The objective of this study was to quantify to what extent honey bee colonies use ornamental nursery plants as sources of pollen over the season. We put honey bee colonies at two large commercial ornamental plant nurseries and used a pollen-trapping device to collect pollen from foraging honey bees as they returned to the hive. Pollen was collected each week from June until September in 2015 and 2018. Samples from the pollen collected were identified to genus by a pollen specialist, and by counting and measuring the pollen cells, we could quantify how much of the pollen came from what plant source. We found that most of the pollen in July and August was collected from plant genera not grown at the nursery, including clover (Trifolium), maize (Zea), buckwheat (Fagopyrum), and jewelweed and related species (Impatiens). Major genera grown in at the nurseries and found in the honey bee-collected pollen in

June and early July included roses (Rosa), sumac (Rhus), and hollies (Ilex), but each of these genera also include native or naturalized species that are abundant in the surrounding area, so the pollen probably came from both the nursery and the surroundings.

Chemical Ecology of Crop Pests

We aim to understand how pests, such as spotted wing Drosophila (SWD) and spotted lanternfly (SLF) interact with crops. At the core of this research endeavors lie a set of focused objectives: 1) Exploring Ecologically

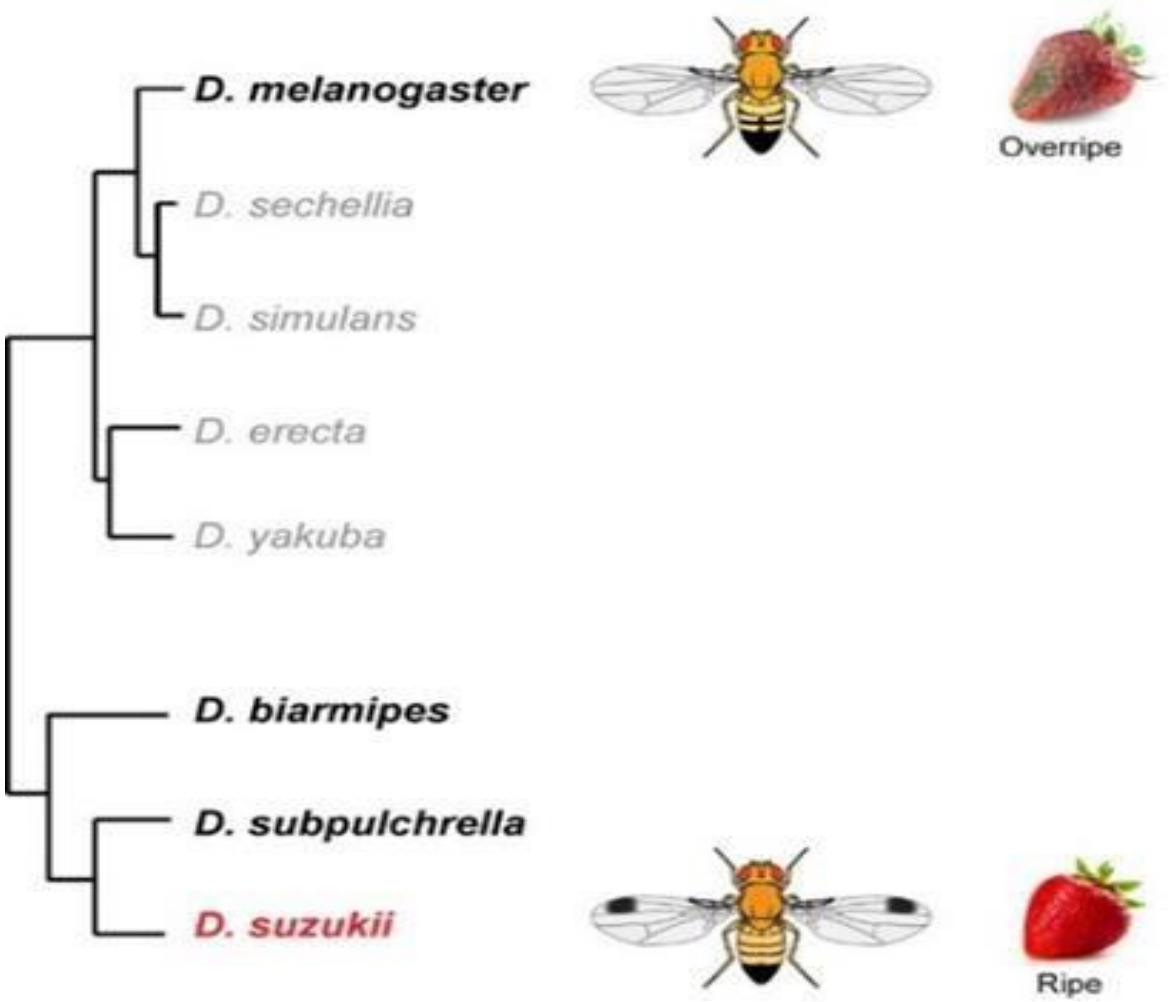
Relevant Chemical Cues: We strive to unravel chemical signals used by insects for vital functions such as sexual communication, host location, and their ability to evade natural enemies and harmful microbes. 2) Investigating Neurons and Receptors: We study the sensory neurons and receptors responsible for detecting these chemical cues toe understand how insects perceive and respond to their chemical environment. 3)Analyzing Behavioral Outputs: We investigate the behavioral outputs elicited by these cues, studying how they influence mating patterns, host selection, and defense mechanisms in insects. This knowledge forms the foundation for the development of targeted strategies to disrupt or manipulate insect behavior for pest control and integrated pest management (IPM), ultimately benefiting Connecticut's agricultural industry and food production systems.

Acid Taste Sensing in Spotted Wing Drosophila

(Laboratory of Chemical Ecology, Dr. Hany Dweck)

We aim to understand the gustatory mechanisms that enable animals to adapt to new environments. When a species inhabits a novel ecological niche, one crucial aspect that must undergo evolutionary changes is its taste system. This dynamic and adaptive process ensures that the species can modify its sensory capabilities to effectively assess the suitability of newly available resources for vital activities such as feeding and egg-laying. By optimizing its interactions with the surroundings, the species can enhance its survival and reproductive success. However, the specific mechanisms underlying these adaptations are still not fully understood.

Fig. 1. Phylogenetic tree depicting the relationship between *D. suzukii* and closely related species



To bridge this gap, our research focuses on the unique egg-laying behavior of Drosophila suzukii, commonly known as spotted-wing Drosophila (SWD). Unlike its closely related species, including the model organism D. melanogaster, which lays eggs on fermented fruit, D. suzukii exhibits a distinct egg-laying preference for early maturation stages, including both ripe fruit and earlier stages of ripening (Fig.1).

To lay eggs on ripe fruit and early stages of ripening, D. suzukii has evolved two key modifications. First, D. suzukii has evolved an enlarged saw-like ovipositor, a specialized organ for egg-laying, to penetrate the skin of early maturation stages and lay eggs. Second, D. suzukii has acquired the ability to lay eggs on ripe fruit

and earlier stages of ripening as opposed to fermented fruit. This evolutionary shift poses not only an urgent agricultural problem but also a fascinating biological question: What are the underlying mechanisms driving such a significant behavioral change?

The shift in egg-laying preference requires alterations in the perception of various sensory stimuli, particularly in taste. Previously, with the support of the National Institutes of Health (NIH) and the Life Sciences Research Foundation (LSRF), our research demonstrated at the behavioral, cellular, and molecular levels thatD. suzukii and D. melanogaster exhibit differential responses to bitter compounds and sugars. This research now invites a similar investigation into the sensation of other significant taste cues. Therefore, we investigate the acid taste sensation in D. suzukii and its contribution to the shift in egg-laying preference towards ripe fruit and earlier stages of ripening.

Olfactory Mechanisms by Which Spotted Lanternfly Interacts with its Host Plants

we aim to delve into the olfactory mechanisms and their pivotal role in an interaction that holds both economic urgency and fundamental biological significance: the interaction between the spotted lanternfly (SLF) and Connecticut's trees.

Similar to numerous other insects, the SLF primarily relies on olfactory cues to locate its host trees. Additionally, olfaction plays a crucial role for the SLF in predator avoidance, aggregation, mate selection, and identifying suitable sites for depositing its egg masses.

The long-term goal of this work is to comprehensively understand the olfactory mechanisms through which the SLF interacts with its host trees. To achieve this, we pursue three specific objectives. Firstly, we identify the odors that hold significant importance for the SLF (**objective 1**). Secondly, we pinpoint the specific neurons responsible for detecting these odors (**objective 2**). Lastly, we investigate the behaviors triggered by these odors (**objective 3**). By attaining these objectives, we anticipate discovering new and innovative approaches that are cost-effective and environmentally friendly for managing the invasion of this pest.

Mechanisms of Repellency in Spotted Wing Drosophila

(Laboratory of Chemical Ecology, Dr. Hany Dweck)

This project aims to identify novel natural odorants that deter egg-laying in spotted wing Drosophila (SWD) in agricultural settings. It also seeks to unravel the cellular and molecular mechanisms through which these repellents are detected and encoded. The outcomes of this proposal hold the potential to offer valuable insights into pest control strategies and agricultural management practices. This project takes advantage of our recent chemical analysis of the odor profiles from 28 different fermented fruits, the non-preferred fruit developmental stage for egg-laying by SWD. This analysis led to the identification of 19 aromatic volatiles that are similar in their physiochemical properties to known insect repellents, such as DEET, a widely used insect repellent. Furthermore, most of these identified aromatic compounds strongly deter egg-laying in SWD in laboratory conditions.

Metal Nanoparticles as a Sustainable Solution for Managing Spotted Wing Drosophila (SWD)

(Laboratory of Chemical Ecology, Dr. Hany Dweck)

The Spotted Wing Drosophila (SWD), Drosophila suzukii, is an invasive pest that significantly threatens fruit crops worldwide, including strawberries, blueberries, cherries, peaches, and grapes. Unlike other fruit flies, SWD lays eggs in ripe fruit, causing severe damage and substantial economic losses in agriculture. Traditional insecticides have proven inadequate due to the rapid spread of SWD, its high reproductive rate, and increasing resistance. This project aims to develop and test metal nanoparticles (MNPs) as an innovative, sustainable alternative for controlling SWD infestations. The primary objectives are to formulate effective metal nanoparticle solutions (objective 1), assess SWD's behavioral response to these formulations (objective 2), and investigate the interaction between metal nanoparticles and the bitter taste system (Objective 3), testing the hypothesis that MNPs evade detection by SWD's bitter taste neurons, which typically warn flies of toxic food, thus preventing SWD from avoiding nanoparticle-treated crops. The broader impacts of this project are substantial: agricultural benefits include reducing SWD-related crop losses, stabilizing fruit production, and improving economic sustainability for fruit growers. Environmentally, metal nanoparticles provide an eco-friendly alternative to chemical insecticides, breaking down more quickly and posing less risk to non-target species. From a public health perspective, this method promises to enhance food security by minimizing fruit loss and reducing pesticide residues in food, benefiting consumers and promoting public health. Overall, this project could revolutionize agricultural pest control by offering a sustainable solution to the invasive SWD, with positive outcomes for both farmers and the environment.

Evolution of Olfaction in spotted lanternfly

Laboratory of Chemical Ecology, Dr. Hany Dweck)

This project explores olfactory mechanisms and their role in an interaction that is of both economic urgency and fundamental biological significance: the spotted lanternfly (SLF)-Connecticut's trees interaction. SLF, like many other insects, finds its host trees primarily through olfactory cues. It also depends on olfaction to avoid predators, aggregate, find mates, and identify sites upon which to deposit its egg masses. The long-term goal of this proposal is to understand the olfactory mechanisms by which SLF interacts with its host trees. Specifically, we will identify odors that are highly significant to SLF (objective 1), the neurons that detect these odors (objective 2), and the behaviors that these odors elicit (objective 3). The results may lead to new, economical and environmentally friendly approaches to controlling the invasion of this pest.

Milkweed quality impacts adult and larval monarch survival, growth and development, and behavior.

Kelsey E. Fisher

Integrating aspects of adult and larval lepidopteran behavior that enhance survival into conservation plans could increase the overall impact of conservation efforts. Monarchs seem to favor young, succulent, and lush milkweed for oviposition, and larvae may prefer and have higher survival rates when fed new growth. Monarch eggs and larvae are most often observed on the top portion of milkweed ramets foliage where new growth is present. Further, monarch larvae perform a seemingly innate behavior of rejecting their natal milkweed ramet during the 4th instar after fully consuming the leaves from the top portion of the ramet. Older healthy foliage on their natal milkweed ramet is not consumed when these larvae leave in search of new host plants. The motivations of this behavior are unknown, but it is hypothesized larvae reject their natal host plants because of diminished nutritional quality. Reduced plant quality could result from (1) preferential consumption of young vegetation, (2) induced cardenolides, (3) induced defenses including "call for help" compounds to attract predators and/or parasitoids, and/or (4) reduced leaf cover resulting in exposure to potential predators.

Laboratory studies were conducted in 2023 to determine the impact of vegetation age on larval survival, growth, development, and feeding preferences. Field experiments implementing strategically

timed mowing will be conducted in 2024 to explore the impact of providing young vegetation later in the season on oviposition rates and subsequent larval survival. Experiments addressing the additional hypotheses will be conducted in future years.

Small native plantings prevent water run-off and may benefit pollinators

Kelsey E. Fisher

Habitat fragmentation provides a significant barrier to insect movement across the landscape. Individuals that can traverse an unsuitable matrix often do so at an energetic cost, while those that cannot suffer from potential resource limitation and genetic inbreeding from habitat isolation. Connecting habitat patches, either directly with corridors or functionally with 'stepping stones,' facilitates the efficient movement of individuals across fragmented landscapes to increase population sizes and gene-flow. "Pollinator Pathways" is a grassroots volunteer organization that started in Connecticut in 2016 and aims to "de-fragment" the landscape by establishing pollinator plots on public and private lands within 750 m of each other. Similarly, although designed to mitigate water run-off, >150 bioswales were established in New Haven, CT over the past 5 years. As native plants are often utilized in bioswales, these sites have to potential serve as additional Pollinator Pathway sites and support native insects/pollinators. Currently, biodiversity surveys of nine bioswales in New Haven, CT and one in Hamden, CT are being conducted monthly from May to September for plant species and insect utilization to determine if these sites are supporting pollinator communities.

How connected are the sites on the pollinator pathway? Siblingship analysis of bumblebees

Kelsey E. Fisher

Bumble bees (*Bombus* sp.) are native, generalist pollinators that contribute to the fertilization of native forbs and enhance the yield of field, fruit, and seed crops. However, habitat fragmentation provides a significant barrier to bumble bee movement across the landscape, jeopardizing their capacity to deliver pollination services. Individuals that can traverse an unsuitable matrix often do so at an energetic cost, while those that cannot suffer from potential resource limitation and genetic inbreeding from habitat isolation. Connecting habitat patches, either directly with corridors or functionally with 'stepping stones,' facilitates the efficient movement of individuals across fragmented landscapes to increase population sizes and gene-flow. "Pollinator Pathways" is a grassroots volunteer organization that started in Connecticut in 2016 and aims to "de-fragment" the landscape by establishing pollinator plots on public and private lands within 750 m of each other. While commendable, the efficacy of these efforts is unknown. Here, I am using bumblebees to estimate the connectivity of the pollinator pathway. To determine landscape connectivity, we need to determine how colonies (the biological unit) utilize forage habitat provided by pollinator pathway sites. Because bumble bee workers within a colony are nearly genetically identical, a population genetics approach can be used to understand movement ecology and space use for foraging in bumble bees. With this approach, foraging workers are collected, genotyped, and assigned to sibling groups or colonies. To date, this method has been used to analyze a colony's space use for foraging, the number of colonies foraging within a habitat patch, and dispersal ability of a colony across forest barriers. I am applying these methods to quantify how many colonies are utilizing pollinator gardens in New Haven, Bethany, and Hamden, CT and identify if individual colonies are utilizing more than one of the surveyed sites. With this study, I am also estimating colony abundance, home range, foraging movement, and approximate nest location.

Using knowledge of movement and dispersal ecology to manage Spotted Lanternfly (*Lycorma delicatula*) in vineyards

Kelsey E. Fisher and Claire Rutledge

The spotted lanternfly was first introduced to the US in Pennsylvania in 2014 and has recently been reported in Connecticut. This invasive species has potential to economically impact several crops, with a significant threat to the grape industry. The purpose of this project is to obtain a better understanding of spotted lanternfly dispersal behavior to aid in developing management strategies in vineyards. In 2024, we are using

use the stable isotope of nitrogen (N^{15}) to help quantify SLF dispersal ability at properties in Westport and Milford, CT. Funding for this project is provided by a specialty crop block grant: "Using the stable isotope of nitrogen as a long-term marking strategy to estimate natural dispersal capacity of spotted lanternfly".

European corn borer: a generalist agriculture pest in Connecticut.
Kelsey E. Fisher

The European corn borer, *Ostrinia nubilalis* (Hubner), was introduced to North America near Boston, Massachusetts, in the early 1900s. Eventually, the European corn borer was distributed throughout the major corn-growing regions of North America. European corn borer was initially identified as a pest of corn (*Zea mays*), but it was also found as eggs and larvae on >200 crop and weedy plant species, earning the label of a "generalist herbivore". There are two pheromone races of European corn borer: E and Z. Both races are known to be generalist feeders, though the E-pheromone race tends to have a stronger association with non-corn hosts like potato (*Solanum tuberosum*), wheat (*Triticum aestivum*), hops (*Humulus lupulus*), and weedy plants. The Z-pheromone race individuals tend to feed and oviposit mostly on corn because their first-generation life cycle is synchronized with the availability of corn in V5-R1. In New England and the MidAtlantic United States, the two races can crossbreed to create hybrids.

Through the 1920s, 1930s, and 1940s, European corn borer devastated the US corn industry due to late-instar feeding damage. Many management strategies were attempted in subsequent decades, but few were fully successful until 1996 with the commercialization of genetically modified corn in North America. Bt (*Bacillus thuringiensis*) corn expresses insecticidal crystalline (Cry) proteins in plant tissues, basically in a high dose, forcing the insect to ingest the toxin upon feeding, leading in most cases to larval death. Bt corn is highly effective, and has been widely adopted, accounting for 90% of the corn planted in the United States. Until recently, the high dose refuge and the use of pyramids (multiple toxins targeting the same host) have prevented the development of resistance; however, in 2018, resistance was reported in Nova Scotia, Canada. In 2023, I observed evidence of potential resistance to Bt at Lockwood farm in sweet corn sentinel corn that was planted to monitor pest pressure in CT. This is the first report of potential resistance in the United States. A manuscript is in preparation in collaboration with the scientists that reported resistance in Canada and will be submitted in 2024, prior to the growing season. As a result of this observation, a collaborative agreement was formed between CAES and Bayer CropScience to test potential future insecticidal traits. In addition to the trait trial plots, sentinel plots will be planted at Lockwood, Valley Lab, and Griswold to continue to monitor ECB resistance in collaboration with Galen Dively's sentinel sweet corn network of more than 50 sentinel trials with side-by-side Bt and non-Bt plots will be established in 27 states and 5 provinces of Canada.

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. Victoria Smith, Plant Inspectors Jeffrey Fengler, Tia Blevins, and Jacob Ricker, Apiary Inspector Mark Creighton, and State Survey Coordinator Austin Vitelli.

Nursery Inspection and Certification. One hundred ninety one nurseries were certified to conduct intra- and interstate business. There were 154 nursery inspections during the growing season.

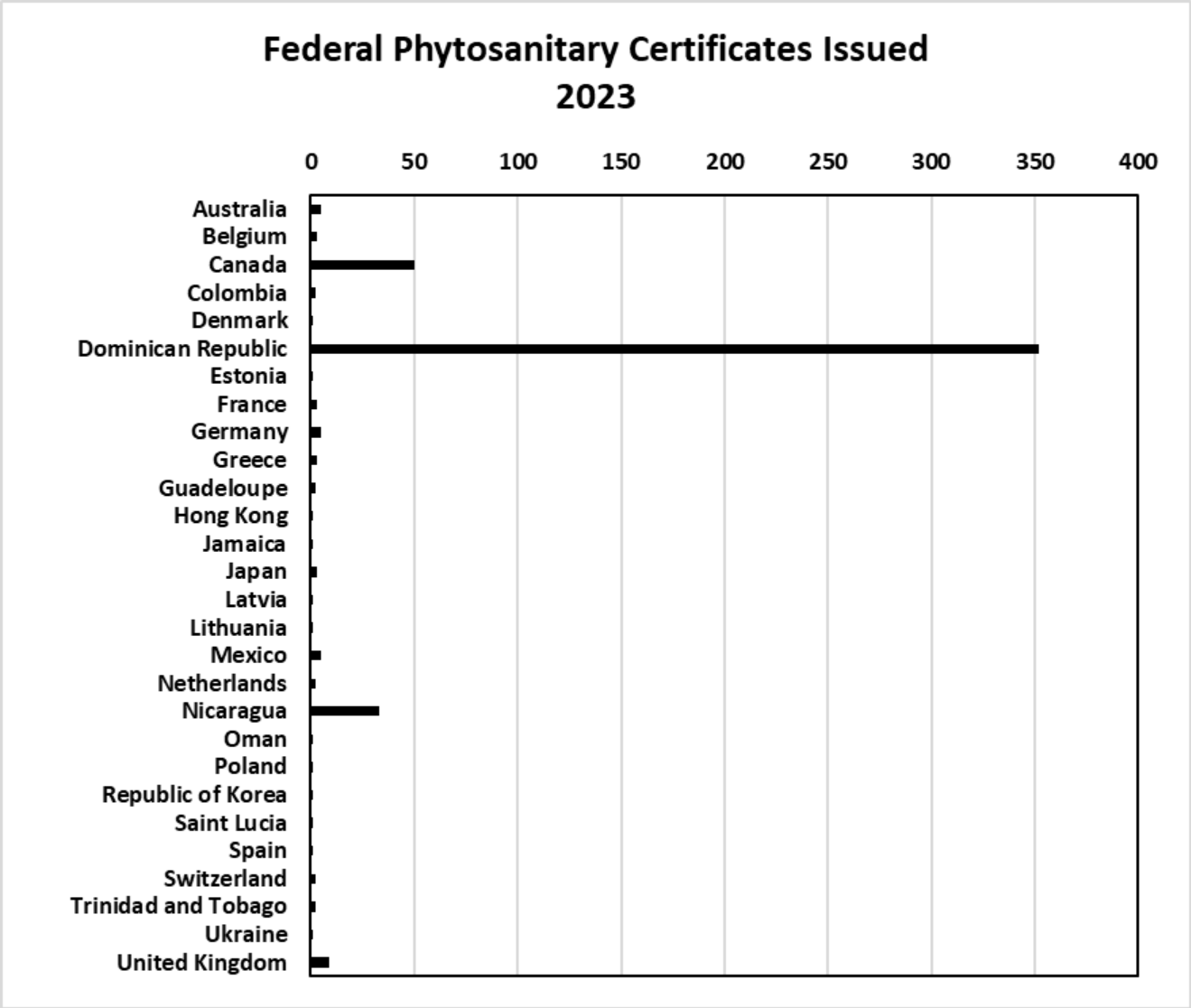
Nursery Insects and Diseases. The most important pests found in nurseries (in order of prevalence) were red headed flea beetle, various aphids, woolly aphids, and thrips. The most important diseases found in nurseries (in order of prevalence) were powdery mildew, cedar apple rust, miscanthus blight, and various fungal leaf spots.

Nursery Dealer Permits. Nursery dealer permits were issued to 97 firms.

International Phytosanitary Certificates. Four hundred forty eight phytosanitary inspection certificates were issued covering the shipment of the following plant materials to 28 destinations outside the United States. Of the top three destinations, 352 consignments were bound for the Dominican Republic (tobacco), 50 to Canada (ornamental plants), and 3to Nicaragua (tobacco).

Destinations for out-of-country exports from Connecticut.

Product			Quantity	
Hemerocallis	Day lily	plants	259	plants
Hemerocallis	Day lily	seed	706	packets
Juglans regia	Walnut	ground shells	40	bags
Juglans regia	Walnut	ground shells	232	Kg
Juglans regia	Walnut	ground shells	3,960	pounds
Nicotiana tabacum	Tobacco	leaves	12,895	bales
Nicotiana tabacum	Tobacco	leaves	2	boxes
Nicotiana tabacum	Tobacco	leaves	80,079	bundles
Nicotiana tabacum	Tobacco	leaves	23,495	cartons
Nicotiana tabacum	Tobacco	leaves	191.25	Kg
Nicotiana tabacum	Tobacco	leaves	1,756,475	pounds
nursery stock	various	plants	25,089	plants
Paeonia lactiflora	Peony	plants	1	plant
Paeonia X lemoinei	Peony	stems	45	Stems
Paeonia suffruticosa	Tree peony	plants	68	plants
Pelargonium alpinum	Geranium	plants	26	Plants
Phytelephas macrocarpa	Vegetable ivory	ground seed	500	Kg
Tillandsia sp.	Air plant	plants	754	plants
vegetables and herbs	various	seed	171	bags
vegetables and herbs	various	seed	159.76	Kg

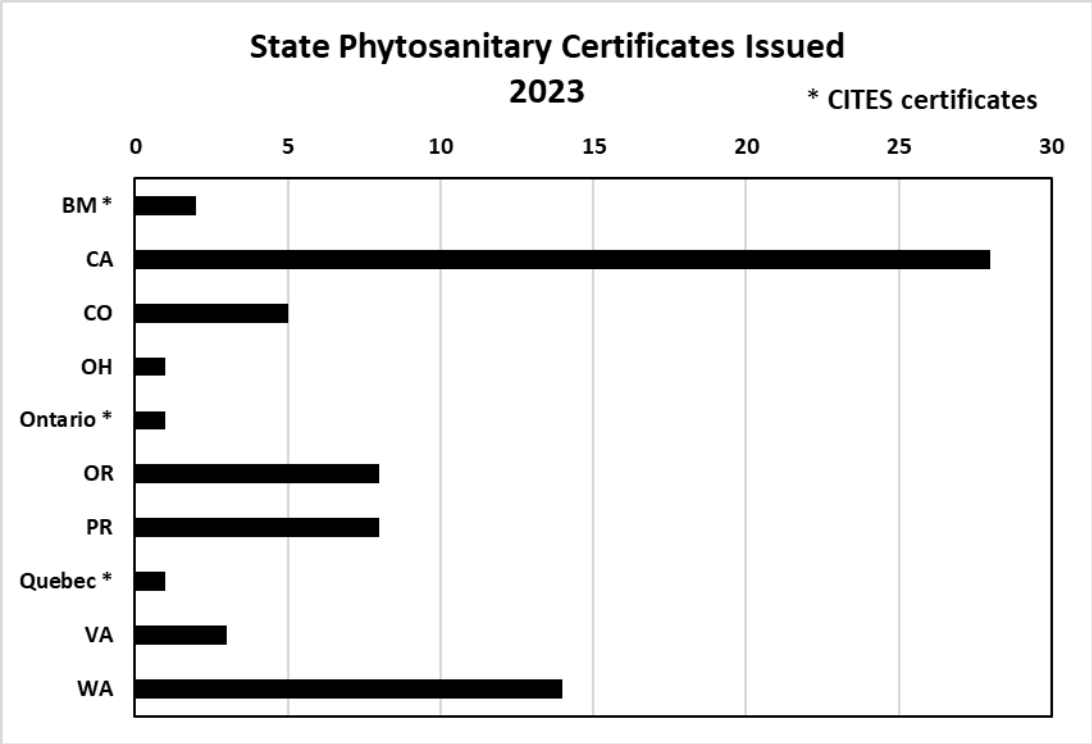


Houseplant Inspections. Three inspections were conducted for 17 individual plants to assist homeowners moving out of state.

Domestic. A total of 71 State of CT phytosanitary inspection certificates were issued to assist nurseries and other vendors moving the following plants interstate, either to destinations in other states or to US Territories and Puerto Rico (11 listed destinations). Of the top three destinations, 28 consignments were bound for California, 14 to Washington, and 8 each to Oregon and Puerto Rico.

Product			Quantity	
nursery stock	various	plants	13,393	plants
Paeonia suffruticosa	Tree peony	plants	3	Plants
Orchids	various	plants	2623	plants
Pelargonium sp.	Geranium	plugs	1,329	plants
Research plant material	various	plants	205	Plants
vegetables and herbs	various	seed	46	bags

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



Permits to move live plant pests, noxious weeds, and soil. In 2022, there were 152 PPQ 526 Permits (Permit to move live plant pests, noxious weeds, and soil) approved in CT. There were 10 Permit to Receive Soil issued.There were 5 Controlled Import permits issued.

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

Notification of Shipments of *P. ramorum* hosts and Associated Hosts. There were no notifications of shipments of *P. ramorum* hosts and associated hosts, pursuant to 7 CFR 301.92.

FOREST HEALTH

In general, the hardwood forests are suffering from successive years of drought stress and gypsy moth defoliation, and are under threat due to development pressure, and ash mortality due to emerald ash borer infestation is increasing. Most of the ash, especially in urban and suburban areas, is dead due to EAB. We no longer assess damage and mortality of ash. Beech leaf disease exploded in both forested and managed landscapes of CT in 2023, affecting all size classes of trees. Mortality due to beech leaf disease remains to be determined.

INSECT AND DISEASE SURVEYS

SPOTTED LANTERNFLY. Populations of spotted lanternfly (egg masses plus adult insects) were first found at several locations in Fairfield County, near the New York State line, in September 2020, and populations were found in 2022 in Fairfield, Litchfield, Hartford, New Haven, and New London counties. Adult insects were also reported at various locations throughout the state, in all eight counties. There were about 8,000 reports submitted and 1,000 email reports answered.

Lymantria dispar dispar. In 2023, we recorded 21,327 acres with significant defoliation caused by LDD, primarily in Litchfield County, significant decrease from the previous year. In December 2023 through March 2024, a gypsy moth egg mass survey was conducted in 80-95% favorable host sites on a 7-mile grid (103 sites) throughout Connecticut. Egg mass counts were relatively low in Litchfield County, which indicates only a slight potential for an outbreak there in summer of 2024.

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, although hemlocks in some areas are thriving. In 2023, we recorded only 119 acres affected by elongate hemlock scale.

BEECH LEAF DISEASE, caused by the nematode Litylenchus crenatae mccannii, has been detected and confirmed to occur throughout the state. It is causing tree discoloration and some mortality primarily in the shoreline areas. We measured almost 10,160 acres affected by beech leaf disease in 2023, a ten-fold increase over 2022, and expect that number to increase in the coming years.

TORNADO. A tornado struck a rural area of CT in Windham County, leaving a destruction trail several miles long. In total, 169 acres were affected.

FROST. A late spring cold snap caused frost damage on deciduous hardwoods, primarily in Litchfield County. Damage manifested as discoloration of the leaves on the uppermost tips of trees and persisted throughout the summer. This damage was mapped on 148 acres.

WHITE PINE NEEDLE DAMAGE. WPND was scattered in nature, with 141 acres affected.

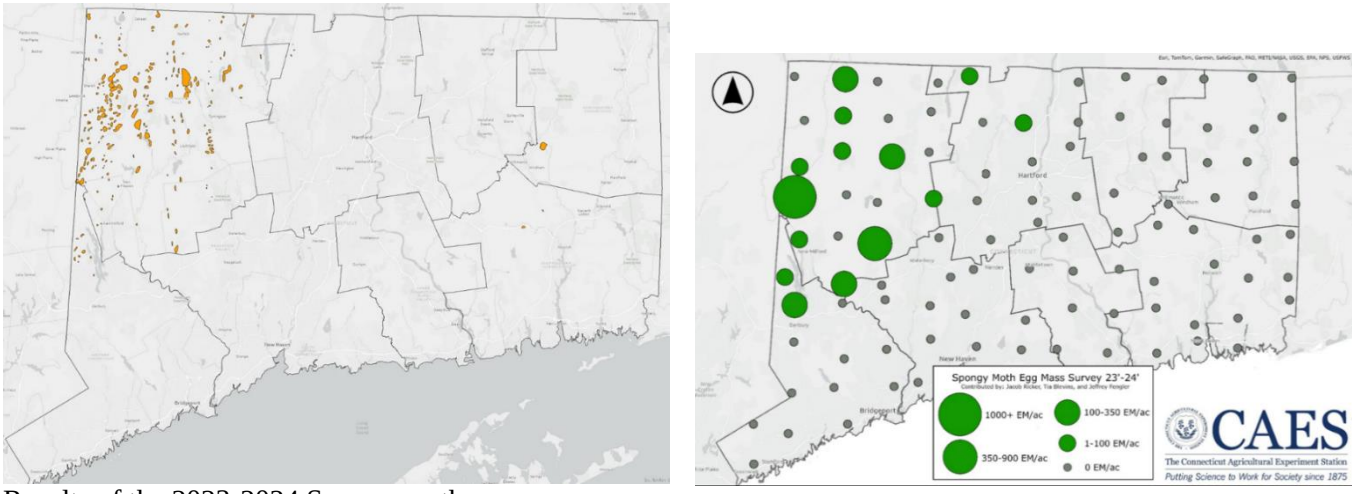
ANTHRACNOSE. The foliar disease anthracnose was recorded on hardwood species, primarily maple. Damage was estimated to occur on approximately 42 acres.

APIARY INSPECTION

This year the focus was on supporting the small-scale beekeepers which resulted in inspecting fewer colonies. Bee Health Certificates were issued for large apiaries to sell approximately 600 nuc's to beekeepers in the tri-state area (MA, NJ, and NY), and 7 were issued for travel to South Carolina, Florida, and Maine.
Approximately 1,115 colonies were inspected at 74 apiaries
Suspected American Foulbrood cases (4) were determined to be Parasitic Mite Syndrome. Varroa mites continue to be a leading cause of colony mortality in Connecticut. The Bee Informed partnership reported the average annual colony loss for Connecticut to be 49.7 %, which was the highest in the New England region. Varroa mite testing kits continue to be issued to beekeepers for the 2023 season.

Seven bee complaints were investigated and resolved.

The annual aerial survey of CT forests and natural lands was conducted during June through August of 2023; findings are below.



Results of the 2023-2024 Spongy moth egg mass survey.

CENTER FOR VECTOR BIOLOGY AND ZOONOTIC DISEASE

The CAES Center for Vector Biology & Zoonotic Diseases (CVBZD) and the infectious disease organisms they transmit in Connecticut and the Northeastern US. The mission of the Center is to advance the knowledge of epidemiology and ecology of vector-borne disease organisms and to develop novel methods and more effective strategies for their surveillance and control. The CVBZD is currently engaged in laboratory and field research on the biology and control of mosquitoes, ticks, and bedbugs and is investigating the epidemiology and ecology of mosquito-borne viruses that occur throughout the region including West Nile virus WNV, and eastern equine encephalitis virus (EEEV), and other arboviruses, as well as tick-borne pathogens such as Borrelia spp., Anaplasma phagocytophilum, Babesia microti, Ehrlichia spp., and Powassan virus. The Center is additionally responsible for conducting the state- wide mosquito and arbovirus surveil- lance for EEEV and WNV as well as active and passive tick and tick-borne diseases surveillance.
Vector-borne diseases (VBDs) are parasitic, viral, bacterial, and filarial human illnesses transmitted by mostly arthropod vectors, including mosquitoes, ticks, fleas, and several other groups, and account for more than 17% of all infectious diseases, causing more than 700,000 deaths each year worldwide. Linked,

in part, to a warming climate, VBDs are increasingly becoming a major public health concern in the U.S., where a total of 642,602 human disease cases were reported to the Centers for Disease Control and Prevention. Persistently warming temperatures may not only lead to the continued geographic range expansion of some vectors but may also extend their active season, thereby altering host availability and abundance; interactions among vectors, pathogens, and hosts; and the prevalence of infection. A warming climate and other environmental changes will affect abundance, distribution, seasonal activity patterns, and interactions among species differently for various vectors.

In recent years, we have witnessed introduction, range expansion, and changes in the dynamics and frequency of mosquito- borne arboviruses in the Western Hemisphere. WNV has now become firmly established in the continental U.S. since its discovery in the New York City area in 1999, and EEEV with sporadic transmission over the past several decades, has made a comeback in 2019 in the Northeast including Connecticut.

Invasive mosquito species including *Aedes albopictus* and *Aedes japonicus*, with abilities to transmit arboviruses of concern to humans, may soon pose considerable risk to human and animal health in Connecticut. The invasion and spread of *Ae. albopictus* in the U.S. occurred in the past three decades and its range continues to expand. *Ae. albopictus* inhabits a wide range of environments, from urban to rural, and bites a wide variety of hosts including mammals, birds, reptiles, and amphibians.

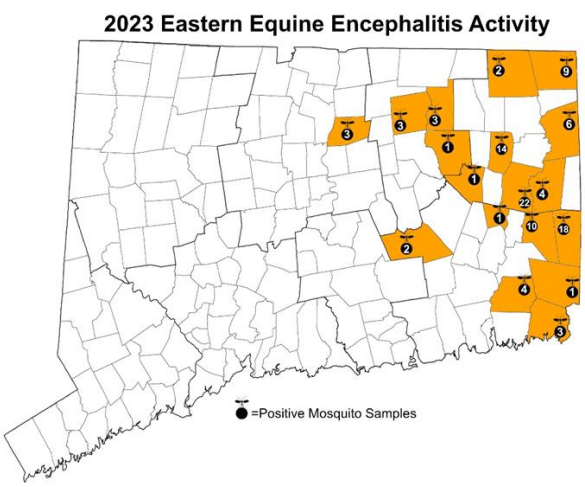
Mosquito Trapping and Arbovirus Surveillance Program

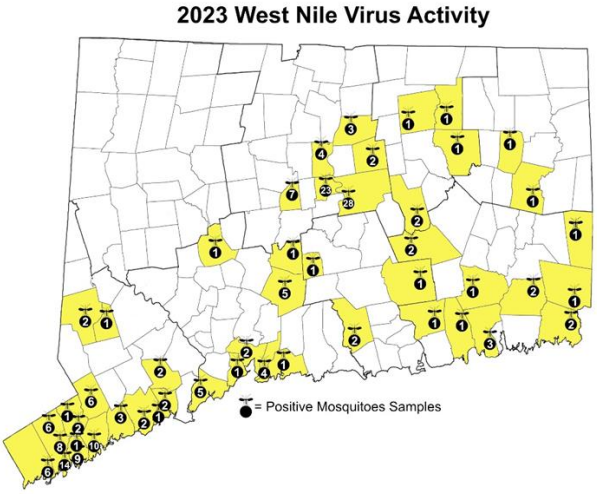
Philip M. Armstrong, John Shepard, Tanya Petruff, Angela Bransfield, Michael Misencik, Andrea Gloria-Soria

Mosquito-borne viral disease transmission is an annual threat to human health in Connecticut, and surveillance for eastern equine encephalitis (EEEv) and West Nile virus (WNv) is integral to the public health response to these mosquito-transmitted diseases in Connecticut, providing an effective early warning system for citizens of the State (CGS Section 22-81a). A comprehensive surveillance program, complemented by science-based control strategies and timely public health messaging, are the most effective methods of protecting the public and reducing the risk of human infections. CAES scientists and technicians monitor for EEEv and WNv activity at 108 locations across the state in 88 towns from June to October. The objectives of the Mosquito Trapping and Arbovirus Surveillance Program are to provide: 1) early evidence of mosquito -borne virus transmission 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 EEEv and WNv to warn stakeholders and guide the implementation of public health measures for disease prevention. CAES is the agency responsible for conducting all mosquito trapping and testing activities.

In 2023, state-wide trapping for mosquito and mosquito-borne virus activity was conducted 108 trapping sites from May 30 through October 26. Approximately one-third of the sites were in densely populated residential locales along urban/suburban corridors in the coastal southwestern corner of the state extending east through New Haven and north to greater Hartford. 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 at all 108 trapping sites with CO2 (dry ice)-baited CDC miniature light traps equipped with aluminum domes, gravid mosquito traps baited with a lactalbumin-yeast-hay infusion. Enhanced surveillance for Aedes albopictus (Asian Tiger Mosquito) was performed at 33 trap sites utilizing BioGents Sentinel traps baited with the human-scent lure. 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. When EEEv or WNv was identified at a trap location, trapping frequency was increased to once or twice per week, to provide additional data to the risk of virus transmission. 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 (1-50 individuals) by species, collection date, trap type, and collection site and stored at -80°C until processed for virus isolation.





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

A total of 357,448 mosquitoes were trapped, represented by 21,760 pooled samples were tested for arboviruses. Eastern equine encephalitis virus (EEEv) was isolated from 107 pooled samples and obtained from 12 mosquito species: Culiseta melanura = 67, Anopheles crucians complex = 13, Ochlerotatus canadensis = 7, Psorophora ferox = 5, An. punctipennis = 3, Oc. trivittatus = 2, Coquillettidia perturbans = 2, Uranotaenia sapphirina = 2, Aedes cinereus = 2, Ae. vexans = 2, Culex pipiens = 1, and Cx. restuans = 1. The first isolation of EEEv was made from mosquitoes collected on August 24 and the last on October 26. EEEv activity was found throughout eastern CT at 18 trap sites in 18 towns primarily in New London, Tolland and Windam counties. Veterinary cases of EEEv were reported from 3 horses (New London, Windham counties) and an emu (Windham county). There were no human infections reported.

West Nile virus (WNv) was isolated from 188 pools, and obtained from 7 species: Culex pipiens = 110, Cx. restuans = 64, Cs. melanura = 9, Cx. salinarius = 2, Ae. vexans = 1, Oc. trivittatus = 1, and Ps. ferox

= 1. WNv isolates were geographically distributed at 49 trapping sites in 44 towns located among seven counties. The first WNv positive mosquitoes were collected on July 17 and the last on October 2. The majority of WNv activity was detected in densely populated urban and suburban regions in Fairfield, Hartford and New Haven counties, however, positive mosquito samples were identified across many suburban and rural location in Middlesex, New London, Tolland, and Windham counties. Five human cases of WNv-associated illness were reported (2 neuroinvasive, 3 WNv fever) in Fairfield, Hartford, and New Haven counties, with no fatalities. Dates of onset of symptoms ranged from July 17 to September 30. Patients ranged from 53 to 69 years of age. All human cases were locally acquired, with no out-of-state travel reported. Additionally, 9 wild birds were reported with WNv infections with mortality ranging between August 9 and September 18.

Other mosquito-borne viruses isolated included: Jamestown Canyon virus = 18 isolates from 8 species (June 7 – September 28), Highlands J virus = 41 isolates from 8 species (September 5 – October 26), Potosi virus = 59 isolates from 8 species (August 8 – October 16), Cache Valley virus = 13 isolates from 6 species (July 26 – September 18), Flanders virus = 5 isolates from 2 species (July 11 – September 5), and Trivittatus virus = 3 isolates from 2 species (June 29 – October 10).

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 withing enzootic transmission cycles and assess the risk of human infection. This data is used to inform the public and health care providers of these risks, guide disease prevention mosquito control efforts, and prevent disease outbreaks or epidemics. In addition, this large-scale sampling effort informs our understanding of the ecology of mosquitoes and mosquito-borne viruses with respect changes of climatic factors and land use over time. Additional studies on the roles of different mosquito species as vectors of viral pathogens may be used to target anti-vector interventions more effectively.

Investigating non-retroviral insertions in arthropod genomes

(Gloria-Soria A*. with Havill J. from Bucknell U.)

Eukaryotic genomes harbour sequences derived from non-retroviral RNA viruses, known as endogenous viral elements (EVEs) or non-retroviral integrated RNA virus sequences (NIRVS). These sequences represent a record of past infections and have been implicated in host anti-viral response. We have created a program to identify viral sequences integrated in a host genome. It begins with a specimen BAM file and outputs candidate NIRVS, along with putative host insertion sites and overlapping genomic features of the host genome in XML and visual formats, with minimal intermediary intervention. We ran through this software short-read data derived from the genomes of 222 wild-caught A. aegypti mosquitoes, from a dozen geographical regions, and located putative NIRVS from seven virus families. This program is as accurate as currently available software for NIRVS detection, and represents a significant improvement in adaptability and user-friendliness. Furthermore, the flexibility of this pipeline allows the user to search for sequence integrations across the genome of any organism, as long as a query sequence database and a reference genome is provided. Potential extended applications include identification of integrated transgenic sequences used for research or vector control strategies.

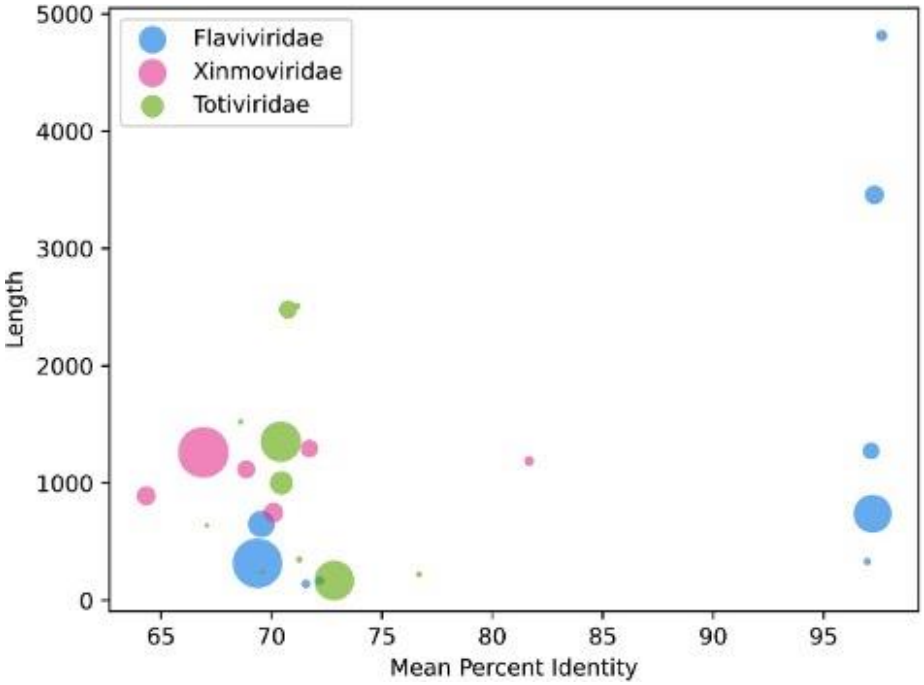


Figure: Scatter plot showing basic metrics of the discovered NIRVS from three virus families. The point size represents the relative number of specimens in which each NIRVS was found.

Publication: Havill, J., Strasburg, O., Udoh, T., Crawford, J.E. and Gloria-Soria, A., 2024. EVE-X: Software to Identify Novel Viral Insertions in Wild-Caught Arthropod Hosts From Next-Generation Short Read Data. Molecular Ecology Resources, p.e14026.

Development of low-cost genotyping tools to study vector genomics

(Andrea Gloria-Soria* a with Powell JR at Yale University).

The mosquito Aedes aegypti is the primary vector of many human arboviruses such as dengue, yellow fever, chikungunya, and Zika, which affect millions of people worldwide. Population genetic studies on this mosquito have been important in understanding its invasion pathways and success as a vector of human disease. The Axiom aegypti1 SNP chip was developed from a sample of geographically diverse A. aegypti populations to facilitate genomic studies on this species. We evaluate the utility of the Axiom aegypti1 SNP chip for population genetics and compare it with a low-depth shotgun sequencing approach using mosquitoes from the native (Africa) and invasive ranges (outside Africa). These analyses indicate that results from the SNP chip are highly reproducible and have a higher sensitivity to capture alternative alleles than a low-coverage whole-genome sequencing approach. Although the SNP chip suffers from ascertainment bias, results from population structure, ancestry, demographic, and phylogenetic analyses using the SNP chip were congruent with those derived from low-coverage whole-genome sequencing, and consistent with previous reports on Africa and outside Africa populations using microsatellites. More importantly, we identified a subset of SNPs that can be reliably used to generate merged databases, opening the door to combined analyses. We conclude that the Axiom aegypti1 SNP chip is a convenient, more accurate, low-cost alternative to low-depth whole-genome sequencing for population genetic studies of A. aegypti that do not rely on full allelic frequency spectra. Whole-genome sequencing and SNP chip data can be easily merged, extending the usefulness of both approaches.

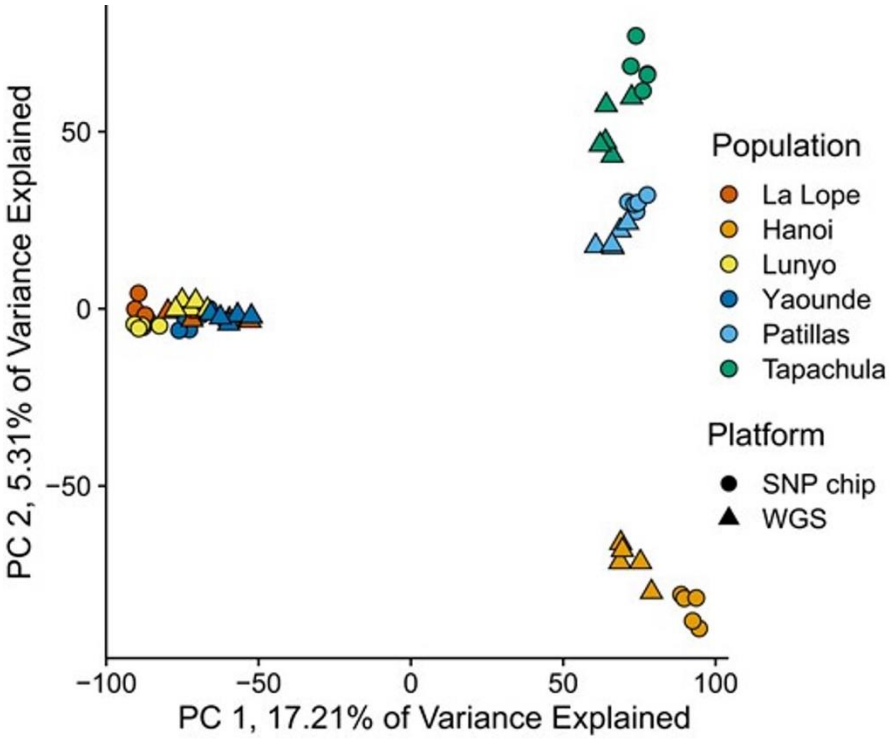


Figure: Principal component analysis of combined WGS and SNP chip data for positions validated in this manuscript. Main population clusters are driven by geographic sampling region. Each locale is drawn in a different color, as indicated by the legend. The source populations are: La Lope—La Lope Forest, Gabon; Hanoi—Hanoi, Vietnam; Lunyo—Lunyo, Uganda; Yaounde—Yaounde, Cameroon; Patillas—Patillas, Puerto Rico; Tapachula—Tapachula Norte, Mexico.

Evolutionary history of the yellow fever mosquito Aedes aegypti

(Gloria-Soria A*. with Mashlawi A.- Jazzan U.).

The Aedes aegypti (Linnaeus, 1762) mosquito is the main vector of dengue, chikungunya and Zika and is well established today all over the world. The species comprises two forms: the ancestral form found throughout Africa and a global domestic form that spread to the rest of the tropics and subtropics. In Saudi Arabia, A. aegypti has been known in the southwest since 1956, and previous genetic studies clustered A. aegypti from Saudi Arabia with the global domestic form. The purpose of this study was to assess the genetic structure of A. aegypti in Saudi Arabia and determine their geographic origin. Genetic data for 17 microsatellites were collected for A. aegypti ranging from the southwestern highlands of Saudi Arabia on the border of Yemen to the north-west in Madinah region as well as from Thailand and Uganda populations (as representatives of the ancestral African and global domestic forms, respectively). The low but significant level of genetic structuring in Saudi Arabia was consistent with long-distance dispersal capability possibly through road connectivity and human activities, that is, passive dispersal. There are two main genetic groupings in Saudi Arabia, one of which clusters with the Ugandan population and the other with the Thailand population with many Saudi Arabian individuals having mixed ancestry. The hypothesis of genetic admixture of the ancestral African and global domestic forms in Saudi Arabia was supported by approximate Bayesian computational analyses. The extent of admixture varied across Saudi Arabia. African ancestry was highest in the highland area of the Jazan region followed by the lowland Jazan and Sahil regions. Conversely, the western (Makkah, Jeddah and Madinah) and Najran populations corresponded to the global domesticated form. Given potential differences between the forms in transmission capability, ecology and behaviour, the findings here should be taken into account in vector control efforts in Saudi Arabia.

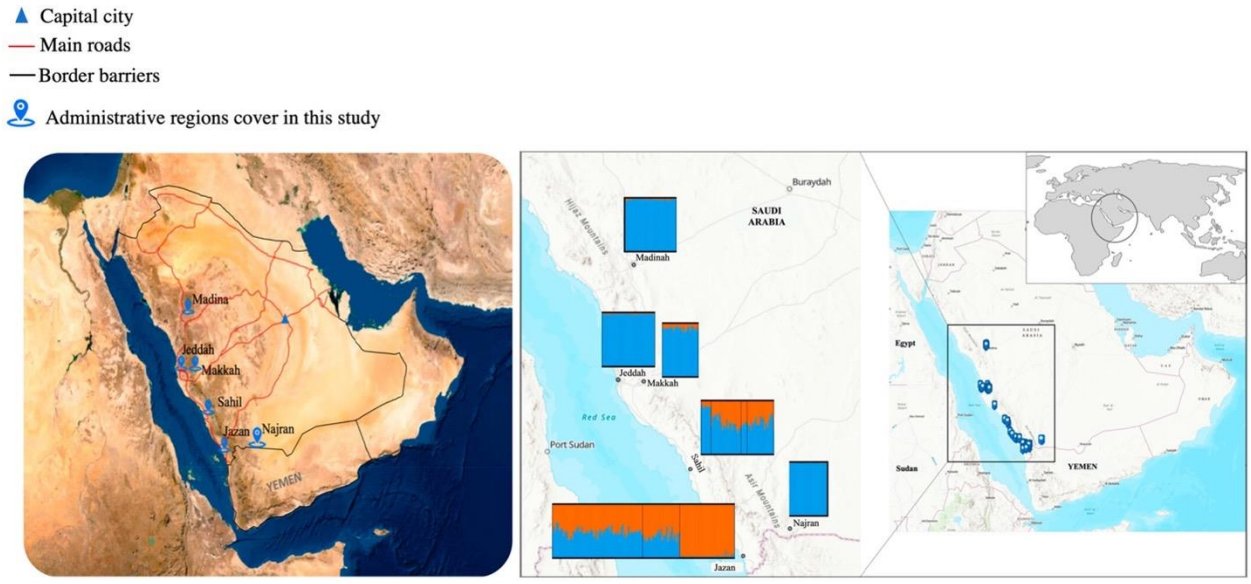


Figure: Map of Saudi Arabia showing the sampling locations of Aedes aegypti, that is, Jazan, Sahil, Makkah, Jeddah, Madinah and Najran with main road connectivity (left) and the STRUCTURE bars of each population based on K = 2 in STRUCTURE software (Pritchard et al., 2000). Colours within each bar represent each genetic cluster, and the percentage of the colour indicates the percentage of ancestry of each cluster for a particular individual in this study (right). The website ArcGIS (https://www.arcgis.com/index.html) was used to generate the map.

Publication: Mashlawi, Abadi M., Hussain Alqahtani, Sara A. Abuelmaali, Andrea Gloria-Soria, Jassada Saingamsook, Martha Kaddumukasa, Ahmad Hassn Ghzwani, Ahmed A. Abdulhaq, Hesham M. Al-Mekhlafi, and Catherine Walton. "Microsatellite-based analysis reveals Aedes aegypti populations in the Kingdom of Saudi Arabia result from colonization by both the ancestral African and the global domestic forms." Evolutionary Applications 17, no. 2 (2024): e13661.

(Gloria-Soria and Crawford J. – Verily Sci. with collaborators throughout the world)
The number of dengue cases worldwide has increased ten-fold over the past decade as Aedes aegypti, the primary vector of this disease, thrives and expands its distribution, revealing limitations to current control methods. To better understand how Ae. aegypti evolved from a forest dwelling, generalist species to a highly anthropophilic urban species and the impact of contemporary gene flow on the future of dengue control, we sequenced 1,206 genomes from mosquitoes collected at 74 locations around the globe. Here we show that after evolving a preference for humans in the Sahel region of West Africa, the origin of the fully domesticated, anthropophilic subspecies Ae. aegypti aegypti (Aaa) occurred in the Americas during the Atlantic Slave Trade era and was followed by its explosive expansion around the globe. In recent decades, Aaa has invaded coastal Africa, the ancestral home range, introducing insecticide resistance mutations and an affinity for human hosts. Evidence of back-to-Africa migration is found in regions with recent dengue outbreaks, raising concern that global movement of Aaa could increase transmission risk of arboviruses including dengue in urban Africa. These data provide a platform to further study this important mosquito vector species and underscore developing complexity in the fight to limit the spread of dengue, Zika, and chikungunya diseases.

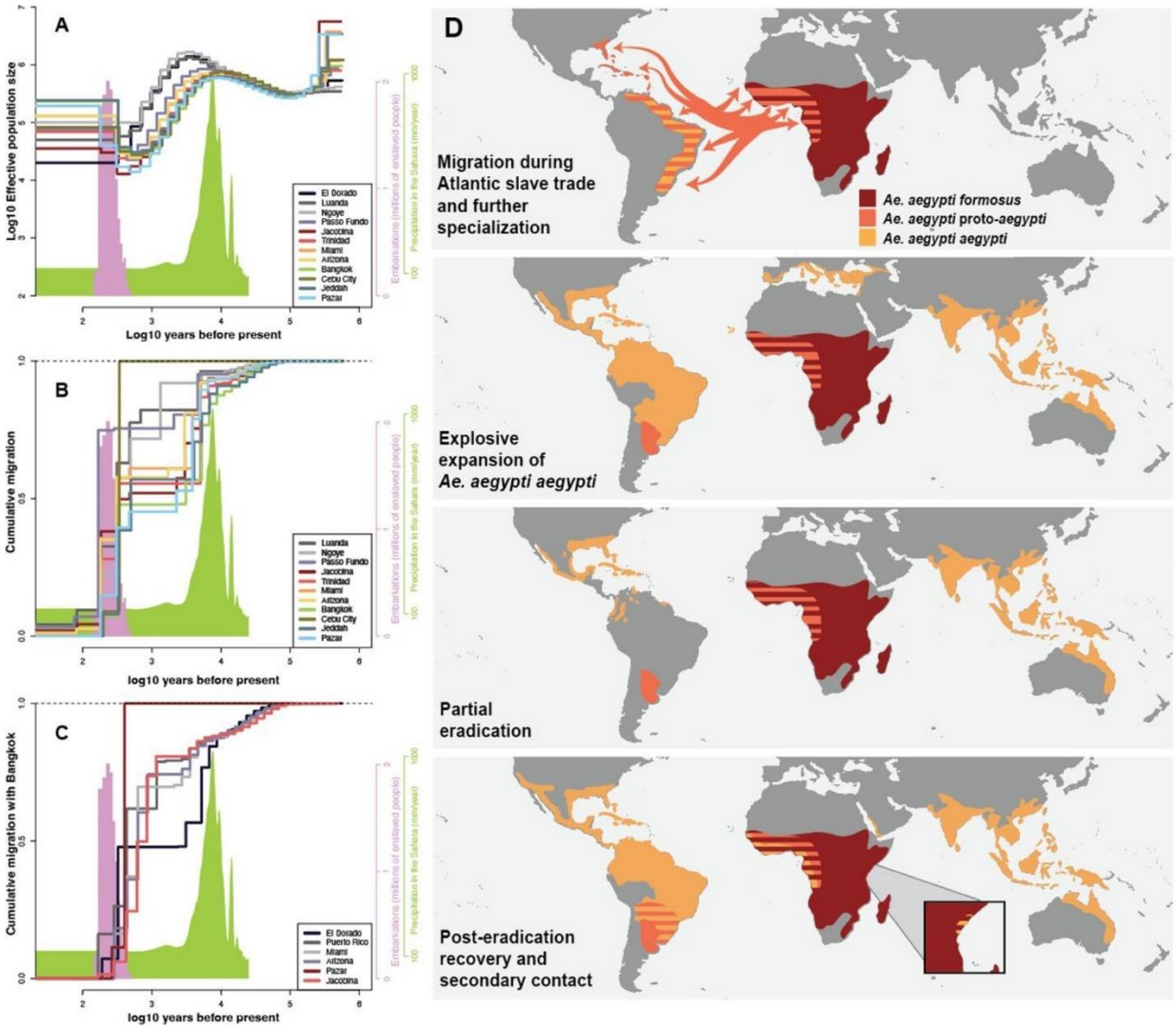
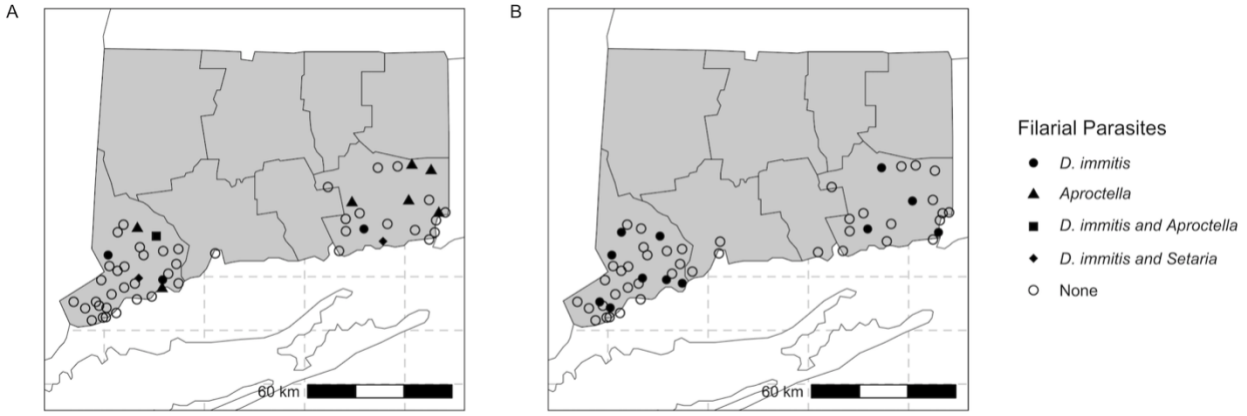


Figure: A) Cross-coalescent analysis of effective population size and migration using MSMC2. Effective population size plotted on log10 scale for representative populations as a function of years before present, also on a log10 scale, assuming 12 generations per year. The pink histogram shows the estimated number of slave vessel embarcations scaled by millions of enslaved people (Slave Voyages 2023) (33) on the alternative, pink y-axis at right. The green histogram shows precipitation levels in the Sahara (34) according to the green scale at right. Both histograms shown for approximate temporal reference. B) Cumulative migration plotted as a function of time on log10 scale (assuming 12 generations per year) between representative populations and El Dorado (Argentina) estimated using MSMC-IM. Cumulative migration is expected to plateau at one going back in time. Pink and green histograms are the same as for A). C) Same as for B) but cumulative migration between representative populations and Bangkok. D) Phased map showing simplified distributions and movements of different subspecies and forms of Ae. aegypti according to color. Description of each phase is shown in the bottom left corner of each phase. Orange arrows in the first phase indicate movement of proto-Aaa during the AST. Striped areas indicate more than one form or subspecies found in that region at that time.

Prevalence of Dog heartworm in Connecticut Mosquitoes

(Gloria-Soria A.* with members of the CT Mosquito Surveillance Program)

Filarial nematodes are parasitic roundworms transmitted by mosquitoes that can cause morbidity and mortality for their human and animal hosts. The filariae community, specifically infection prevalence of heartworm, Dirofilaria immitis (Filarioidea: Onchocercidae) (Leidy) and its primary mosquito vector species, has not been described in Connecticut since 1977. In light of the recent invasion and establishment of an important filariasis vector, Aedes albopictus (Diptera: Culicidae) (Skuse), we used molecular based sequencing methods to identify filarial species infecting field-caught mosquitoes in Connecticut, USA. The filarial parasites identified include D. immitis, Aproctella sp., and Setaria sp. (Filarioidea: Setariidae). The total minimum infection rate (MIR) for D. immitis for all mosquito species tested in 2020 was 0.97 [0.56-1.56] and in 2021 was 1.48 [0.93-2.24]. Ae. albopictus had the highest infection prevalence compared to other species during both years. We determined a low but persistent mosquito infection prevalence for D. immitis and suggest that Ae. albopictus is likely to be the primary vector in the region. Aproctella sp., and Setaria sp. had lower burdens compared to D. immitis. Persistent mosquito infection with filarial parasites, particularly in invasive species, poses a risk to veterinary and public health.



Comparison of acarological risk metrics derived from active and passive surveillance and their concordance with tick-borne disease incidence

Holcomb, K. M., Khalil, N., Cozens, D. W., Cantoni, J. L., Brackney, D. E., Linske, M. A., Williams, S. C., Molaei, G., and Eisen, R. J.

Tick-borne diseases continue to threaten human health across the United States. Both active and passive tick surveillance can complement human case surveillance, providing spatio-temporal information on when and where humans are at risk for encounters with ticks and tick-borne pathogens. However, little work has been done to assess the concordance of the acarological risk metrics from each surveillance method. We used data on Ixodes scapularis and its associated human pathogens from Connecticut (2019–2021) collected through active collections (drag sampling) or passive submissions from the public to compare county estimates of tick and pathogen presence, infection prevalence, and tick abundance by life stage. Between the surveillance strategies, we found complete agreement in estimates of tick and pathogen presence, high concordance in infection prevalence estimates for Anaplasma phagocytophilum, Borrelia burgdorferi sensu stricto, and Babesia microti, but no consistent relationships between actively and passively derived estimates of tick abundance or abundance of infected ticks by life stage. We also compared nymphal metrics (i.e., pathogen prevalence in nymphs, nymphal abundance, and abundance of infected nymphs) with reported incidence of Lyme disease, anaplasmosis, and babesiosis, but did not find any consistent relationships with any of these metrics. The small spatial and temporal scale for which we had consistently collected active and passive data limited our ability to find significant relationships. Findings are likely to differ if examined across a broader spatial or temporal coverage with greater variation in acarological and epidemiological outcomes. Our results indicate similar outcomes between some actively and passively

derived tick surveillance metrics (tick and pathogen presence, pathogen prevalence), but comparisons were variable for abundance estimates.

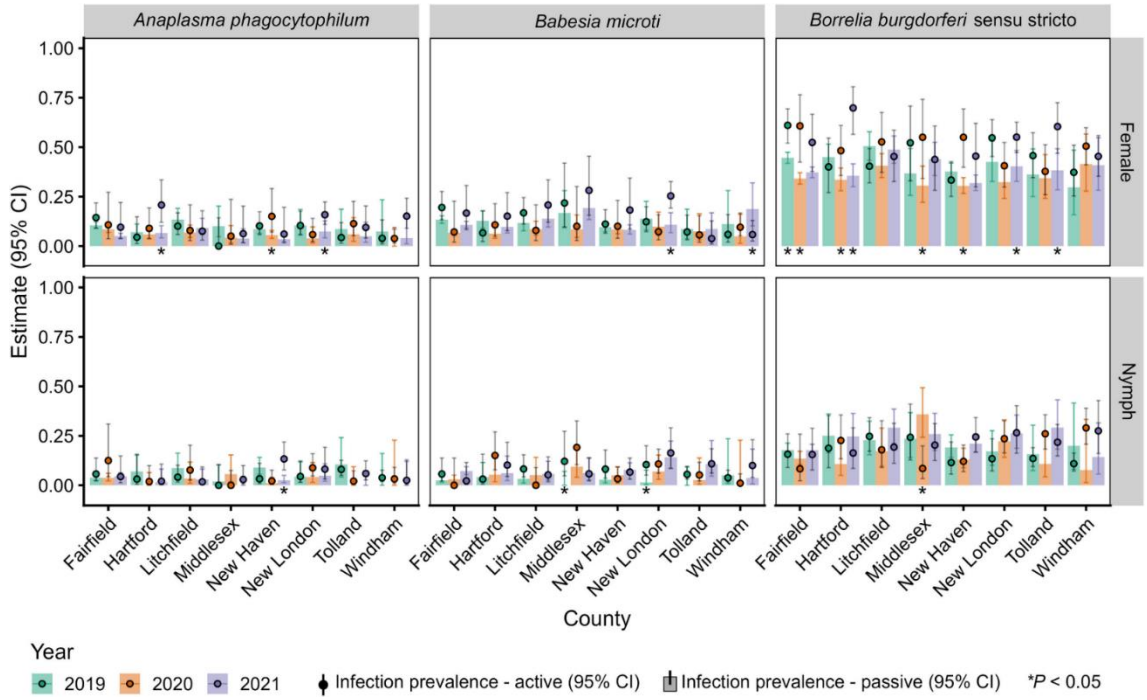


Fig. Estimated infection prevalence (95% CI) of I. scapularis from active and passive surveillance in Connecticut, USA (2019–2021). Infection prevalence estimated per pathogen and life stage for all ticks dragged (active surveillance; point) or submitted (passive surveillance; bar) per year and county. Statistically significant differences in estimates indicated by * (Fisher's exact test P-value < 0.05).

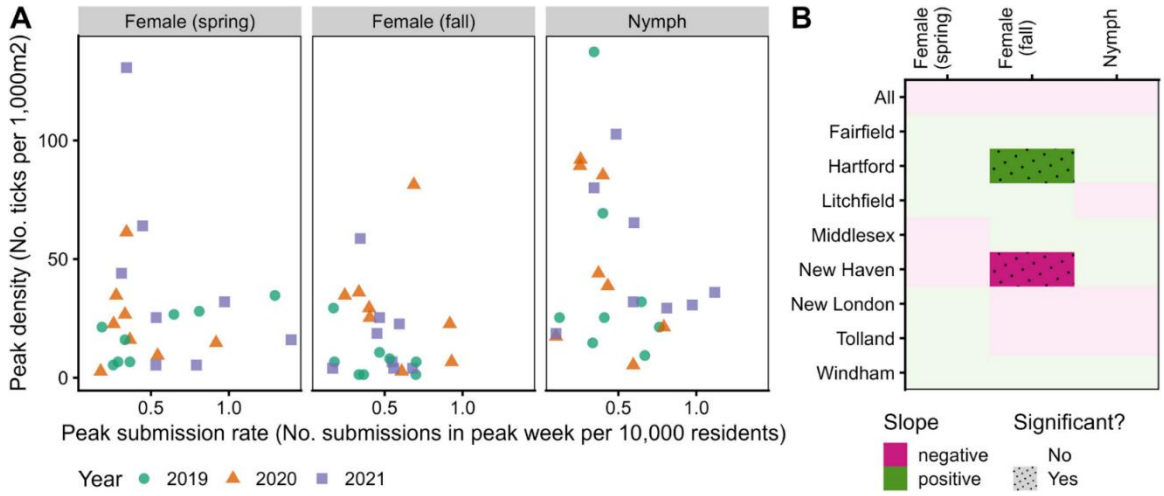


Fig. Peak density vs. peak submission rate of ticks in Connecticut, USA (2019–2021). (A) All county-year scatter plot of the relationship of peak density (active surveillance) and peak submission rate (passive surveillance) of I. scapularis ticks by cohort. Each point represents a single county and year. See Fig. A.2 for county-level plots per cohort. (B) Direction (slope) and significance (Wald P-value < 0.05) of the linear relationship between peak density and peak submission rate per cohort at the individual county or aggregated county level. Top row ("All") corresponds to slope and significance of relationships in (A).

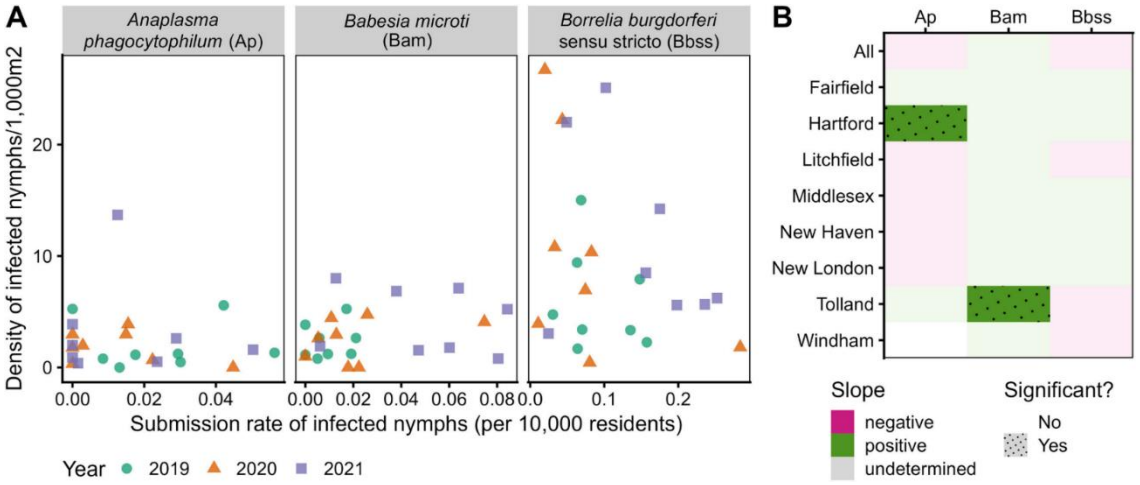


Fig. Peak density of infected nymphs vs. peak submission rate of infected nymphs in Connecticut, USA (2019–2021). (A) All county-year scatter plot of the relationship of peak density of infected I. scapularis nymphs (active surveillance) and peak weekly submission rate of infected I. scapularis nymphs (passive surveillance) by pathogen. Each point represents a single county and year estimate. See Fig. A.4 for county-level plots per pathogen. (B) Direction (slope) and significance (Wald P-value < 0.05) of the linear relationship between peak density and peak submission rate of infected nymphs per pathogen at the individual county or aggregated county level. Top row ("All") corresponds to the slope and significance of relationships in (A).

Impact. Using active and passive surveillance data for I. scapularis in Connecticut (2019–2021), we investigated the relationship between corresponding acarological risk metrics derived from each method. While both methods agreed on the establishment status of the tick, presence of the pathogens in ticks, and infection prevalence of Bo. burgdorferi s.s., A. phagocytophilum, and Ba, microti, we did not find a consistent relationship between host-seeking nymphal density and nymphal submission rate nor the host-seeking density and submission rate of infected nymphs. Considering nymphal metrics from both active and passive surveillance, we did not find consistent relationships with incidence of Lyme disease, anaplasmosis, or babesiosis. Limiting the numbers of ticks tested per county may be economical without compromising estimates of pathogen prevalence. Binning tick abundance estimates (derived from passive and active measures) into categories may provide meaningful risk estimates that might provide consistent associations with epidemiological outcomes. Surveillance methods could be used synergistically with targeted active surveillance informed by passive surveillance. Further work is needed to effectively integrate both active and passive surveillance into public health response for tick-borne diseases, including evaluating the correspondence of metrics across methods in emerging locations.

Introduction of the ectoparasite Rhipicephalus pulchellus (Ixodida: Ixodidae) into Connecticut with a human traveler from Tanzania, and a review of its importation records into the United States
Stafford, K. C. III., Molaei, G., Williams, S. C., and Mertins, J. W.
Globalization, increased frequency of travel, and a rise in legal and illegal animal trades can introduce exotic ticks into the United States. We herein report the importation of a male Rhipicephalus pulchellus (Gerstäcker) on a human traveler returning to Connecticut from Tanzania, Africa, and review historical importation records of this species into the United States. This common tick is broadly distributed throughout East Africa, from Eritrea to Tanzania, has a wide host range on domestic animals and wildlife, and has been most frequently introduced into the United States on tick-infested wild animal hosts and animal trophies, but documentation of importation on humans has been rare. Archival records at the United States Department of Agriculture's National Veterinary Services Laboratories show R. pulchellus has been introduced into the United States at least 40 times over the last 62 yr. Rhipicephalus pulchellus has been

linked to Rickettsia conorii, the agent of boutonneuse fever in humans, Crimean-Congo hemorrhagic fever orthonairovirus, and Nairobi sheep disease orthonairovirus. Given the potential for this exotic tick to introduce animal or human pathogens, proper surveillance, interception, identification, and reporting of these ticks are vital in protecting human and animal health.

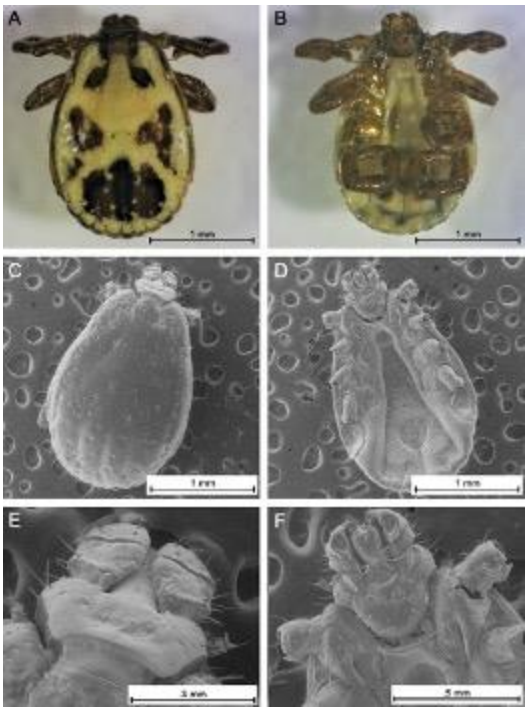


Fig. Dissecting microscope images (A, dorsal; B, ventral) and electron microscope images (C, dorsal; D, ventral; E, dorsal capitulum; and F, ventral capitulum) of the male Rhipicephalus pulchellus specimen from Connecticut.

Impact. The exotic tick interceptions discussed herein highlight the ongoing challenges and risks associated with personal travel, animal, or animal product importations. A broader and up-to-date review of past importations of exotic ticks, with their ecological and host requirements, would help to better delineate the potential for establishment of such vectors and their tick-borne pathogens in the United States.

Active Tick and Tick-borne Pathogen Surveillance Program

(Megan Linske, Douglas E. Brackney, Jamie Cantoni, and Duncan W. Cozens)

An active tick surveillance program was initiated in Connecticut in 2019 and continued in 2022 funded in part by a grant from the Centers for Disease Control and Prevention (CDC) through the Epidemiology and Laboratory Capacity (ELC) program at the Connecticut Department of Public Health. The field program is run by Dr. Dr. Megan A. Linske with sampling conducted by research assistant Jamie Cantoni. All the tick testing is conducted by Dr. Douglas E. Brackney and Duncan W. Cozens.

The blacklegged tick, *Ixodes scapularis* Say, is the primary vector for at least seven pathogens that cause human disease:

Borrelia burgdorferi, the agent of Lyme disease, *Babesia microti* (babesiosis), *Anaplasma phagocytophilum* (anaplasmosis),

B. miyamotoi (a relapsing fever *Borrelia*), *B. mayoni* (a new Lyme *Borrelia* spp.), the *Ehrlichia muris*-like agent, now *E. muris* subsp. *eauclairensis* (ehrlichiosis) (known only from upper mid-west so far), and Powassan virus.

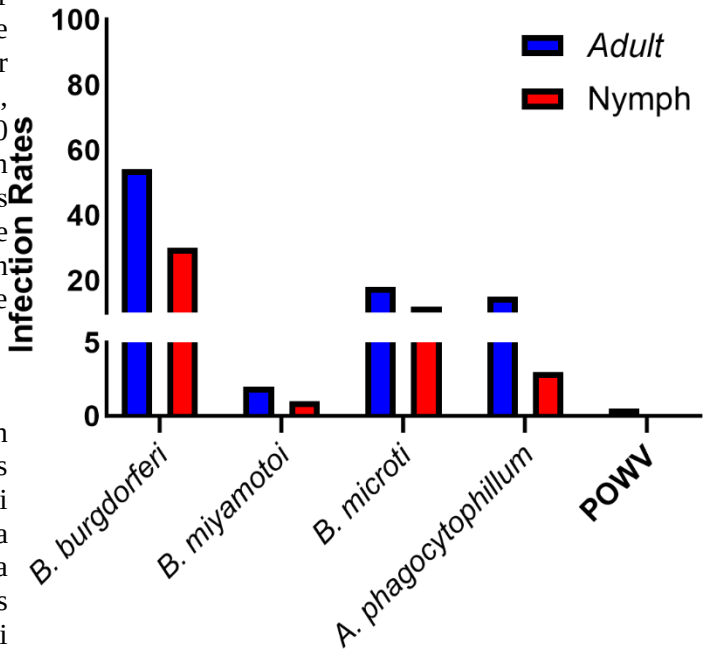
Ticks are collected at 40 paired publicly-accessible active tick surveillance sampling locations throughout CT's eight counties from April through October with a focus on the blacklegged tick, *Ixodes scapularis*. Other tick species that are being found and tabulated include American dog ticks, *Dermacentor variabilis*, the vector of Rocky Mountain spotted fever, the lone star tick, *Amblyomma americanum,* an aggressive southern species that is becoming established in Connecticut and parts of coastal New England, and the exotic Asian longhorned tick, *Haemaphysalis longicornis*. In calendar year 2024, a total of 699 adult female and 1,423 nymphs *I. scapularis* were tested for *Borrelia burgdorferi s.l.*, *Babesia microti*,

Anaplasma phagocytophilum, *Borrelia miyamotoi*, and Powassan virus lineage II using our multiplexed RT-qPCR assay. The 2023 testing results for adult blacklegged ticks revealed infection rates of 54% *B. burgdorferi*, 1% *B. miyamotoi*, 14% *B. microti*, 9.3% *A. phagocytophilum*, 0.3% Powassan virus II. For nymphal ticks, we found infections rates of 19.5% *B. burgdorferi*, 1% *B. miyamotoi*, 10.7% *B. microti*, 5.7% *A. phagocytophilum*, 0% Powassan virus II. .

A.1. Passive Tick and Tick-borne Pathogen Surveillance Program and Tick Testing Laboratory Services for Assessing Human Health Risk with Tick-borne Diseases

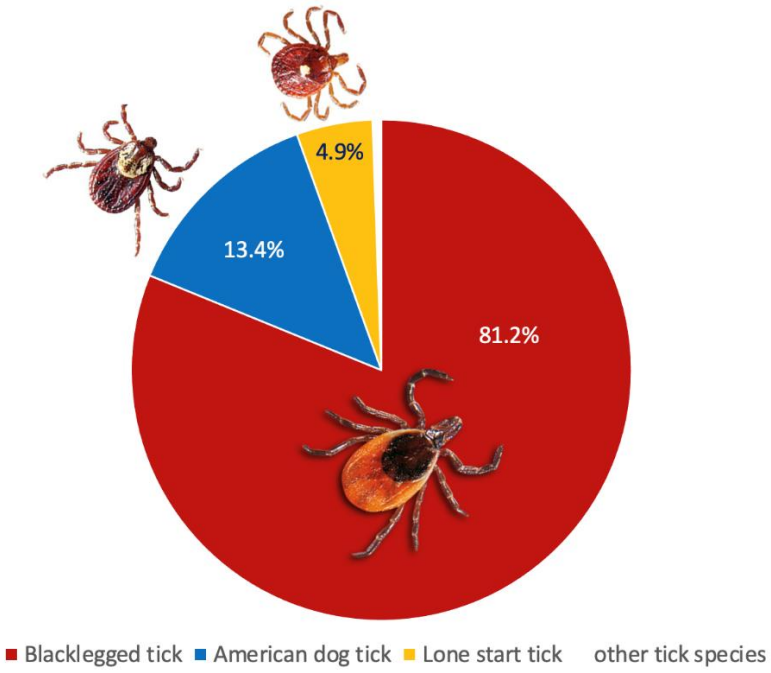
(Goudarz Molaei assisted by Noelle Khalil)

Passive Tick and Tick-borne Pathogen Surveillance. The passive tick and tick-borne pathogen surveillance program was established in 1990 following the first discovery of Lyme disease in Connecticut and several years of pioneering research on this disease at the CAES. The objectives of this program are to: 1) screen ticks for pathogens; 2) monitor the distribution and spread of both native and invasive ticks; 3) develop mathematical and statistical models to better predict the presence, abundance, and range expansion of ticks and their associated pathogens; and 4) investigate the effects of environmental factors such as climate change on the spatiotemporal patterns of tick species. Within the framework of the passive surveillance program, the CAES Tick Testing Laboratory (TTL) was initially mandated to screen the blacklegged tick for evidence of infection with Borrelia burgdorferi, the causative agent of Lyme disease. However, in 2015, the program was expanded to include testing for Anaplasma phagocytophilum and Babesia microti, the two important tick-borne pathogens responsible for human granulocytic anaplasmosis and babesiosis, respectively. The CAES-TTL receives nearly 3,000 tick submissions each year from residents, health departments, and physician's offices; however, this number has recently increased to 6,000. Over the years, the CAES passive tick and tick-borne pathogen surveillance program has developed into one of the most important surveillance programs in the region.



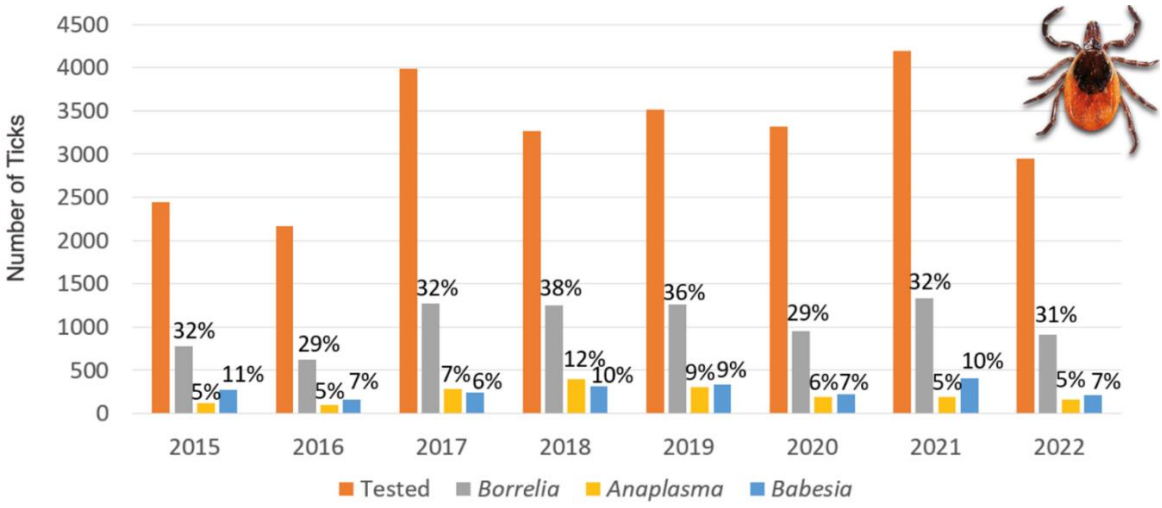
Most tick-borne disease cases are associated with blacklegged tick also known as deer tick (Ixodes scapularis), the primary vector of Borrelia burgdorferi and Borrelia mayonii (Lyme disease), Borrelia miyamotoi (B. miyamotoi disease), Anaplasma phagocytophilum (anaplasmosis), Ehrlichia muris eauclairensis (ehrlichiosis), Babesia microti

(babesiosis), and Powassan virus (Powassan virus disease). From July 1, 2023June 30, 2024, the CAES-TTL received a total of 4,892 Ticks, submitted by residents, health departments, and healthcare providers for identification and testing. Of these, 3,879 (81.2%) were identified as Ixodes scapularis (blacklegged or deer tick), 638 (13.4%) as Dermacentor variabilis (American dog tick), 235 (4.9%)as Amblyomma americanum (lone star tick), and 27 (0.5%) as other tick species.

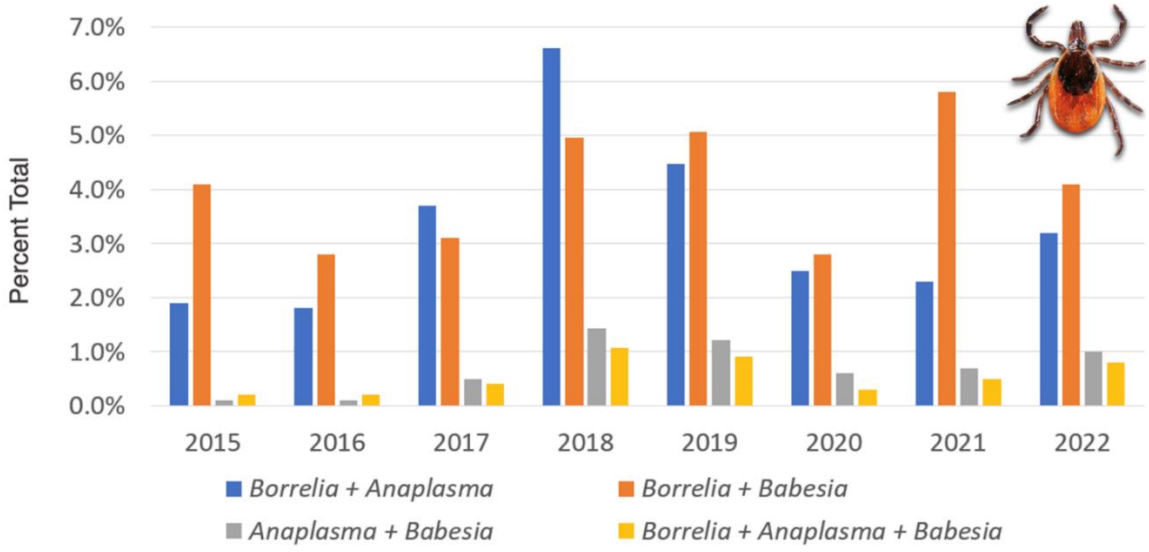


Tick species abundance and composition, Connecticut, July1, 2023-June 30, 2024.

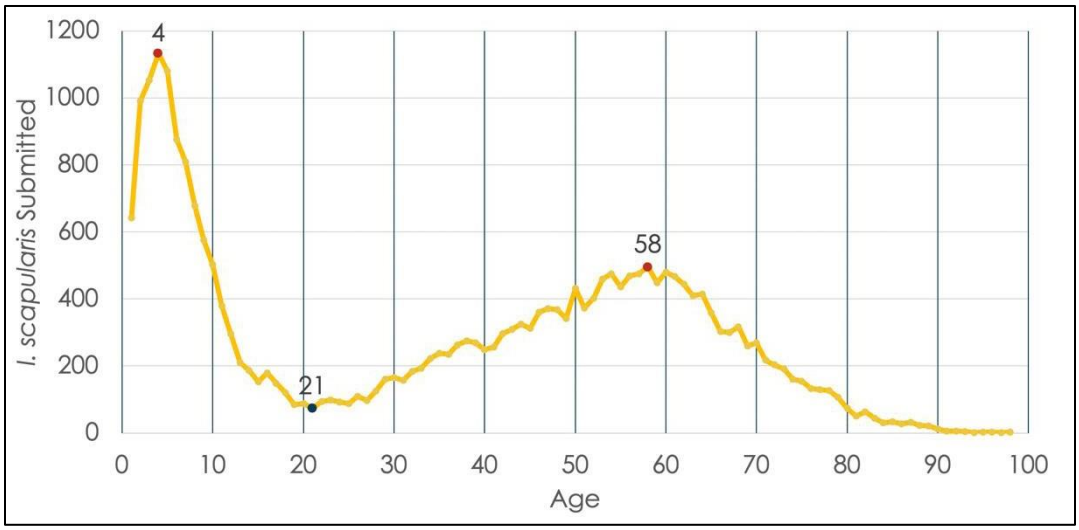
Of 3,755 adult female and nymphal blacklegged ticks screened for evidence of infection with three most prevalent tick- borne pathogens, 8744(23.3%) tested positive for B. burgdorferi (Lyme disease), 122 (3.2%) for A. phagocytophilum (anaplasmosis), and 333(8.9%) for B. microti (babesiosis). In addition, 44 (1.1%) were also tested positve for Borrelia miyamotoi (Borrelia miyamotoi disease) and Powassan virus (Powassan virus disease). A total of 208 ticks were co-infected with two or more pathogens. Co-infection with more than one pathogen in ticks could lead to concurrent human infection with B. burgdorferi, A. phagocytophilum, B. microti, and other tick-borne diseases, which may complicate diagnosis, lead to insufficient treatment, and increase the severity of disease.



Blacklegged tick infection with Lyme disease, anaplasmosis, and babesiosis pathogens in Connecticut, 2015-2022
Blacklegged tick coinfection with pathogens responsible for Lyme disease, anaplasmosis and babesiosis Agents, Connecticut, 2015-2022.



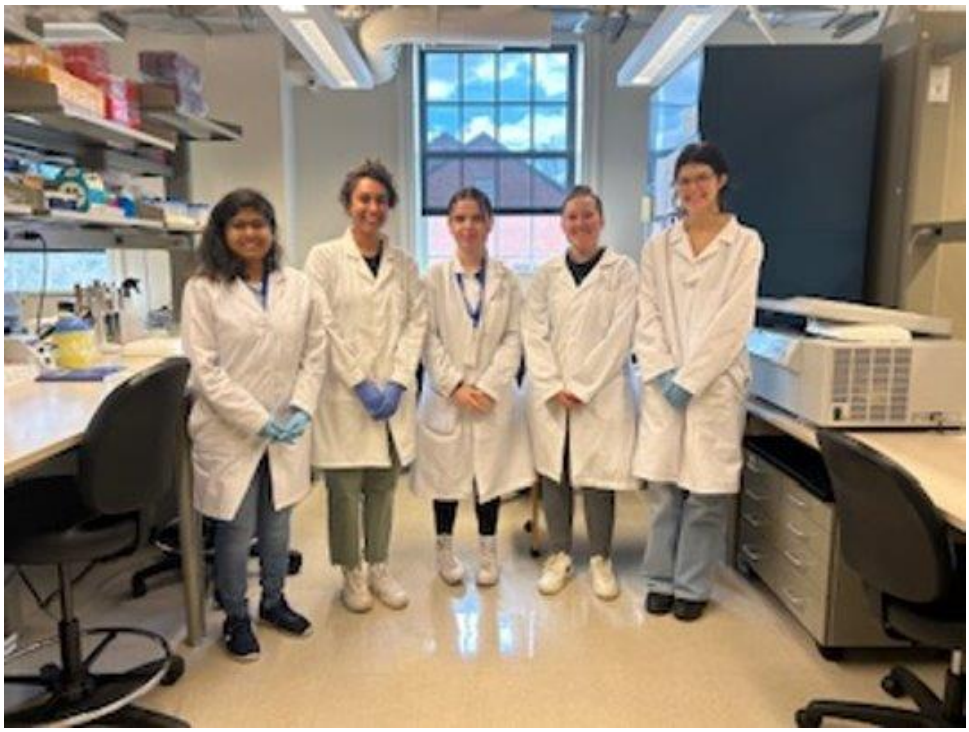
Blacklegged tick co-infection with pathogens responsible for Lyme disease, Anaplasmosis, and Babesiosis, Connecticut, 2015- 2022.



Age of human hosts bitten by blacklegged ticks in Connecticut

Impact: Ticks and tick-borne diseases continue to pose a major health concern for Connecticut residents. In recent years, populations of native ticks have progressively increased, and established populations of invasive tick species have been discovered in the state. As a result, an increasing number of communities are at risk of exposure to ticks and tick-borne pathogens. Among the factors that contribute to the changing dynamics of tick and tick-borne disease activity are reforestation, rising temperatures, an increase in trade and travel, and a rise in the abundance of animal hosts. Increases in population densities, geographic range expansion, and the ensuing potential of greater interactions with humans and wildlife highlight the importance of ticks as a public health threat. With the ongoing introduction and establishment of invasive ticks and tick-borne pathogens as well as range expansion of native ticks, it is unclear if and how these changes will alter the tick- borne disease landscape in Connecticut and Northeast.

In addition, within the framework of a passive tick surveillance program, the CAES-TTL continues to monitor the range expansion of native ticks and incursion of invasive ticks in Connecticut. On August 26, 2021, we discovered an established population of the Asian longhorned tick (*Haemaphysalis longicornis*) in New Haven County in addition to reported populations of this tick in Fairfield County in September 2020.



Tick Testing Laboratory Staff (2023-2024). (left to right) Amrita Ray Mohapatra, Noelle Khalil, Inva Fero, Emily Seigel, and Lorelei Sandland.

Evidence of Protozoan and Bacterial Infection and Co-infection and Partial Blood Feeding in the Invasive Tick

Haemaphysalis longicornis

Keith J. Price, Noelle Khalil, Bryn J. Witmier, Brooke L. Coder, Christian N. Boyer, Erik Foster, Rebecca J. Eisen, and Goudarz Molaei*

The Asian longhorned tick, Haemaphysalis longicornis, an invasive tick species in the United States, has been found actively host-seeking while infected with several human pathogens. Recent work has recovered large numbers of partially engorged, host-seeking H. longicornis, which together with infection findings raises the question of whether such ticks can reattach to a host and transmit pathogens while taking additional bloodmeals. Here we conducted molecular blood meal analysis in tandem with pathogen screening of partially engorged, host-seeking H. longicornis to identify feeding sources and more inclusively characterize acarological risk. Active, statewide surveillance in Pennsylvania from 2020 to 2021 resulted in the recovery of 22/1,425 (1.5%) partially engorged, host-seeking nymphal and 5/163 (3.1%) female H. longicornis. Pathogen testing of engorged nymphs detected 2 specimens positive for Borrelia burgdorferi sensu lato, 2 for Babesia microti, and 1 co-infected with Bo. burgdorferi s.l. and Ba. microti. No female specimens tested positive for pathogens. Conventional PCR blood meal analysis of H. longicornis nymphs detected avian and mammalian hosts in 3 and 18 specimens, respectively. Mammalian blood was detected in all H. longicornis female specimens. Only 2 H. longicornis nymphs produced viable sequencing results and were determined to have fed on black-crowned night heron, Nycticorax nycticorax. These data are the first to molecularly confirm H. longicornis partial blood meals from vertebrate hosts and Ba. microti infection and co-infection with Bo. burgdorferi s.l. in host-seeking

specimens in the United States, and the data help characterize important determinants indirectly affecting vectorial capacity. Repeated blood meals within a life stage by pathogen-infected ticks suggest that an understanding of the vector potential of invasive H. longicornis populations may be incomplete without data on their natural host-seeking behaviors and blood-feeding patterns in nature.

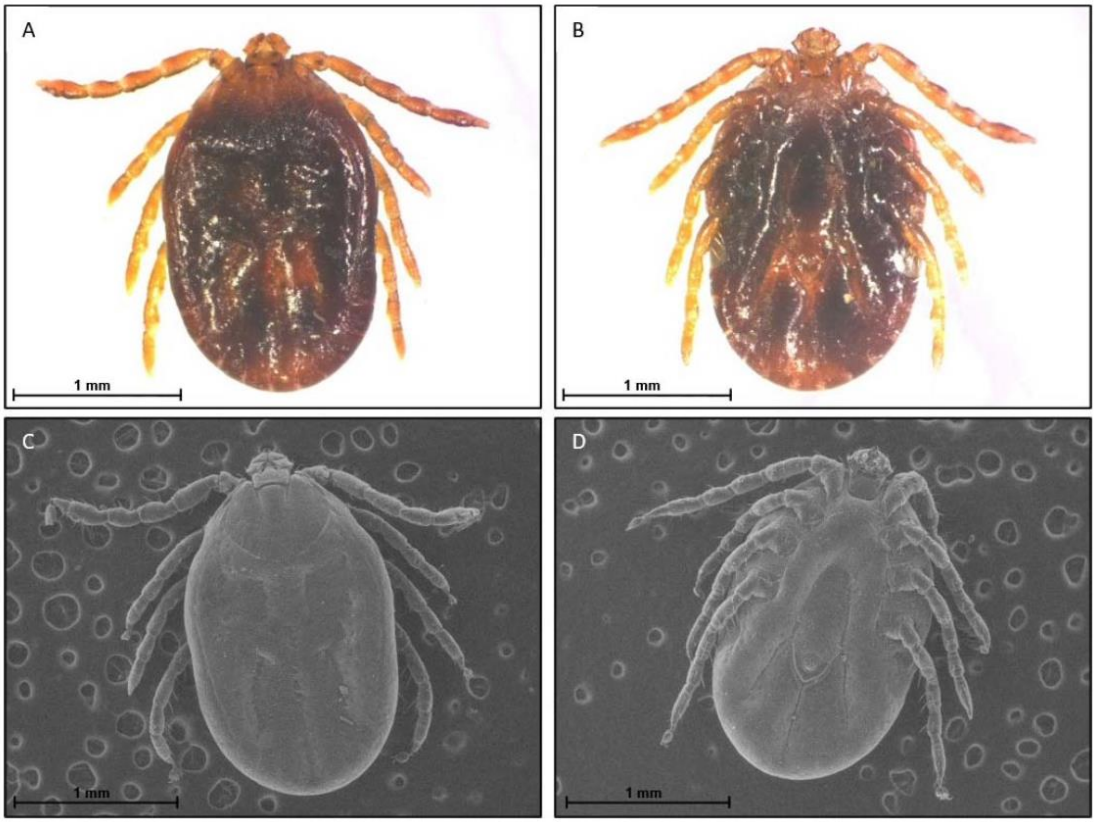
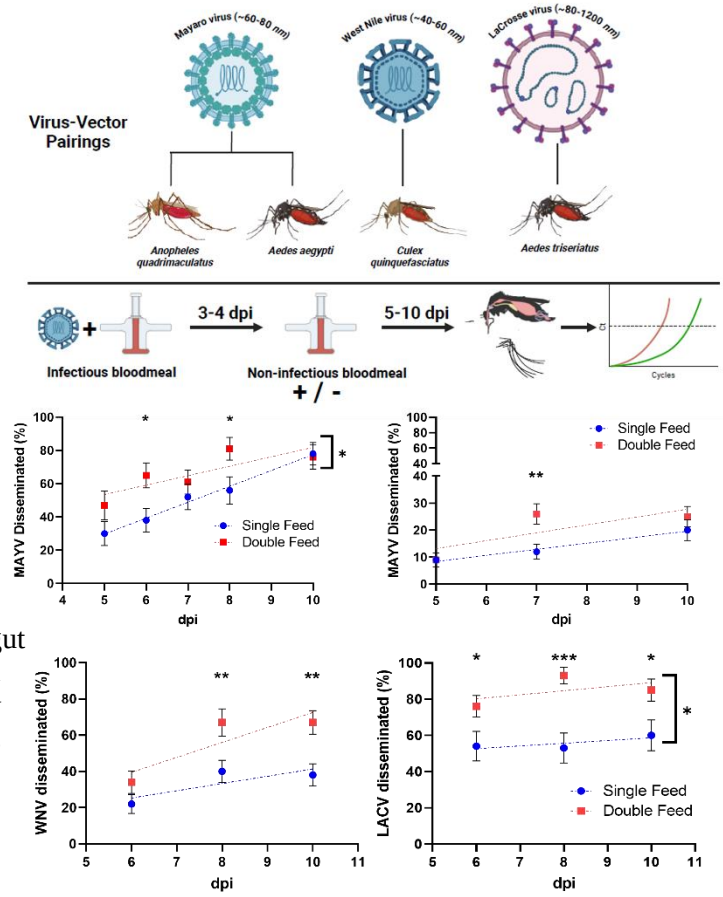


Fig. Light microscopy images of dorsal (A) and ventral (B) aspect and scanning electron microscopy images of dorsal (C) and ventral (D) aspect of adult *Haemaphysalis longicornis*.

Impact: Overall, this study provides important evidence for interrupted feeding of H. longicornis via molecular confirmation of partial blood meals of vertebrate hosts and represents the first U.S. detection of Ba. microti infection and simultaneous detection of Ba. microti and Bo. burgdorferi s.l. in this invasive tick species. The rapidly progressing invasion of H. longicornis in the United States presents an ecological disturbance and disease threat. The incorporation of blood-feeding behavior and pathogen screening in active surveillance efforts can improve understanding of potential environmental impacts and public health risks associated with *H. longicornis* expansion. Our findings highlight the growing importance of recognizing the H. longicornis invasion within an ecological and epidemiological context, which should encourage active surveillance to include density measures, pathogen (co)infection rates, and human-tick encounters to develop a baseline of risk and inform integrated management strategies.

The impact of partial blood meals on midgut damage and viral dissemination. (Doug Brackney, Philip Armstrong, Rebecca Johnson, Duncan Cozens)

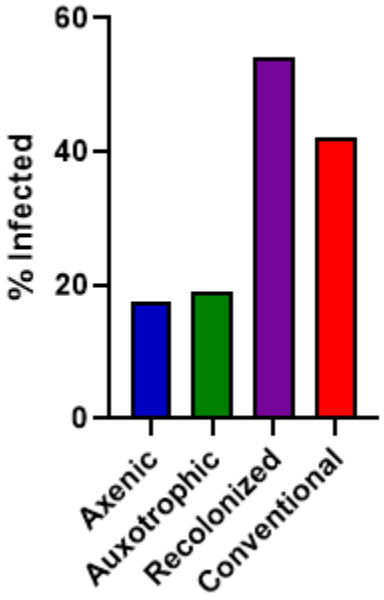
Studies of vector competence rarely consider the impacts that successive blood meals have on arboviral transmission by mosquitoes. *Aedes aegypti* mosquitoes readily feed more than once and often take partial blood meals. The impact this behavior has on viral transmission needs to be better understood and incorporated into models of mosquito-borne disease epidemics. Previously we demonstrated that *Ae. aegypti* infected with dengue virus (DENV) via a primary blood meal had earlier viral dissemination when given a second non-infectious blood meal three days later. Evidence suggests that gut distention during blood feeding leads to damage of the midgut basal lamina and faster viral escape. However, it is unclear if this phenomenon occurs in other virus-vector pairings. Therefore, we examined if the addition of a second non-infectious blood meal increased the dissemination rate of viruses from disparate families and sizes in different genera of mosquitoes. We found that a second non-infectious BM had no impact on midgut infection rates but increased virus dissemination for all virus-vector pairings. Taken together, our findings show that sequential blood feeding enhances virus dissemination across diverse arbovirus-vector pairings, representing three mosquito genera and virus families.



Using an axenic model to interrogate the role of the microbiome in mediating mosquito susceptibility to arboviruses. (Doug Brackney, Blaire Steven, Zannatul Ferdous, Rebecca Johnson, and Duncan Cozens)

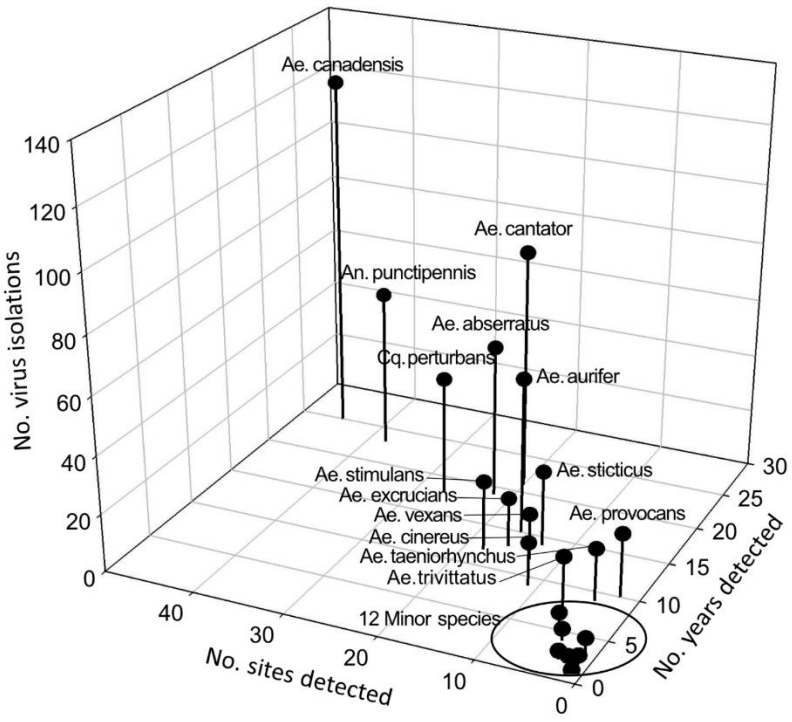
The mosquito midgut microbiota has been reported to influence many mosquito phenotypes including susceptibility to virus infection. While individual bacteria can influence susceptibility to virus infection, such experiments are reductionist and do not consider that these bacteria exist within a complex microbial community within the mosquito gut and, therefore, do not accurately replicate what is happening in nature. Others have reported that bacterial communities can influence susceptibility through a process called carry-over effects. Basically, the microbiota of the larval mosquito can impact the mosquito's susceptibility to infection as an adult. Using our germ-free mosquito model, we were able to directly test if carry-over effects can alter mosquito susceptibility to chikungunya virus (CHIKV). Interestingly, we found that adult mosquitoes colonized with a single bacterium that can be cleared from the mosquito midgut prior to molting (auxotrophic) is infected with CHIKV at similar rates as our germ-free mosquitoes (axenic) and much less than our conventionally reared controls. Further, we find that if our mosquitoes are raised germ-free as larvae and then recolonized with our conventional microbiome (recolonized) as adults that infection rates are comparable to our conventionally reared mosquitoes (conventional). Together, this data suggest that the presence or absence of a microbiome as larvae has no impact on susceptibility to infection as an adult, thereby challenging the carry-over effect hypothesis.

Schematic diagram of a common garden experiment. Three species of mosquito larvae are made axenic by surface sterilization of their eggs. The microbe-free larvae are exposed to the same environmental water source and reared alone or in combination. In this manner we can investigate which bacteria are recruited to the microbiome and how co-rearing influences which bacteria are present.

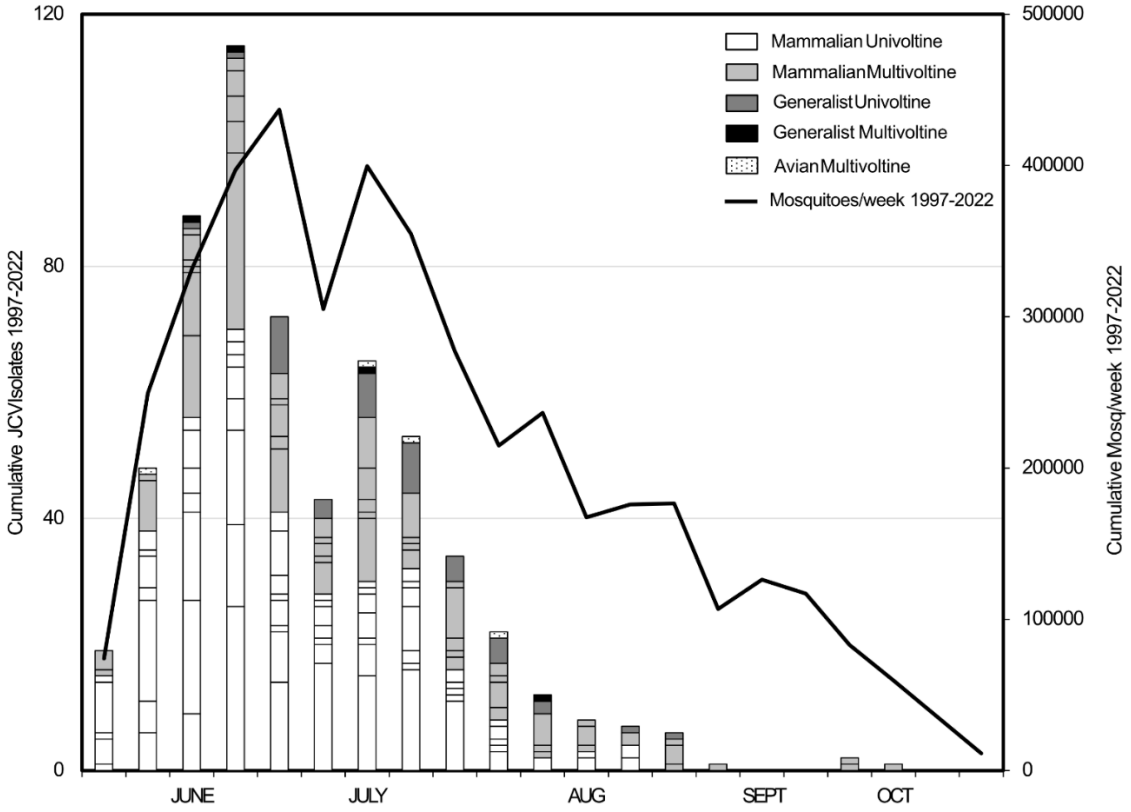


Jamestown Canyon virus comes into view: understanding the threat from an underrecognized arbovirus

(John Shepard and Philip Armstrong)



We examined the epidemiology, ecology, and evolution of Jamestown Canyon virus (JCV) and highlights new findings from the literature to better understand the virus, the vectors driving its transmission, and its emergence as an agent of arboviral disease. We also reanalyze data from the Connecticut Arbovirus Surveillance Program which represents the largest dataset on JCV infection in mosquitoes. JCV is a member of the California serogroup of the genus *Orthobunyavirus*, family *Peribunyaviridae*, and is found throughout much of temperate North America. This segmented, negative-sense RNA virus evolves predominately by genetic drift punctuated by infrequent episodes of genetic reassortment among novel strains. It frequently infects humans within affected communities and occasionally causes febrile illness and neuroinvasive disease in people. Reported human cases are relatively rare but are on the rise during the last 20 years, particularly within the northcentral and northeastern US. JCV appears to overwinter and reemerge each season by transovarial or vertical transmission involving univoltine *Aedes* (Diptera: Culicidae) species, specifically members of the *Aedes communis* (de Geer) and *Ae. stimulans* (Walker) Groups. The virus is further amplified in a mosquito-deer transmission cycle involving a diversity of mammalophilic mosquito species. Despite progress in our understanding of this virus, many aspects of the vector biology, virology, and human disease remain poorly understood. Remaining questions and future directions of research are discussed.



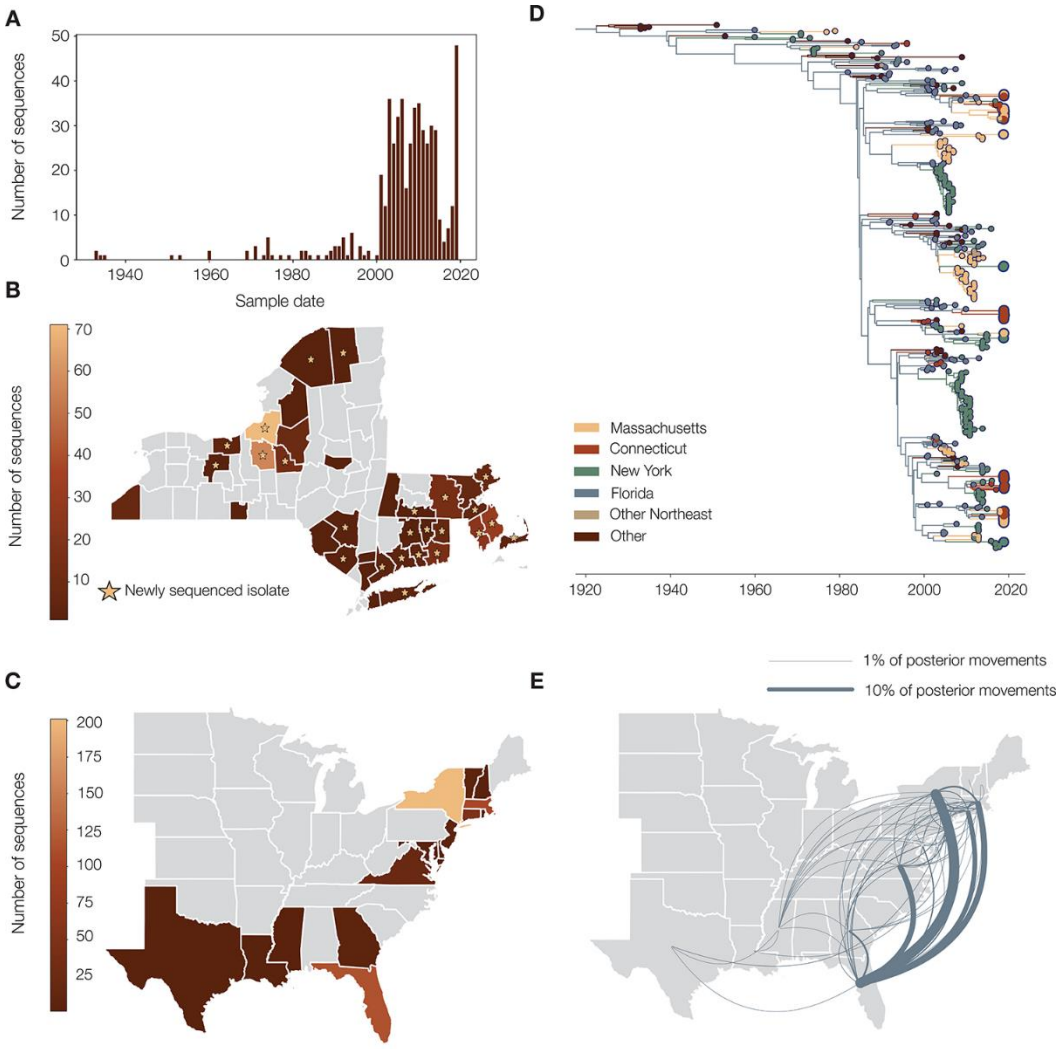
Weekly JCV isolates from mosquitoes (bars) and adult female mosquito collections (line) from CT, 1997-2022. JCV isolations per species per week are demarcated by horizontal lines of stacked bar and shaded according to host-association and phenology

Field isolation and laboratory vector-host studies of Brazoran Virus (*Peribunyaviridae: Orthobunyavirus*) from Florida

Brazoran virus was first isolated in Texas during 2012, yet little is known about this virus. In this study, we report the isolation of this virus from *Culex erraticus* from southern Florida during 2016. The Florida strain had a nucleotide identity of 96.3% (S-segment), 99.1% (M-segment), and 95.8% (L-segment) to the Texas isolate. *Culex quinquefasciatus* and *Aedes aegypti* colonies were subsequently fed virus-blood meals to determine their vector competence for Brazoran virus. *Cx. quinquefasctus* was susceptible to midgut infection but few mosquitoes developed disseminated infections. Aedes aegypti supported disseminated infection but virus transmission could not be demonstrated. Suckling mice became infected by needle inoculation without visible disease signs. Virus was detected in multiple mouse tissues but only rarely infected the brain. This study documents the first isolation of Brazoran virus outside of Texas. Although this virus infected *Ae. aegypti* and *Cx. quinquefasicatus* in laboratory trials, their vector competence could not be demonstrated.

C.5. Dynamics of eastern equine encephalitis virus during the 2019 outbreak in the Northeast United States

Eastern equine encephalitis virus (EEEV) causes a rare but severe disease in horses and humans and is maintained in an enzootic transmission cycle between songbirds and *Culiseta melanura* mosquitoes. In 2019, the largest EEEV outbreak in the United States for more than 50 years occurred, centered in the Northeast. To explore the dynamics of the outbreak, we sequenced 80 isolates of EEEV and combined them with existing genomic data. We found that, similar to previous years, cases were driven by multiple independent but short-lived virus introductions into the Northeast from Florida. Once in the Northeast, we found that Massachusetts was important for regional spread. We found no evidence of any changes in viral, human, or bird factors which would explain the increase in cases in 2019, although the ecology of EEEV is complex and further data is required to explore these in more detail. By using detailed mosquito surveillance data collected by Massachusetts and Connecticut, however, we found that the abundance of *Cs. melanura* was exceptionally high in 2019, as was the EEEV infection rate. We employed these mosquito data to build a negative binomial regression model and applied it to estimate early season risks of human or horse cases. We found that the month of first detection of EEEV in mosquito surveillance data and vector index (abundance multiplied by infection rate) were predictive of cases later in the season. We therefore highlight the importance of mosquito surveillance programs as an integral part of public health and disease control.



A) Number of EEEV sequences in the dataset over time by year of sampling. Note that the nationwide reporting of surveillance data began in 2003. B) Location of EEEV sequences in the dataset from Massachusetts, New York, and Connecticut to the county level. Stars indicate the location of EEEV samples which were newly sequenced for this study. C) Location of all EEEV sequences in the study to state level. D) Time-resolved phylogeny colored by location of nodes from the discrete phylogeographic analysis. States in the Northeast are colored separately, but non-Northeast and non-Florida states are grouped together. Larger tips represent EEEV sequences from 2019. E) Movement of virus from the full posterior of the discrete phylogeographic analysis. Direction is counterclockwise, and width of lines corresponds to frequency of movement across the posterior. Movements that make up fewer than 1% of the total posterior have been filtered out.

DEPARTMENT OF ENVIRONMENTAL SCIENCE AND FORESTRY
ENVIRONMENTAL SCIENCE AND FORESTRY

Connecticut's landscape is a quilt of forests, farms, towns, and cities. Scientists in the Department of Environmental Science and Forestry are studying the factors that influence forest and farm productivity, ticks and public health, how trees respond to novel pests and a changing climate, identification and management of invasive aquatic plants, innovative forest management practices, the effect of the growing deer population on natural and managed landscapes, novel growing techniques for crops in urban areas, integrated tick management strategies, as well as soil ecology, soil organic carbon, and soil remediation from a variety of chemical inputs. Additionally, the Applied Environmental Analytical Chemistry program is an interdepartmental effort with Analytical Chemistry with a focus on developing and testing methods for analyzing environmental contaminants and applying our methods to field samples and studies that characterize pollution, assess human exposure to contaminants, and investigate contaminant remediation options.

ADVANCES IN KNOWLEDGE

Field trial of fipronil-laced bait to control *Ixodes scapularis* immatures on rodents

Drs. Scott C. Williams and Megan A. Linske assisted by Heidi Stuber and Jamie Cantoni. Funded by a subcontract with Genesis Laboratories, Inc. and the Centers for Disease Control and Prevention.

The main purpose of this work is to evaluate the impact of an orally delivered acaricide, in the form of a fipronil-laced rodent bait, on the feeding success of *Ixodes scapularis* (blacklegged ticks) immatures on rodent hosts, including *Peromyscus* mice. The outcome of the research will be of direct relevance for homeowners and professional landscaping firms engaging in tick control activities. In summers 2022 and 2023, we fed out 100s of pounds of fipronil-laced bait in residential properties in the Town of Guilford, CT and trapped and blood-sampled small rodents. In 2022, we tested a subsample of rodent blood for active ingredient fipronil and found that mice had far exceeded the level of fipronil needed to manage immature blacklegged ticks. In 2023 we reduced bait distribution to every other week instead of weekly and then in 2024, we distributed bait every three weeks in May-June to target parasitizing nymphal *Ixodes scapularis* and plan to target larvae in late summer. In 2023 we sampled 465 ticks from treated and control properties and captured 204 unique mice over 286 occasions. Rodent sampling in 2024 will commence in August. Blood samples will be sent to Genesis Laboratories, Inc. for analysis of fipronil presence and sampled ticks and rodent tissue samples will be sent to the Centers for Disease Control and Prevention for pathogen testing.

Impact:

- If we can show that small rodents consume enough treated bait to manage immature ticks, this could be a positive step toward reducing both tick and pathogen abundances in suburban neighborhoods and could lessen tick-borne disease transmission and improve public health.

Suppression of Host-Seeking *Ixodes scapularis* Abundances and Interruption of Pathogen Transmission Through Orally Delivered Systemic Acaricide Treatment of White-tailed Deer and *Peromyscus* spp.

Drs. Scott C. Williams and Megan A. Linske assisted by Heidi Stuber. A competitive 5-year Cooperative Agreement funded by the Centers for Disease Control and Prevention.

The objective of the project initially was to evaluate the efficacy and reproducibility of the use of existing commercially available systemic acaricide treatment of white-tailed deer (*Odocoileus virginianus* (Zimmermann)) and *Peromyscus* spp. in multiple high-risk settings throughout the Northeast on suppression of *Borrelia*-infected host-seeking *Ixodes scapularis* nymphs. We proposed treatment using existing commercially available and federally approved products (Kaput® EPA Reg. No. 72500-17, 72500-28; Cydectin® FDA under NADA #141-099) of both the major reproductive host of *I. scapularis* (*O. virginianus*) and the major pathogen reservoir (*Peromyscus* spp.) both in single and integrated approaches and will document impacts to host-seeking *I. scapularis* abundances and pathogen infection (*B. burgdorferi*, *B. miyamotoi*, *Babesia microti*, *Anaplasma phagocytophilum*, Powassan virus) in both vector and reservoir species. However, due to labeling restrictions, we could not feed Cydectin to deer as the product is not labeled as such. As a result, we pivoted and are using an experimental fipronil-based product for treatment of deer in the Maine site only and are experimenting with a fall spray of synthetic pyrethroid acaricide in Connecticut to manage overwintering juvenile ticks while minimizing risk to pollinators and beneficial insects that have presumably migrated or have gone dormant underground.

During the 2023 summer field season, we sampled 1000s of ticks in both Connecticut and Maine as well as many 100s of rodents at both sites to determine latent tick and rodent abundances as well as infection prevalence with the various pathogens of concern to establish baseline data with which to compare data after intervention. Thus far in the 2024 field season, we placed out fipronil-based bait in 100s of cooperating homeowner properties in Woodbridge and Bethany, CT and Isle au Haut, Maine to target nymphal *I. scapularis* feeding on rodents. Host-seeking tick sampling also occurred in May-June 2024. In late summer/fall 2024 we plan to place out bait to target larval *I. scapularis* and rodent trapping efforts will take place at both locations. In Connecticut, we plan to spray for ticks post-frost on select properties and in Maine, deer feeders will be erected and an experimental fipronil-based bait will be distributed.

Impact:

- Having shown that deer and mice will consume treated bait, this research seeks to determine if the combined treatment of both will result in fewer pathogen-infected nymphal *I. scapularis* on the landscape which could lessen tick-borne disease transmission and improve public health at a regional scale beyond individually treated backyards. Fall spraying can kill overwintering ticks while reducing impact to beneficial, non-target insects.

Detection of urban maple decline based on non-structural carbohydrate (NSC) levels in association with site and tree growth metrics in urban environments

Dr. Susanna Keriö, co-investigators Dr. Faisal Qaseem, Dr. Leigh Whittinghill, Dr. Nubia Zuverza-Mena. Assisted by Liberty Bednarz, Susan Yang (Naugatuck Community College), Ana DiMauro (Plant Health Fellow), Eveleen Jiang (UConn student), and Carlin Eswarakumar. Funded through the Louis A. Magnarelli Postdoctoral Program at CAES.

Urban trees have a critical role in improving the habitability of towns and cities in Connecticut where 86% of the population lives in urban areas. Results from a CAES urban tree survey in New Haven in 2020 indicate that urban maple mortality in New Haven has increased from 2010, but the causal factors are unclear. The goal of this project is to study the potential of non-structural carbohydrate (NSC) levels as an early indicator of urban maple decline syndrome. The project leveraged existing maple health monitoring data in New Haven and Hartford to associate observed patterns in tree health decline with NSC levels. We sampled 120 urban maples in New Haven to investigate how site factors, soil properties, and tree growth metrics to quantify urban maple stress. We observed that Norway maple, an invasive exotic tree species, had the highest levels of dieback and least growth in the warmest tree planting sites. Work is ongoing to characterize the carbohydrate reserves in the trees growing in tree planting sites with varying temperature and soil conditions. During the field work, the involved CAES scientists and research assistant have discussed the importance of urban tree health with more than 50 members of the public.

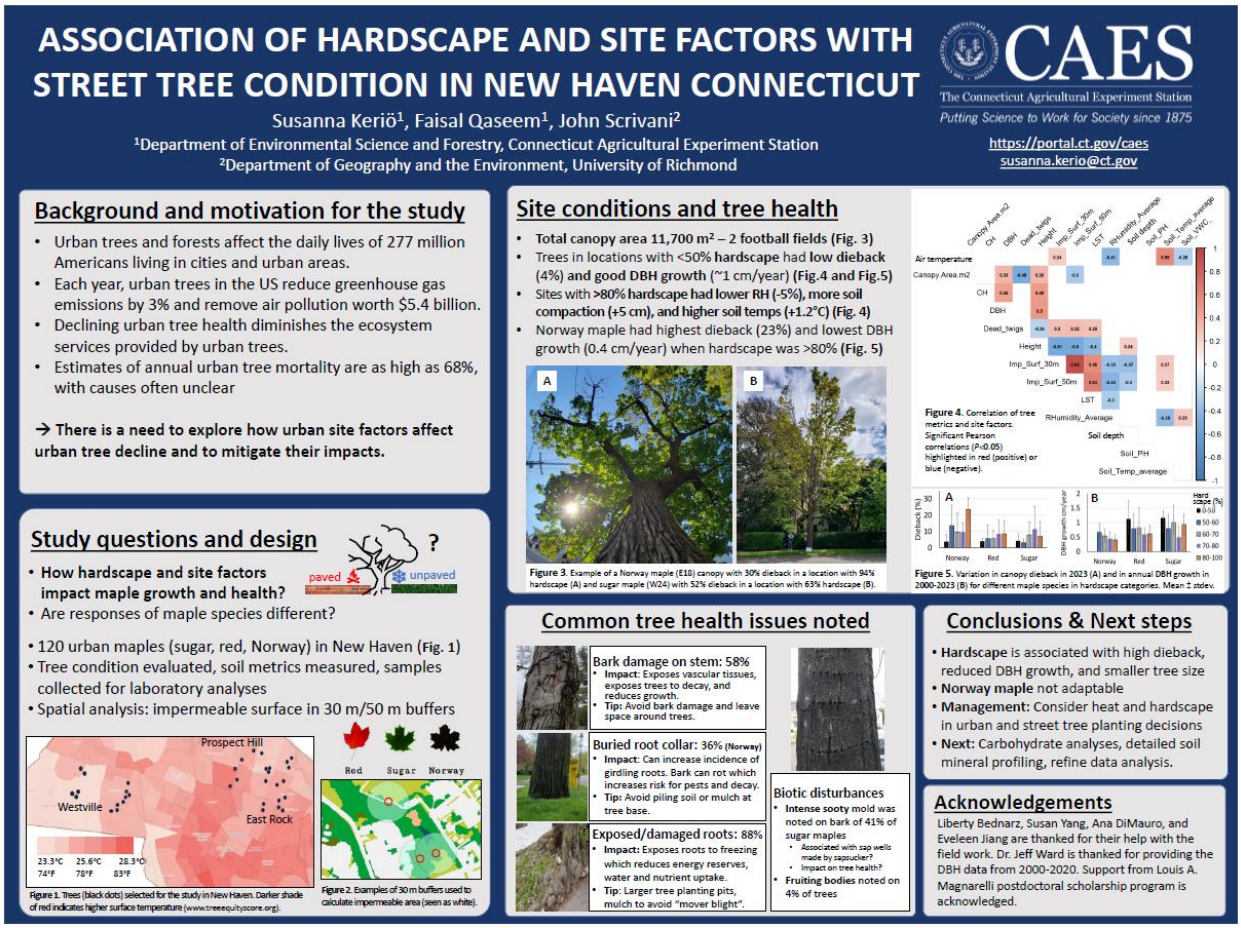


Figure 1. Outline and preliminary results of the project studying the association of urban heat island effect, pavement, and soil conditions with urban maple health.

Impact:

- Identifying site and soil factors that affect tree health can have practical implications for guiding planting decisions. The results indicate that Norway maple performs poorly in warm and heavily paved tree planting sites. Threshold values for non-structural carbohydrates could have practical applications in tree health diagnostics to quantify tree stress.

Impact of mycorrhizal inoculation on landscape tree health in Connecticut

Dr. Susanna Keriö, assisted by Carlin Eswarakumar. Funding through the Specialty Crop Block Grant Program through the Connecticut Department of Agriculture.

The Keriö lab partnered with Connecticut tree planting programs in eight towns to test the impact of mycorrhizal inoculation on tree health for 240 newly planted landscape trees. Transplant shock affects landscape trees in tree planting sites, which increases tree mortality and causes economic losses. Mycorrhizal inoculation can reduce sapling mortality, but quantitative data on the benefits of mycorrhizal inoculation for landscape trees is limited. We inoculated 120 trees with mycorrhizae and left 120 trees as untreated controls. Our preliminary findings indicate that the benefit of mycorrhizal inoculation may vary among tree species: foliar nitrogen:flavonoid ratio in eastern red buds increased by 38%, whereas no change was seen in red maples (**Figure 4**). We will continue to monitor the trees and repeat the treatments to estimate the impacts of mycorrhizal inoculation on tree growth and root colonization.

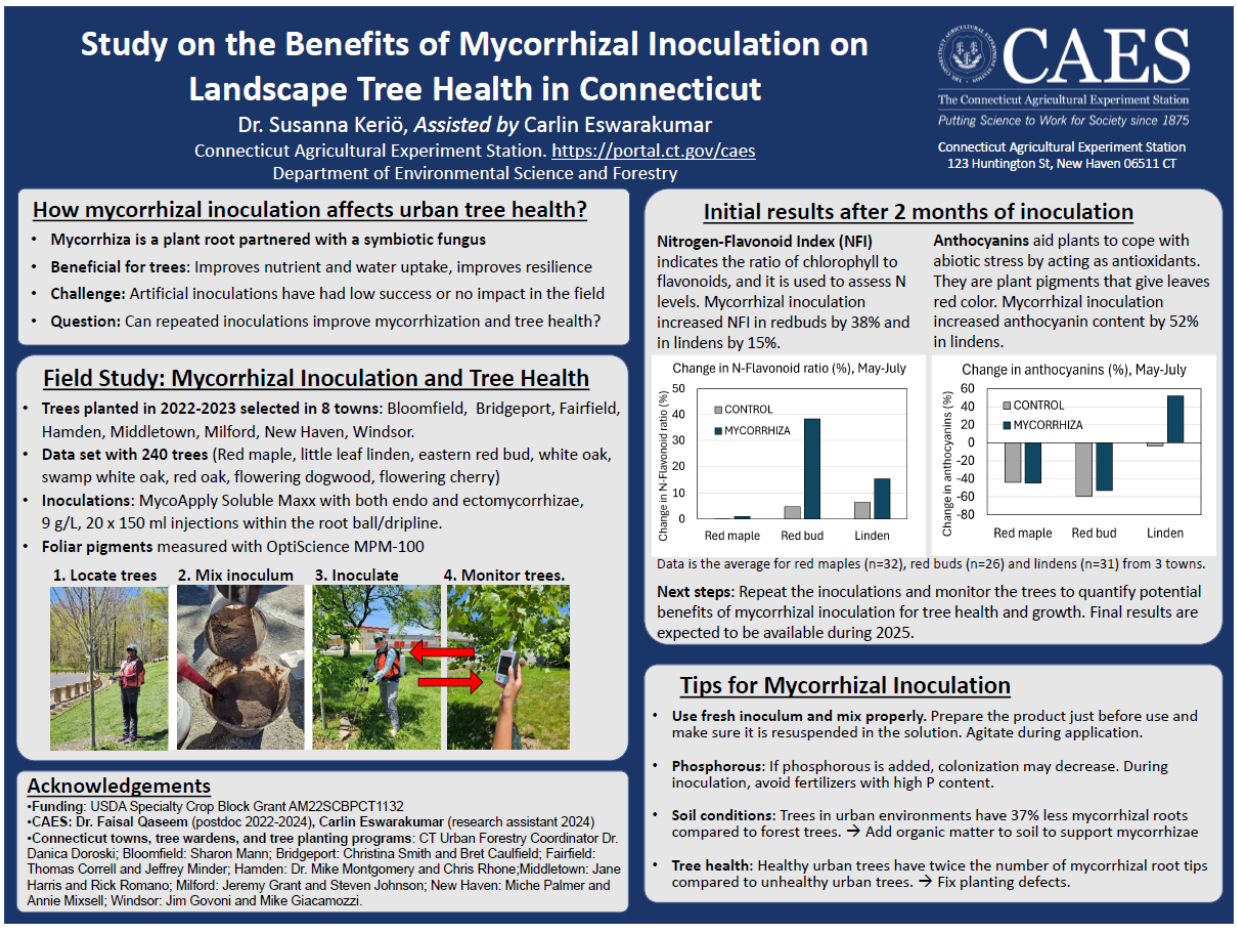


Figure 4. Preliminary findings from a field experiment studying the impacts of mycorrhizal inoculation on tree health by Dr. Susanna Keriö's lab.

Impact:

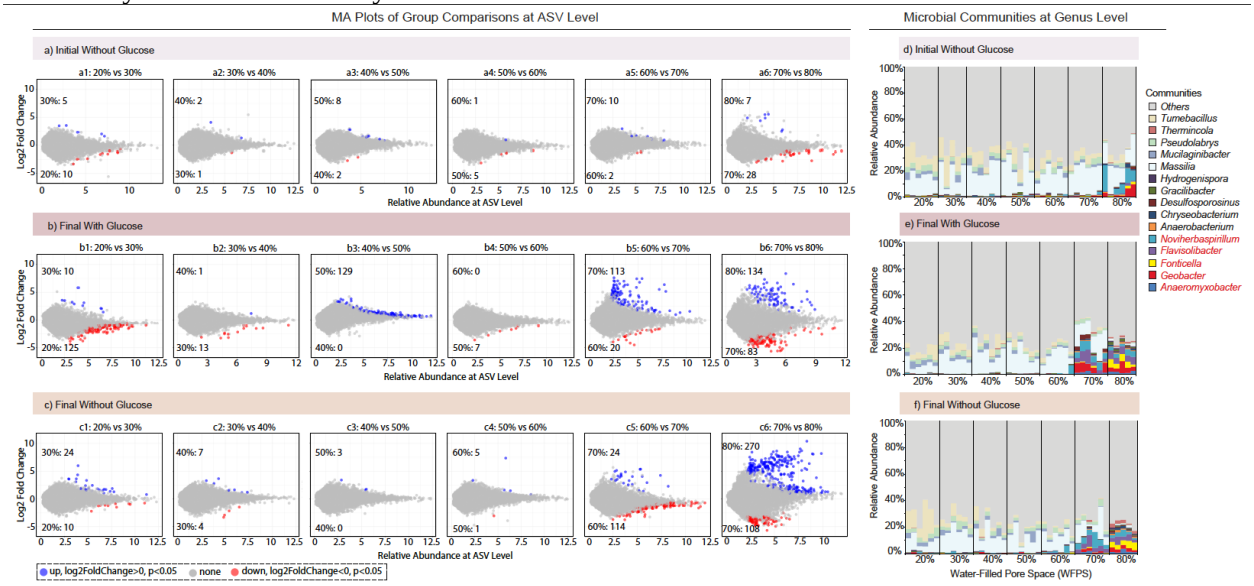
- The project provides quantitative data on how mycorrhizal inoculation affects landscape tree health across a wide range of site and soil conditions among different tree species. The study will inform tree care practitioners of which trees benefit most from mycorrhizal treatment, and what site and soil factors affect tree health.

Impact of soil water potential on microbial C cycling

Dr. Itamar Shabtai, Dr. Blaire Steven, and collaborators from the University of Connecticut

Soil organic matter represents a critical component of global carbon (C) cycling. Carbon primarily enters the soils as plant biomass, but microbial decomposition of this biomass converts organic plant-C into biosynthetic molecules that may continue to be recycled, become stable soil organic carbon (SOC) resistant to decay, or lost from soil as carbon dioxide (CO_2) via respiration. Understanding the conditions which drive this partitioning can help to forecast changes to SOC stocks and CO_2 efflux, particularly as climate stressors such as warming, and drought alter rates of microbial activity. Here, we investigated the understudied effect of water content on microbial cycling of SOC. We conducted a manipulative experiment with soil water content gradient ranging from 10 to 80% water filled pore space (WFPS). We found a strong threshold response with microbial community changes primarily only happening in the wettest soils (80%

WFPS). This suggests there are critical moisture levels in the soil that predominantly influence microbial community function and activity.



Microbial community composition shists in response to soil moisture. A) Each panel represents the number of microbial taxa identified as statistically significantly different along a soil moisture gradient. There is a clear pattern of the most taxa responding at highest moisture levels. **B)** Identification of responsive taxa.

Impact:

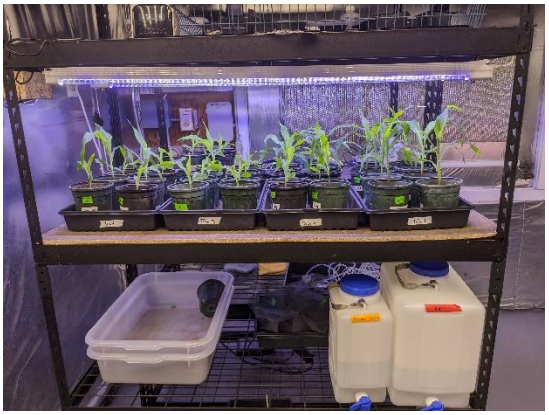
- These results suggest that extreme soil moistures associated with climate change may predominantly impact the sequestration of C and securing current C stocks, which is critical for soil functions.

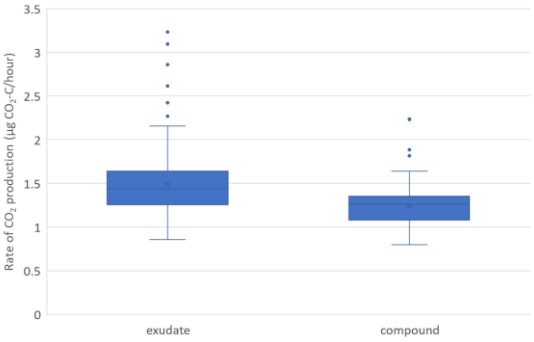
Assessing the appropriateness of single compounds as model root exudates in rhizosphere carbon studies

Dr. Itamar Shabtai

Plants exude organic compounds to manipulate their belowground habitat. The higher release of C (as CO_2), compared to unplanted soil, resulting from root activity in the rhizosphere (root-soil interface) is termed rhizosphere priming. Most studies on rhizosphere priming employ single molecules (e.g., sugars, organic acids, amino acids, and phenolic acids) hypothesized to mimic single possible functions of root exudates, each driving different chemical reactions (reduction, chelation, mineralization). However, root exudates are a complex mixture and therefore their chemical and biological influence on C and NP cycling may significantly differ from what is observed for single molecules. In this project, we grew corn plants and

collected their root exudates using a hydroponic approach. A root exudate solution, or a single or combination of model compounds were added to soils and the CO_2 evolved was measured.





CO_2 production rate in soils amended with a root exudate solution or single model compounds (glucose, oxalic acid, catechol)

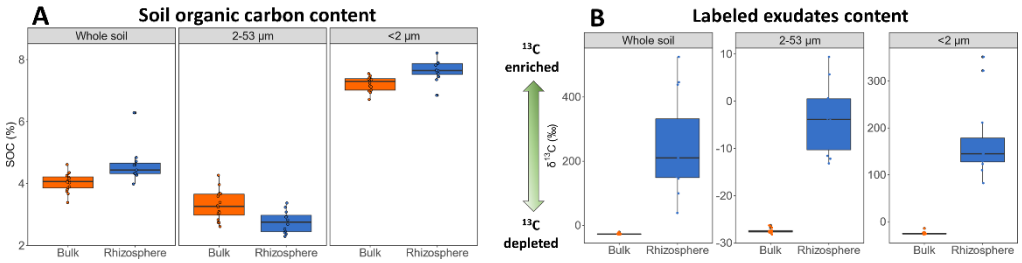
Impact:

- These findings indicate that the current methodology for studying how root exudation impacts microbial C cycling in the rhizosphere does not capture accurate magnitudes of C fluxes. We encourage the use of more realistic root exudate solutions to investigate exudate-induced processes.

Formation of mineral-associated organic matter from root exudation

Dr. Itamar Shabtai and collaborators from Cornell University and Technical University of Munich

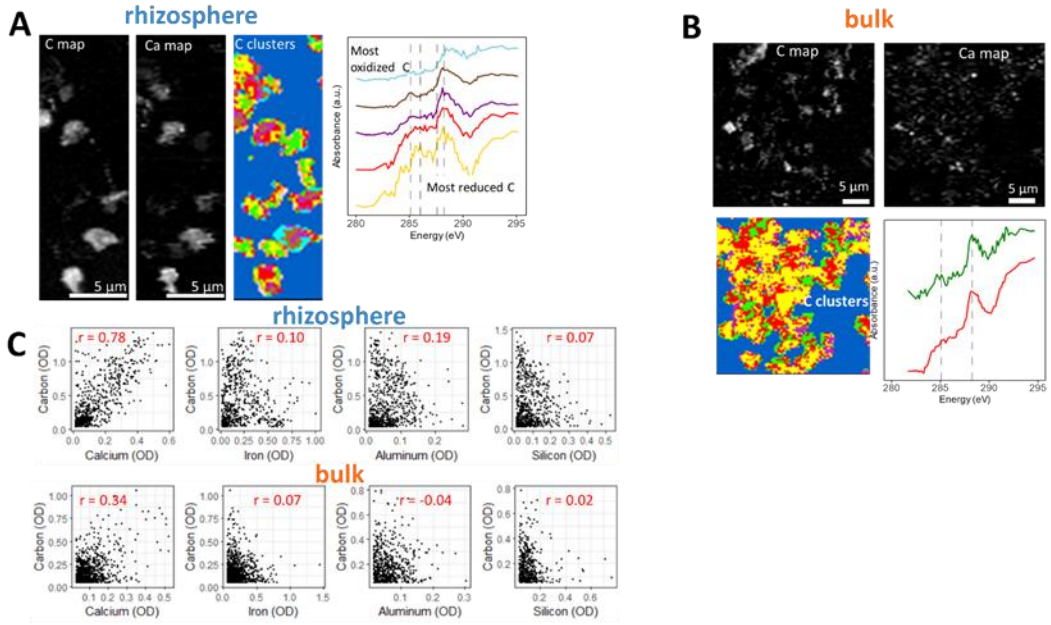
Plants exude organic compounds from their roots into the rhizosphere (soil-root interface), making it a hotspot for soil organic carbon (SOC) formation. However, there is little information on how root-zone conditions might impact exudation patterns, and subsequently rhizosphere SOC dynamics. We continue this project which seeks to understand how root exudation affects SOC formation in the rhizosphere. We grew maize well-watered and water-stressed conditions and pulse-labeled the plants with $^{13}CO_2$ to trace the root exudate C in the soil. We then isolated the clay-sized fraction from rhizospheres and investigated the chemical and spatial characteristics of the organo-mineral interactions using stable isotope ratio mass spectrometry (IRMS) and synchrotron radiation spectromicroscopy (STXM-NEXAF). We found that exudates were preferentially accumulating in < 2 um size fractions, resulting in a greater C content in the rhizosphere compared to the bulk soil.



Elemental and isotopic analyses showing that (A) carbon, and (B), specifically exudate-derived carbon, accumulate in the rhizosphere on < 2 µm particles

Then, applying STXM-NEXAFS analysis on the <2 um fraction, we found that the rhizosphere carbon was more diverse in terms of types of C functional groups compared to the bulk soil. This is likely due to continuous inputs of a mixture of compounds present in root exudates. We also found a higher co-localization of C with minerals, specifically with calcium in the rhizosphere than in the bulk soil, reflecting preferential formation of mineral-associated organic matter in the rhizosphere. Ongoing work is focused on

understanding the effects of growing conditions on rhizosphere C dynamics as well as the stability of C in the rhizosphere compared to C in the bulk soil.



Spectro-microscopy (STXM-NEXAFS) images of clay-sized particles (< 2 µm) showing spatial distribution of C and Ca, and diverse C forms in the rhizosphere (A); lower C-Ca co-localization and C form diversity in the bulk soil (B). Spatial correlation analysis of carbon (C), with calcium (Ca), iron (Fe), aluminum (Al), and silicon (Si) showing C is most strongly co-localized with Ca, and to a greater extent in the rhizosphere than in the bulk soil.

Impact:

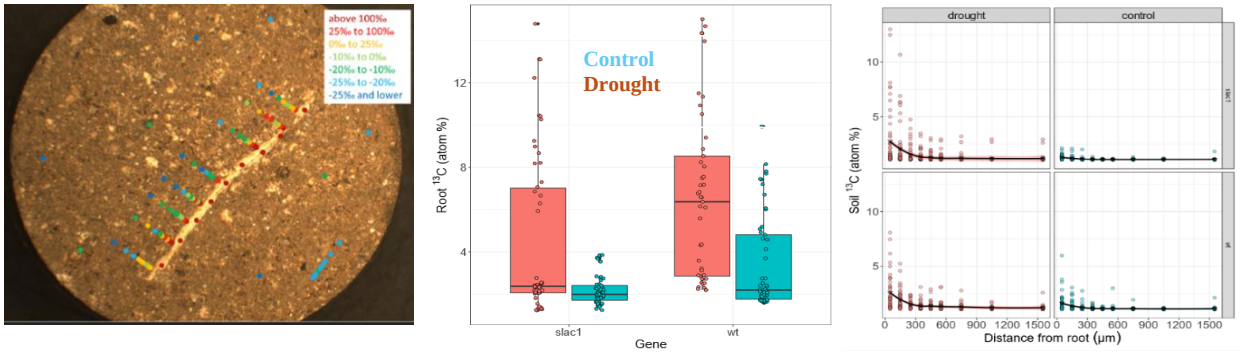
- These observations of sub-micron scale processes reveal little known mechanisms of C cycling in the rhizosphere, which fuels plant nutrient cycling.

Investigating the effects of drought on plant allocation of carbon to roots and exudates

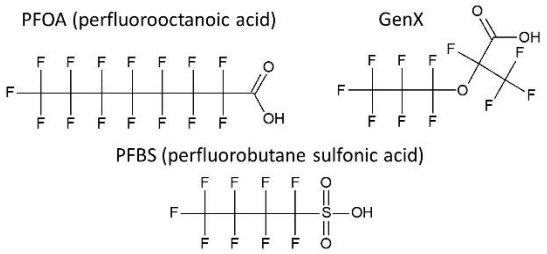
Dr. Shabtai and collaborators from Cornell University

Plant roots release carbon-rich compounds, called exudates, in the soil surrounding the roots. These compounds affect organic matter and nutrient cycling and soil microbial community composition. There is evidence that plant water availability can impact the rate of exudation, however, since exuded C is rapidly utilized by microbes and/or interacts with minerals, it is difficult to quantify exudate C and determine its spatial distribution around the roots. As part of a project supported by the Pacific Northwest National Laboratory (Dept. Of Defense) we grew corn plant under drought and control conditions in an environment that contained CO_2 that was enriched in the heavy stable isotope of carbon – ^{13}C – which allowed us to track exudate carbon in the soil. Using a technique called laser-ablation isotope ratio mass spectrometry (LA-IRMS) we could map out the amount of exudate C in the soil and roots.

Our analyses revealed that under drought both a maize wild type (WT) and mutant with reduced stomatal response to soil moisture (SLAC1) increased allocation of newly fixed C below-ground. The greater allocation of C below-ground was associated with the presence of greater concentrations of exudate C farther from the roots, potentially allowing the plant to manipulate and improve growing conditions via microbial recruitment and nutrient foraging in larger volumes of soil.



Spatial distribution of ^{13}C-labeled root carbon measured by LA-IRMS. (**left**) Heatmap of ^{13}C enrichment (‰ value) in a maize rhizosphere, (**center**) Carbon isotope signature (^{13}C atom %) of *slac1* and *wild-type* maize roots grown under drought and normally irrigated conditions. n ≈ 200. (**right**) Carbon isotope signature (^{13}C atom %) across rhizosphere transects of slac1 and wild-type maize grown in drought and control conditions.



Chemical structures of three common PFAS

Impact:

- This work demonstrates the appropriateness of LA-IRMS to study *in-situ* the fate of root C in the root-soil zone, which is important for understanding plant-soil interactions in general.
- Our observations indicate that the extent of the influence of roots on the surrounding soil is dynamic and varies with growing conditions.

Per- and Polyfluoroalkyl Substances

Per- and polyfluoroalkyl substances (PFAS) are a widespread, emerging class of highly toxic environmental contaminants. PFAS are a key ingredient in aqueous film forming foam (AFFF), used for fighting fires, and have been used in consumer products, such as waterproof and stainproof coatings, Teflon pans, and car waxes, since the 1940s. They are very persistent in the environment as their chemical structure is based on extremely strong the carbon-fluorine bonds. While PFAS are not currently regulated at the federal level, an increasing number of states (including Connecticut) are defining their own limits for PFAS in drinking water, groundwater, and other matrices. Good methods for measuring PFAS and for removing PFAS from the environment will be necessary as knowledge about and regulation of these chemicals increases.

Phytoremediation of PFAS

Dr. Sara Nason, Dr. Nubia Zuverza-Mena, Dr. Sara Thomas, Jasmine Jones, and collaborators

The use of Aqueous Film-Forming Foams (AFFFs) has caused widespread contamination with PFAS in areas that have been used for fire-fighter training. Such is the case at the Burn House site of the former Loring Air Force Base in northern Maine, USA (pictured), where the land now belongs to the Mi'kmaq Nation (Aroostook County), an indigenous group. PFAS have been dubbed “forever chemicals” as they are extremely persistent in the environment, and exposure to PFAS has been linked to cancer and other diseases.

Hemp growing at the former Loring Airforce Base in summer 2022. Upland Grassroots member Chelli Stanley is pictured monitoring the hemp growth.

Uplant Grassroots, an organization formed by concerned citizens, is attempting phytoremediation at the Burn House site in an attempt to reduce the contamination levels, and we are assisting them with assessing the effectiveness of their efforts. So far, we have determined that perfluorooctane sulfonic acid (PFOS) is the primary PFAS contaminant at the site and have detected a total of 68 PFAS in the soil.

We have assisted with 3 years of phytoremediation trials (2019, 2020, and 2022) where industrial hemp was used to remove PFAS from the soil. Hemp is a promising plant for phytoremediation due to its large size, fast growth rate, and high water usage. In 2022, we tested 5 hemp varieties, and determined that ChinMa was the variety that performed the best in the local climate (pictured below). We quantified 10 PFAS taken up by the hemp plants and found that some PFAS were more than 10 time more concentrated in the plants than in the soil.

Additionally, we are collaborating with the Liang lab at SUNY Albany and the Jaffe lab at Princeton University to investigate options for degrading the PFAS that remain in the hemp plants after they are removed from the soil. Hydrothermal liquefaction and microbial degradation have both shown promising preliminary results. We are also collaborating with the Haynes lab at the University of Minnesota and the Vasiliou lab in the Yale School of Public Health to develop novel materials that can be used as soil additives to enhance plant uptake of PFAS for phytoremediation.

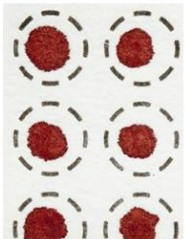
Impact:

- Phytoremediation has the potential to be an effective and low-cost method for removing PFAS, a class of highly toxic chemicals, from soil.

The Burn House at the former Loring Airforce Base.

Measuring PFAS to assess human exposure

Dr. Sara Nason and collaborators from the Yale School of Public Health



Dried blood spots

While PFAS have been in use for decades, we have only recently become aware of their potential health impacts. Therefore, PFAS contamination is extremely widespread, but there are not yet standardized methods for measuring them in most sample matrices. We worked to develop methods (including sample preparation, instrumental analysis, and data processing) for measuring PFAS in dried blood spots and whole blood samples. As PFAS have only recently become a health concern, we do not have long-term records human exposure. However, long term blood spot archives exist, and could be an important resource for characterizing historic human exposures. This year, we

published a newly validated method for measuring PFAS in dried blood spots and whole blood in *Science of the Total Environment*. We also finalized our data for a study relating PFAS to thyroid hormone levels in infants, and submitted a study to *The Journal of Exposure Science and Environmental Epidemiology*.

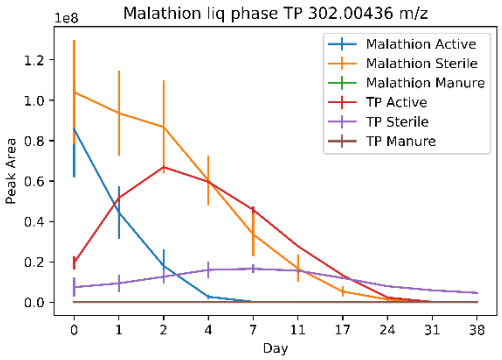
Impact:

- Methods for measuring PFAS in current and archived human blood samples are important for monitoring the presence of and investigating the health effects of these toxic contaminants.

<u>Organic Microcontaminants (OMCs) in waste related matrices.</u>

Contaminant transformation during anaerobic digestion
Dr. Sara Nason and collaborators at Johns Hopkins University

Anaerobic digestion is a common strategy used to produce biogas from waste materials from both farms and wastewater treatment plants. While many organic microcontaminants (OMCs) are present in the sludge and manure used for digestion, we know little about the fate of these chemicals. Digestate is often land applied to agricultural fields, so contaminants and toxic transformation products not destroyed during digestion may reach soil, groundwater, or crop plants intended for human or animal consumption. We designed experiments to examine the transformation of contaminants during anaerobic digestion. Our work has focused on veterinary drugs and pesticides that are likely to be present in digestion in agricultural areas. We found that 11 out of 20 tested compounds degraded biotically or abiotically during anaerobic degradation and identified 47 transformation products. We published this work in the journal *Science of the Total Environment*.



Graph showing degradation of malathion and the formation of a transformation product with a mass to charge ratio of 302.00436 in both active digestion samples and sterile controls.

Impact:

- Anaerobic digestate is often land applied to agricultural fields, so contaminants and toxic transformation products not destroyed during digestion may reach soil, groundwater, or crop plants intended for human or animal consumption. Understanding contaminant transformation processes is important to identify potential environmental and human health risks.

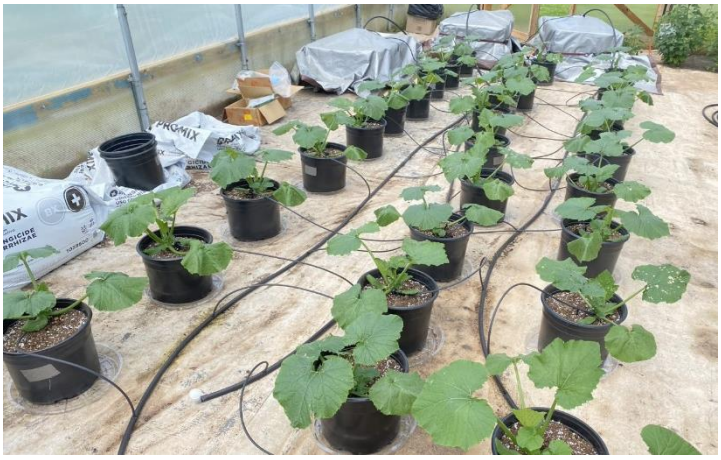
Assessing the impacts of reclaimed wastewater reuse for agricultural irrigation
Dr. Sara Nason, Dr. Nubia Zuverza-Mena, Dr. Peiying Wang, Dr. Jingyi Zhou, Jasmine Jones, Simon Duggan, and collaborators from the University of Maryland Baltimore County

Water scarcity is a problem throughout the modern world and is expected to increase as human population expands and climate change intensifies. Wastewater effluent reuse for agricultural irrigation is an important strategy to reduce demand from surface and ground water sources and is gaining momentum as obtaining freshwater from other sources becomes more difficult. While an important strategy for combating water scarcity, wastewater reuse for agriculture is not without risks. Wastewater effluent can contain higher levels of bacteria, heavy metals, salts, and other contaminants than conventional water sources. Specifically, there is increasing concern over organic microcontaminants (OMCs) such as pharmaceuticals, pesticides, and endocrine disrupting compounds that may be taken up into irrigated crop plants. Variability in wastewater composition is another factor that must be considered for determining the safety of reusing effluent for irrigation. While stormwater infiltration can dilute the concentrations of some contaminants, it may also introduce additional chemicals of concern into wastewater systems.

CAES researchers visit the New Haven Water Pollution Control Authority.

The first goal of this project is to assess how rain events affect the chemical profile of reclaimed wastewater. We developed a sampling protocol for collecting wastewater during rain events and corresponding dry periods that will enable us to determine the impacts of storm water infiltration on contaminant presence in wastewater effluent. We conducted a sampling campaign that included six storm events in New Haven, CT and corresponding dry weather samples. Method validation for our sample analysis plan is in progress. The results will help us to understand how the variability in wastewater effluent composition may affect the safety of using recycled wastewater for irrigation.

Additionally, we grew zucchini plants (pictured) using three different irrigation treatments: fresh water, wastewater effluent collected in dry weather, and wastewater effluent collected in wet weather. Moving forward, we will analyze these plants for contaminants derived from the wastewater.



Zucchini plants grown using reclaimed wastewater for irrigation.

Impact:

- Wastewater effluent reuse for agricultural irrigation is an important strategy to reduce demand from surface and ground water sources but can introduce harmful contaminants to crop plants. Investigating factors that affect the presence of these contaminants and bioaccumulation of contaminants in plants is important for identifying potential health risks.

Small plastic pools as a model for urban container gardening systems

Dr. Leigh Whittinghill, Assisted by Sofia Shubin, Elizabeth Gerbi (Plant Health Fellow), the 2022 Plant Health Fellows: Oliver Mackinnon, Aaliyah Walker, Brooke Issacson, Renee Smith, Naomi Allen, Mia Varney, Emilie Kendrick, Conor Bendett, and Juniper Allen-Cantu; and the 2023 Plant Health Fellows: Ananda Turner, Karena Kulakowski, Eva Rodriguez, Talia Traction, Oliver Kelsey, Charles McLean, Alexandra Carabetta, Aoife Collier-Clarke, Justice Glasgow, Ana DiMauro, Leo Babicz, and Tessa Lancaster; and the 2024 Plant Health Fellows : Emma Donahey, Christian Filteau, Elizabeth Gerbi, Andrew Medina, Katelyn Ouzts, Johanna Sampedro, Elisabeth Shin, Madeline Shin, Alexandra Vitug, and Cole Wilson.

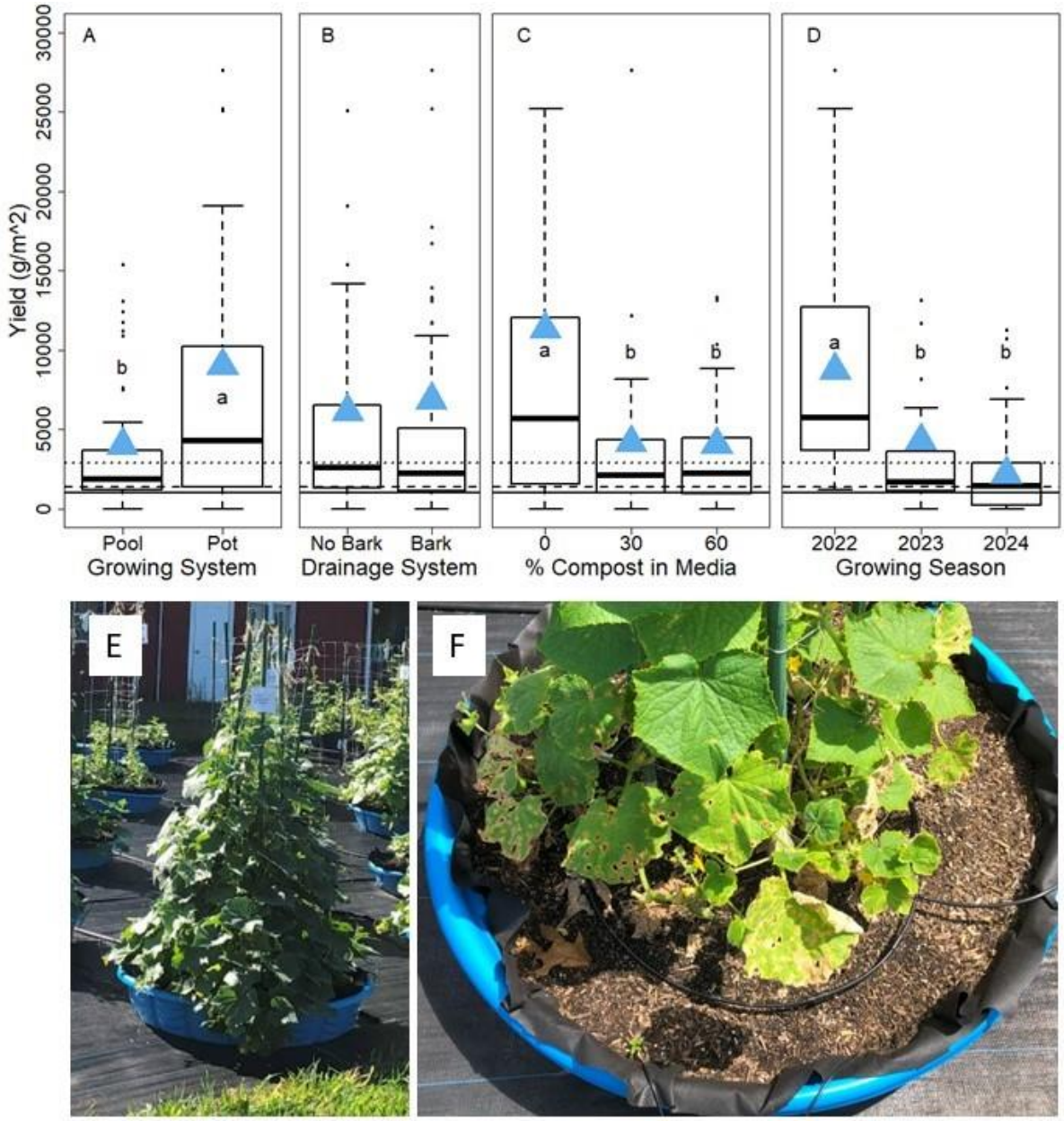
The use of small plastic pools as containers, for example, could help expand urban production to spaces with contaminated soils or otherwise unused surfaces such as parking lots and rooftops. These pools have a relatively low cost compared to other growing systems of similar size and lower cost per growing area than many other available containers, reducing startup costs. Pools may also have different drainage issues and present different plant spacing considerations that traditional nursery containers. Despite growing attention in social media, production in plastic pools has still received little attention from research, so best management practices do not yet exist.

A controlled experiment was set up in 2022 at Lockwood Farm to examine two different drainage strategies for the pools (drainage holes in the bottoms of the pools and no drainage holes in the bottom of the pool with a pine bark mulch water reservoir) and three different media combinations of peat-based media and compost (0, 30, and 60% compost by volume). The small plastic pool system is also being compared to more traditional nursery pot production.

Preliminary results from the 2022 growing season show some difference in yield between the pots and pools, no difference between the drainage strategies, and some better yields in the 0% compost media than the 30 or 60% compost medias. The media results were unexpected, as cucumbers, the chosen crop, have been shown to do well in 60% compost media. At the start of the 2023 growing season, growth and development were still faster in the 0% compost treatments, but the 60% compost treatment was faster than the 30% compost treatment. Early development in 2024 was similar to that of 2023, suggesting that compost nutrients were not available at the start of the 2022 growing season. Production in 2023 and 2024 was, however, heavily affected by wetter weather and significant fungal disease pressures.

***Impacts*:**

- This project is a first step in developing best practices for small plastic pool container production.
- The proposed research will provide alternative growing methodologies in urban areas that will increase the production of healthy fruits and vegetables near urban markets while circumventing the issues of limited growing space and potential soil contamination.
- The results of this study, and anecdotal evidence from local small-scale farmers suggests that Marketmore cucumbers may no longer be suitable for the production in this region of Connecticut due to increasing fungal disease pressures.



Total yieldof cucumbers from 2022-2024 for the (A) growing system types, (B) drainage strategies, (C) media composition and (D) growind season. Blue trianges represent means. Growth and apperance of the cucumber plants in from the same treatment on (E) Aug 4, 2022, and (F) July 29, 2023, showing the impact of fungal disease on plant health and vigor.

Cut-and-Come-Again Greens: Determining fertilizer application rates to promote higher yields and nutrient content in later harvests.

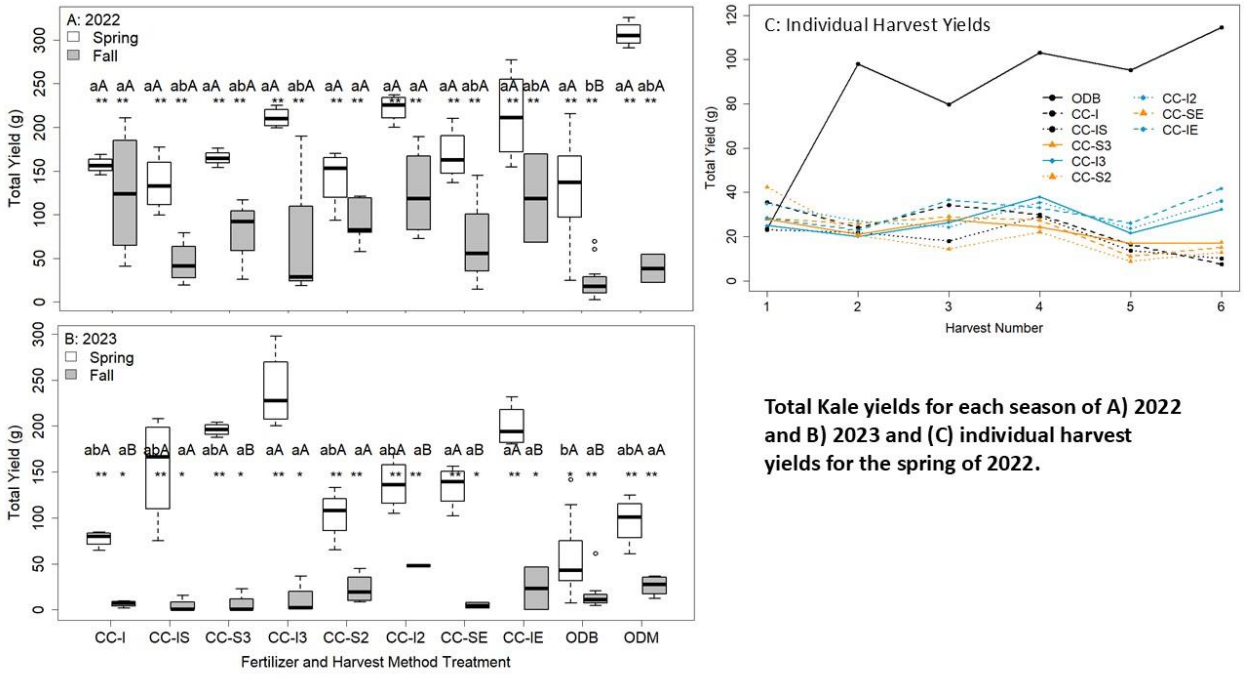
Dr. Leigh Whittinghill, Assisted by Sofia Shubin, Elizabeth Gerbi (Plant Health Fellow), Haley Matesa (Quinnipiac University Intern), and Kavya Sree Gunnala, Revanth Goud Yerra, and Kehinde Omisakin (University of New Haven Interns).

Use of cut-and-come-again harvesting of greens, a technique where a crop is planted, then harvested to leave the plant growing center so that multiple harvests from a single planting are possible, can increase

production without increasing the cost of inputs. Although this technique is recommended for greens such as kale, specific instructions for crop nutrient management do not exist. Nutrient management in greens is important for not only high yield, but for a high-quality crop. The small amount of research done on cut-and-come-again greens suggests that yields and crop quality decrease in later harvests. Adding more nutrients throughout the growing period could help improve the yield and quality of later crops but could contribute to nutrient runoff from urban agriculture.

Two controlled experiments on kale (started in 2022) and collards (started in 2023) were conducted with eight different fertilizer application treatments: no applications after the initial fertilizer application, a side dressing of nitrogen at three weeks, and additional full fertilizer amounts or side dressings at every third, every other, or every harvest. Two single harvest controls were also used, one set was planted to be harvested at the baby stage alongside the cut-and-come-again kale harvests, and one was planted at the start and was harvested when fully mature. These controls will help us compare our results to the harvesting practice used in much of rural and large-scale agriculture. Measurements are being taken on yield, crop nutrient content, soil nutrient content, and runoff/leachate water nutrient content. The idea is to find an optimal fertilizer application that will enable high yields and good crop nutrient content but have minimal impacts on runoff/leachate nutrient content.

Preliminary results from both crops suggest that while individual harvests from the cut-and-come-again treatments can be lower than the one-and-done baby stage controls, they are not always significantly lower. Repeating fertilizer applications appears to prevent a drop in yield often seen after the second or third harvest. There is, however, no obvious dose response to increasing fertilizer applications. When comparing total yields for the growing season, the cut-and-come-again treatments often have higher yields than the one-and-done controls, suggesting a benefit to the cut-and-come-again harvesting practice. Both preliminary runoff water and leaf nutrient content also show no increase in nutrients with increasing amounts of nutrients applied to the cut-and-come-again treatments. Analysis of both leaf and growing media nutrient contents are still underway. These results, and an examination of where nutrients are found in the system (soil, runoff water, or plant leaves) should shed some light on where applied nutrients are and possibly why they are not contributing to yield or runoff water nutrient contents.



Total Kale yields for each season of A) 2022 and B) 2023 and (C) individual harvest yields for the spring of 2022.

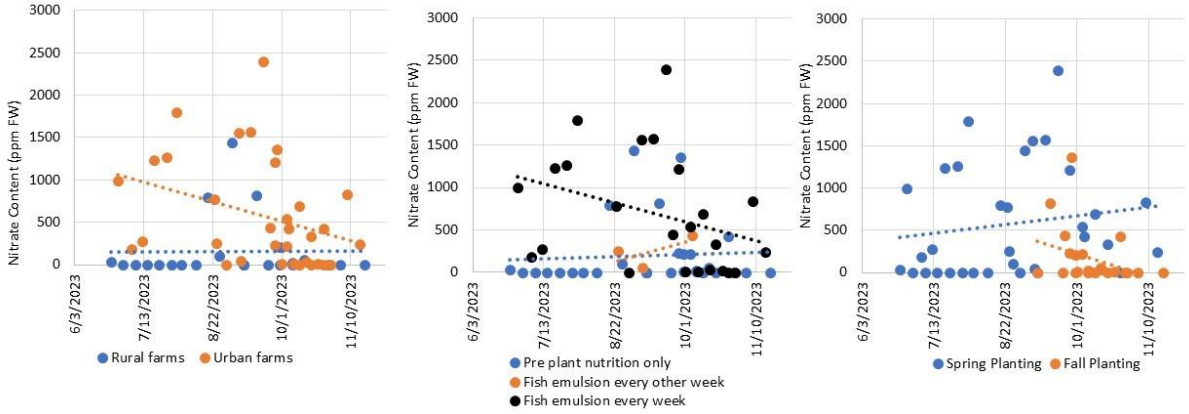
***Impact*:**

- This project is the starting point for the development of fertilizer recommendations for cut-and-come again harvested greens, which should result in higher yields at later harvests, and more nutritious greens.
- The proposed research will provide alternative growing methodologies in urban areas that will increase the production of healthy fruits and vegetables in close proximity to urban markets while circumventing the issues of limited growing space and potential soil contamination.

The effects of management practices on the nutritional quality of cut-and-come-again greens from urban farms in Connecticut.
Dr. Leigh Whittinghill

During the summers of 2023 and 2024 small amounts of kale and collards grown by area urban and rural farmers using cut-and-come-again harvesting practices were collected. Farmers were asked to fill out a brief questionnaire to indicate how they manage their crops. Most farmers reported that they grew crops from transplants and waited to harvest until leaves reached 7-12 inches long. Typical harvest intervals were 1 to 2 weeks and between 1/4th and all but 4 of the leaves that were ready for harvest were collected.
The number of harvests achieved by farms varied. Some farms planted a spring and a fall crop, others only did one planting in either the spring or the fall. For fall crops, about 8 harvests were possible. For spring crops, more harvests were possible, between 10 and 24. These numbers are much higher than the possible harvests suggested by available information about cut-and-come-again harvesting. Nutrient management used by participating farmers mirrored some of the treatments used in the controlled experiments being conducted at CAES. Many farmers followed general brassica guidance for an initial fertilizer application, using either compost or commercial fertilizers. Some farms did not provide further nutrients, which several provided some form of fertilizer every other week, or every week of the growing period.

Preliminary leaf nutrient content results from 2023 are so far hard to interpret. Trends over time are different for each crop and each nutrient when analyzed by urban vs rural farms, prevailing nutrient management strategies, and spring vs fall plantings. No levels of any heavy metals or other micronutrients that could present problems for human health were detected. Analysis of 2024 results are still underway. The inclusion of those data, and some analysis including weather variables may solidify some of the patterns that can be seen.



Preliminary results for kale nitrate content (ppm Fresh Weight) for the 2023 growing season by A) urban vs rural farms, B) nutrient management strategy used, and B) spring or fall planting.

Impact:
- Gain a greater understanding of cut-and-come-again harvesting and management used by local farmers. This information will be used to inform future research project directions, treatments, and management.

- Results from this project will also inform the development of fertilizer and other management recommendations for cut-and-come-again harvested greens.

Microbial ecology and salt marsh conservation

Dr. Blaire Steven assisted by Ms. Jackie LaReau in collaboration with Drs. Chris Elphick, Beth Lawrence, and Ashley Helton University of Connecticut

Salt marshes are changing globally, with increasingly wet conditions as sea levels rise. This results in habitat and species losses. The saltmarsh sparrow has received much attention due to the estimated loss of >70% of the world population since the 1990s and predicted extinction by the mid-21st century. Sediment addition, which raises the elevation of the marsh, has garnered interest from many conservation practitioners given its potential to protect services and improve coastal resilience. Yet we do not understand how restoration affects other ecosystem processes of salt marshes, such as the multitude of functions provided by the sediment microbial populations. In this study we are investigating how wildlife conservation intersects with microbiology and biogeochemistry. Specifically the potential of these practices to form 'sulfidic soils' which can negatively impact vegetation.

Coastal wetland restoration. A saltmarsh sparrow and an image of sediment addition to a coastal wetland to increase elevation. The goal of this conservation effort is to provide safe habitat for the sparrow to nest in the face of sea level rise. The project will address other influences on salt marsh ecology, including sediment microorganisms. Bottom panels show the effect of sulfidic soil development.

Impact:

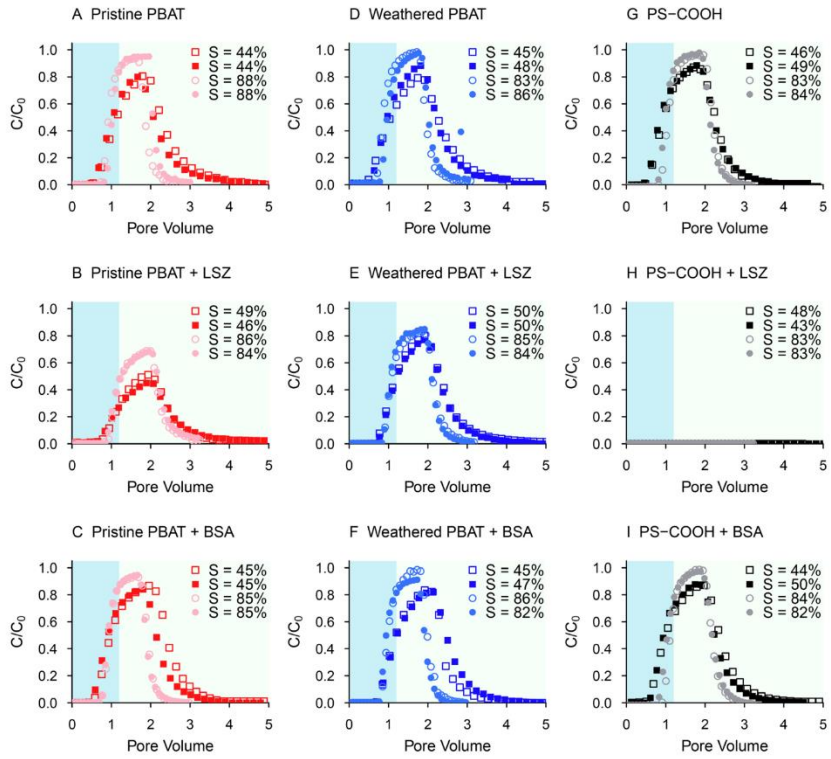
- These studies are taking a holistic approach to wetland restoration, ensuring that conservation efforts for a single species do not impact other aspects of coastal wetland ecology including vegetation, microbes, and carbon cycling.

Environmental fate and transport of biodegradable nanoplastics
Dr. Yingxue Yu

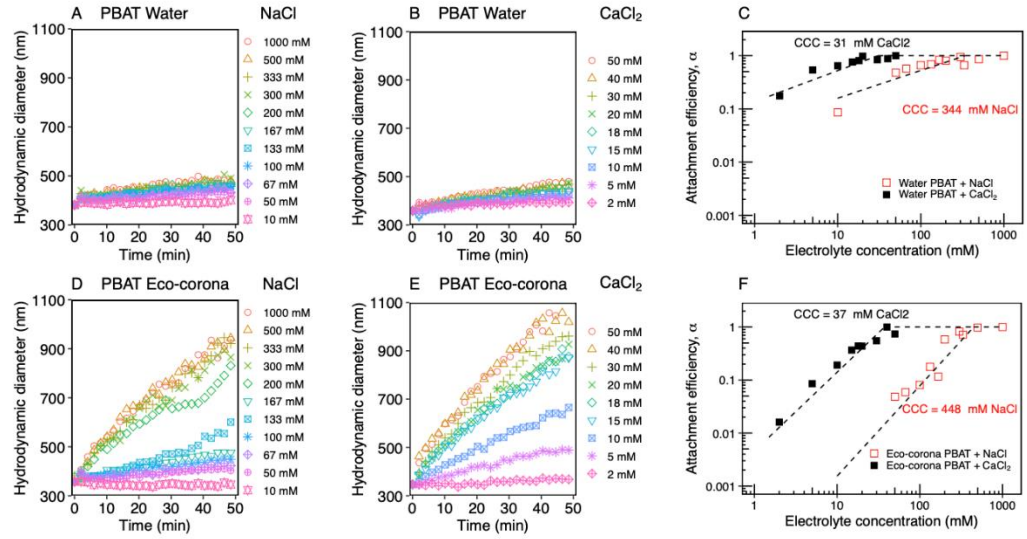
In agriculture, biodegradable plastic mulch has gained significant attention due to its in-situ degradability and satisfying agronomic performance. However, these mulches do not degrade instantaneously; instead, they fragment into micro- and nanoplastics, which can persist in soils or migrate off-site via surface runoff or subsurface water flow. Here, we studied the stability and mobility of biodegradable nanoplastics made from a polybutylene adipate co-terephthalate (PBAT) mulch under various environmental conditions. Stability was assessed with aggregation kinetics in NaCl and $CaCl_2$ solutions, and mobility was evaluated under unsaturated flow conditions in sand columns. Additionally, we examined the effects of soil metabolites, on the stability and mobility of PBAT nanoplastics. Results show that PBAT nanoplastics exhibited greater aggregation in $CaCl_2$ compared to NaCl, with critical coagulation concentrations of 31 mM in $CaCl_2$ and 344 mM in NaCl. Unsaturated column experiments revealed high mobility for both pristine and weathered PBAT nanoplastics, consistent with their high stability observed under low ionic strength conditions (i.e., 10 mM NaCl). Protein interactions affected stability and mobility: negatively charged bovine serum albumin (BSA) and positively charged lysozyme (LSZ) promoted aggregation of pristine PBAT nanoplastics, with LSZ having a more pronounced effect. Correspondingly, LSZ reduced the mobility of pristine PBAT nanoplastics due to its destabilizing effect.

Impact:

- This project provides critical insights into the stability and mobility of biodegradable nanoplastics under realistic environmental conditions, including their interactions with common soil proteins. The findings highlight that even biodegradable plastics can generate nanoplastics that remain stable and mobile in soil systems, indicating a potential for long-range transport and contamination of off-site environments such as groundwater or surface waters. This information is essential for improving risk assessments of biodegradable plastic use in agriculture.
- By demonstrating how ionic strength and protein interactions influence the aggregation and mobility of PBAT nanoplastics, the study informs future design and regulation of biodegradable plastic materials. Manufacturers can use these insights to modify plastic formulations to minimize environmental persistence and mobility, while regulators can use the data to develop guidelines for safe use and disposal of biodegradable plastic mulch in agricultural practices.



Breakthrough curves of nanoplastics under unsaturated flow conditions. PBAT: polybutylene adipate co-terephthalate; LSZ: lysozyme; BSA: bovine serum albumin; PS-COOH: carboxylate-modified polystyrene.



Aggregation profiles and attachment coefficients for PBAT nanoparticles at pH 6.8 to 7. (A,B,C) PBAT nanoparticles with electrolytes in water, in absence of eco-corona solution; (D,E,F) PBAT nanoparticles with electrolytes in presence of eco-corona solution. CCC: Critical Coagulation Concentration.

Understanding the Use, Performance, and Impacts of Soil-Biodegradable Plastic Mulch (BDM) in Agriculture

Dr. Yingxue Yu

This project synthesizes current scientific knowledge and practical insights on soil-biodegradable plastic mulch (BDM) as an environmentally sustainable alternative to conventional polyethylene (PE) mulch in agriculture. The first component, a comprehensive review published in Advances in Agronomy, examines the agronomic benefits, environmental impacts, degradation processes, and economic feasibility of BDMs. It emphasizes that while BDMs offer in-field biodegradability and reduce plastic waste accumulation, they degrade at variable rates depending on polymer composition, environmental conditions, and farming practices. The review also identifies potential risks from micro- and nanoplastic generation and additive release during degradation, underscoring the need for standardized testing, improved formulations, and regulatory guidance.

The second component, a "Frequently Asked Questions" resource, addresses widespread grower concerns regarding the composition, certification, cost, and soil health impacts of BDMs. It confirms that BDMs meeting the EN 17033 standard biodegrade without harming soil ecosystems and can be integrated using existing equipment. However, it also highlights knowledge gaps in long-term soil accumulation, microplastic formation, and regional degradation variability.

Together, these works provide an evidence-based foundation for advancing the sustainable use of BDMs in agriculture, informing both scientific inquiry and practical decision-making. The findings support policy development, certification refinement, and future research into the fate and transformation of biodegradable plastics in agroecosystems.

Impact:

- This project equips farmers, advisors, and policymakers with science-based guidance on the benefits and limitations of soil-biodegradable plastic mulches (BDMs), enabling informed decisions on adopting sustainable alternatives to polyethylene mulch. By clarifying degradation pathways, product certifications, and practical use considerations, the project promotes the responsible transition to BDMs, thereby reducing plastic pollution in agricultural soils.
- The project highlights critical research gaps and performance inconsistencies of BDMs under real-world conditions, informing the refinement of biodegradability standards such as EN 17033 and ASTM D6400. These insights can influence future regulatory frameworks and support the development of improved BDM products that are both environmentally safe and agronomically effective across diverse cropping systems and climates.

OFFICE OF AQUATIC INVASIVE SPECIES

Gregory Bugbee, Dr. Jeremiah Foley IV, Summer Weidman, and Riley Doherty

We are quantifying the locations of aquatic invasive plants in Connecticut's lakes, ponds, and rivers to determine their effects on waterbodies and citizens who use them. We establish baseline data to track their spread and find management strategies that are ecologically sound. The Office of Aquatic Invasive Species (OAIS) was established at CAES through legislation adopted in 2022. OAIS formalizes Connecticut's commitment to protecting its lakes, ponds, and rivers from nonnative species. Invasive aquatic plants disrupt native ecosystems, interfere with recreational use, and reduce property values. Spread by human activities and climate change play a major role in the severity of the problem. A major driver in the formation of OAIS was the CAES discovery of a genetically distinct strain of hydrilla in the Connecticut River. The strain is extremely aggressive and has rapidly engulfed nearly 1000 acres of the river's mainstem, tributaries, and coves. OAIS is charged with (1) coordinating research to reduce duplication of efforts and costs, (2) serving as an aquatic invasive species data repository, (3) performing surveys on the health and ecology of waterways, (4) providing public education, (5) advising municipalities, (6) serving as a liaison among government and private entities, and (7) collaborating with the Connecticut Invasive Plants Council.

Aquatic Plant Surveys

Gregory Bugbee, Dr. Jeremiah Foley IV, Summer Weidman, Riley Doherty

Since 2004, OAIS has completed 420 aquatic vegetation surveys of 261 Connecticut lakes, ponds, and rivers. A total of 77 waterbodies have been resurveyed to determine how invasive plants are changing the quality of lakes and the effectiveness of management practices over time. In fiscal year 2023-2024, the aquatic vegetation was surveyed in three new and 11 previously surveyed waterbodies. Lake Candlewood, Connecticut's largest lake, was surveyed for the 15th consecutive year to determine the effects of deep and shallow winter drawdown and grass carp *(Ctenopharyngodon idella)* on Eurasian watermilfoil (*Myriophyllum spicatum*), minor naiad (*Najas minor*), and curlyleaf pondweed (*Potamogeton crispus*). Nearby Squantz Pond was 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, nitrogen, and phosphorus. These data, along with watershed information, are being used to investigate the factors that influence the susceptibility of waterbodies to individual invasive species. We archived dry specimens of all plant species in the CAES herbarium for future reference. The Office of Aquatic Invasive Species utilizes the latest digital technology to report our findings rapidly and comprehensively to the public. Lake survey maps and other data are published online (https://www.portal.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.

OAIS Lake Surveys 2023/2024

Number	Lake Name	Town	Acres
1	Amos Lake	Preston	112
2	Avery Pond	Preston	36
3	Beseck Lake	Middlefield	116
4	Candlewood Lake	Danbury	5064
5	Chestnut Hill Reservoir	Wolcott	65
6	Lake Elise	Middlebury	16
7	Fence Rock Lake	Guilford	17
8	Great Hill Pond	Portland	76
9	Lower Guilford Lake	Guilford	15
10	Upper Guilford Lake	Guilford	5
11	Hidden Lake	Higganum	39
12	Lake Housatonic	Derby	347
13	Pachaug Pond	Griswold	817
14	Squantz Pond	New Fiarfied	266
15	Lake Wononpakook	Salisbury	167

The most common invasive plants are Eurasian watermilfoil, variable watermilfoil (*Myriophyllum heterophyllum)*, minor naiad, curlyleaf 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 from 2010 to 2013 found the population expanding. We have since found Brazilian waterweed in Lower Moodus Reservoir (East Haddam), Staffordville Reservoir (Stafford Springs), Dogwood Lake (Trumbull), and Mono Pond (Coventry). We tested the efficacy of a CT DEEP approved herbicide in Fence Rock Lake and eliminated the plant for several years but observed regrowth in 2021. We have surveyed Amos Lake from 2006 - 2022 to document changes in aquatic vegetation over time and the effectiveness of recent management with herbicides. Our surveys found that invasive variable watermilfoil had been eliminated without reducing aquatic plant diversity.

OAIS scientists obtaining hydrilla samples from a boat launch in East Twin Lake. Genetic tests confirmed this to be the first known population of Connecticut River in a lake.

Hydrilla is a destructive invasive aquatic plant in many southern states. Following reports of the plant occurring in the Connecticut River, a task force led by the OAIS was formed. Comprising over 30 experts from throughout the northeast, the task force performed preliminary surveillance of the river from central Vermont to southern Connecticut in 2018. Hydrilla was not found in New Hampshire or Vermont and the first sightings were just north of the Massachusetts/Connecticut border. Traveling south, hydrilla became common, creating large dense stands between Hartford and East Haddam. OAIS surveyed hydrilla and other invasive plants in the Connecticut portion of the river and found nearly 1000 acres of hydrilla. It often formed dense stands that spread out on the surface clogging marinas and making coves and tributaries impassible. Of greater concern is changes to the natural aquatic ecosystem. Many valuable and rare species such as bald eagles, sturgeon, and shad call the river home. Menhaden, often called "the most important fish in the sea," utilize the river to grow prior to moving out to sea. The hydrilla found in the river is more robust than seen elsewhere in Connecticut. OAIS performed genetic tests on the Connecticut River hydrilla and found it to be a different strain than previously found in North America. This could mean the plant has an enhanced ability to spread, harm aquatic ecosystems, and resist current control practices. Movement of the CT River hydrilla to lakes and ponds via propagules on trailered boats and wildfowl is of utmost concern. By June 2024, OAIS confirmed that CT River hydrilla had spread to ten CT lakes and ponds including Amos Lake, Bashan Lake, Middle Bolton Lake, Pachaug Pond, and Lake Pocotopaug.

Impact:

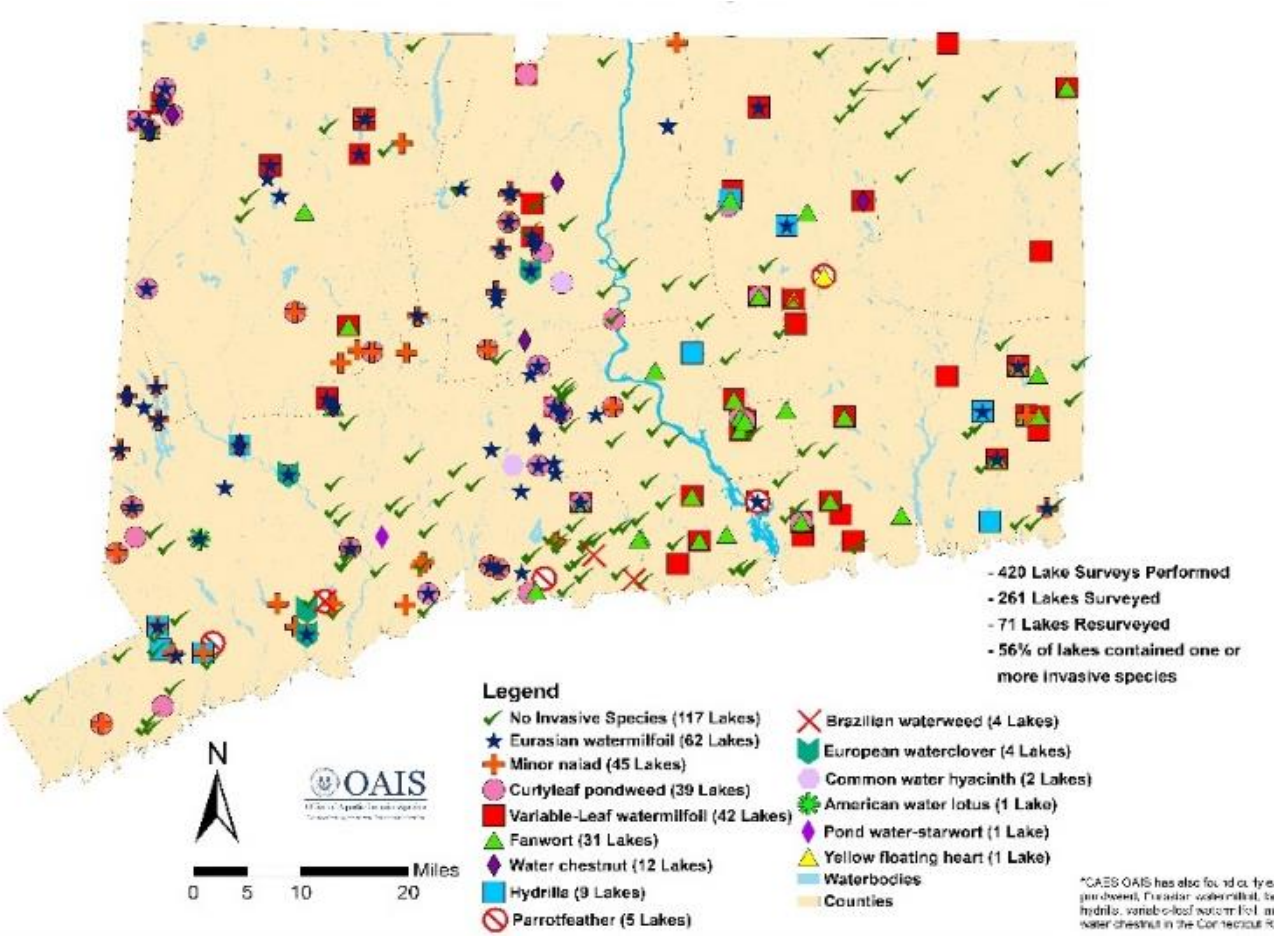
- Aquatic plant surveys document current aquatic ecosystems and can track changes over time.
- Early detection of new invasive aquatic plant populations can promote rapid response before a larger problem develops that requires costly management.
- Management options are often dictated by the overall plant community documented by surveys.

Northern Hydrilla (*Hydrilla verticillata* ssp. *lithuanica*): Discovery and Establishment Outside the Connecticut River

Dr. Jeremiah R. Foley IV, Summer E. Weidman, Riley Doherty, Nicholas P. Tippery, and Gregory J. Bugbee.

This research documents the spread and establishment of northern hydrilla (*Hydrilla verticillata* ssp. *lithuanica*) from the Connecticut River into other waterbodies in Connecticut and Massachusetts. Following its initial discovery in the Connecticut River, surveys from 2017 to 2019 found hydrilla covering over 850 acres across 70 miles of river. In 2023, eight new sites were surveyed after reports of hydrilla outside the river. Genetic analyses confirmed that 75% (n = 6) of the new infestations were northern hydrilla and 25% were wandering hydrilla (H. verticillata ssp. peregrina). Most infestations occurred near public or private boat ramps, implicating watercraft movement as the primary vector of spread. The study

Aerial view of Connecticut River hydrilla in the Mattabesset River in August 2022. The OAIS survey boat is in the foreground.



Locations of invasive aquatic plants found by OAIS from 2004 – 2024.

included East Twin Lake, Amos Lake, Middle Bolton Lake, Lake Pocotopaug, Congamond Lakes, and Pameacha Pond, with some infestations near high-use fishing tournament sites.

Distribution of *Hydrilla verticillata* subsp. *lithuanica* in the Connecticut River and the six new infestations in waterbodies within or bodering Connecticut, US

Impact:

- Northern hydrilla (*H. verticillata* ssp. *lithuanica*) is rapidly expanding beyond the Connecticut River, threatening native aquatic ecosystems.
- Recreational boating, especially fishing tournaments, likely serves as a major vector for spread.
- Increased monitoring and stricter decontamination protocols at boat ramps are critical to limit further spread of this highly invasive subspecies.

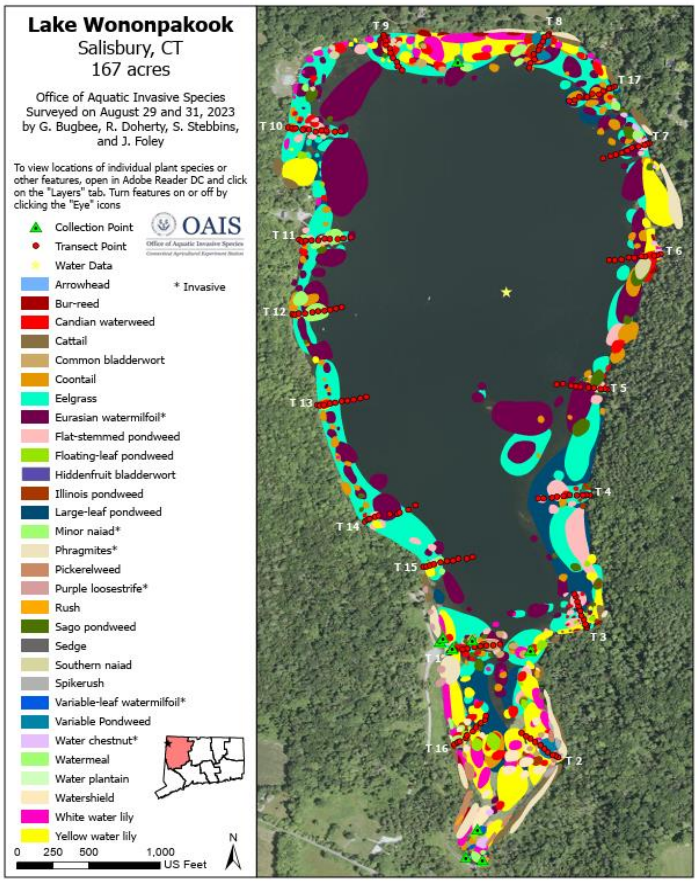
Aquatic Plant Management

The goals of OAIS aquatic plant management studies are to 1) research novel means of control that minimize herbicide usage and protect native vegetation and 2) investigate non-chemical management options such as winter water level drawdown and biocontrol. Continued monitoring and adaptive management are critical for balancing invasive species control with native vegetation conservation.

1. Herbicides.

Gregory Bugbee, Dr. Jeremiah Foley IV, Summer Weidman, Riley Doherty, United Sates Army Corps of Engineers

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



Aquatic plant survey map of lake Wononpakook in Salisbury,


Keeney Cove being treated for hydrilla and water chestnut with herbicide plus tracer dye (left). Keeney Cove two months after treatment (right).

Connecticut River – Large scale control of hydrilla may require targeted herbicide applications. Treating a large tidal river with high flow rates and numerous state listed species requires considerable preliminary research. The United States Army Corps of Engineers in collaboration with OAIS conducted dye studies in 2023 at several CT River sites targeted for herbicide demonstration trials in 2024. This quantified offsite movement, and retention time to optimize dosage. In June 2024, the first test with ProcellaCOR occurred in Keeney Cove with promising results.

Bashan Lake, East Haddam – We are in the 22nd year of research on the use of spot applications of herbicides to control variable watermilfoil in Bashan Lake. In collaboration with the Bashan Lake Association, the Town of East Haddam, we have largely restored the lake to preinfestation conditions. Unfortunately, invasive fanwort (*Cabomba caroliniana*) has now taken hold in the lake. OAIS performed targeted treatments in September 2023 with the herbicide flumioxazin and surveys in June 2024 found none remaining.

Impact:

- Herbicides can effectively manage aquatic invasive vegetation and improve native plant communities.
- OAIS research determines efficacy and effects on nontarget plants to promote use in an ecologically sensitive manner.

2. Winter water level drawdown and grass carp

Dr. Jeremiah R. Foley IV, Summer E. Weidman, Min Lin (UCONN), Neil Stalter (Candlewood Lake Authority), Laurence Marsicano (Candlewood Lake Authority), Joe Cassone (CTDEEP), and Gregory J. Bugbee

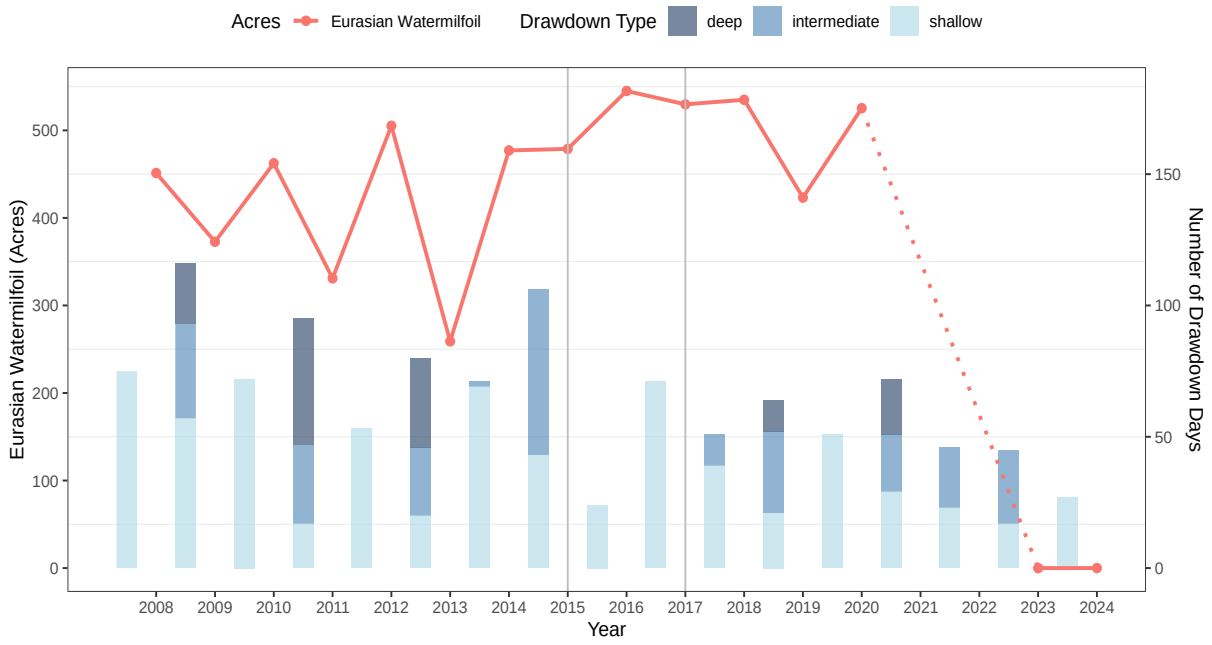
Total area (in acres) of Eurasian watermilfoil from 2008 to 2024. The stacked bars represent the type of drawdown implemented each year: deep (dark blue), intermediate (medium blue), and shallow (light blue). The right y-axis shows the number of drawdown days, indicating the duration of drawdowns for each year.

This research evaluated the effectiveness of winter water level drawdown and triploid grass carp in controlling Eurasian watermilfoil in Candlewood Lake and Squantz Pond. Vegetation surveys conducted from 2008 to 2024 tracked the aquatic plant community, with biomass modeling and regression analysis used to assess management outcomes. Winter drawdown effectiveness has declined over time due to delayed initiation that reduced the period with freezing conditions. Modeling indicates that earlier drawdowns could increase freezing exposure by 100 to 200 percent, potentially improving milfoil control in a warming climate. Grass carp introduced in 2015 and 2017 were associated with a dramatic decline in Eurasian watermilfoil coverage from over 500 acres to zero. However, native plant richness also declined, particularly in shallow zones where carp foraging pressure is highest. Statistical modeling identified grass

carp biomass, freezing-day exposure during drawdowns, and depth as significant predictors of macrophyte abundance.

Impact:

- Grass carp and water level drawdowns are effective in reducing Eurasian watermilfoil, but their combined use also reduces the native aquatic plant community.
- Earlier initiation of winter drawdowns could improve efficacy.
- Continued monitoring and adaptive management are critical for balancing invasive species control with native vegetation conservation.



3. **Benthic barriers—Lake Quonnipaug, Guilford; Bashan Lake, East Haddam; Lake Beseck, Middlefield; and the Connecticut River.** Benthic barriers are 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 typically placed over weed beds early in the growing season and removed in the fall. Research is needed to test if benthic barriers can be effective if they are placed over weeds for only a few weeks and then moved to another location or removed. To test this, we collaborated with the Towns of Guilford and Middlefield and placed benthic barriers at the Lake Quonnipaug and Lake Beseck public beaches. The beaches had problems with Eurasian watermilfoil and other invasive aquatic plants. We placed the benthic barriers in April and removed them within two months. In the Connecticut River, we tested short term placement of benthic barriers to control hydrilla which hindered navigation at Portland Boat Works. The results are promising with little vegetative regrowth throughout the summer. We are also 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 barriers installed at Portland Boat Works.

Impact:

- This research has proven that short term placement of benthic barriers offers an alternative to herbicides in localized areas.

4. **Outreach.**

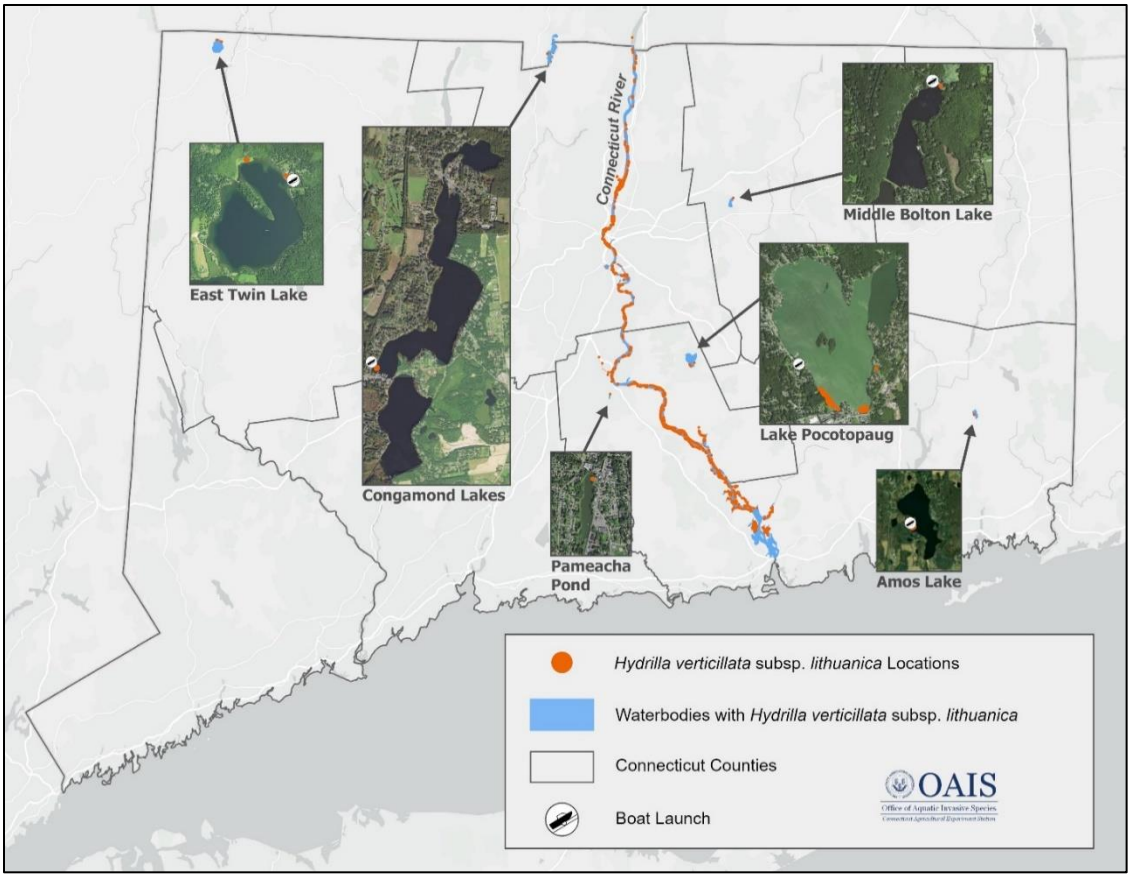
We disseminate information from our program to the public in a timely fashion and educate stakeholders in the identification, prevention, and management of invasive aquatic species. We make every effort to engage citizens, lake associations, government officials, and other stakeholders. OAIS scientists have organized several workshops on the identification of invasive aquatic plants. We also have given presentations to professional organizations such as the Northeast Aquatic Plant Management Society, the North American Lake Management Society, and the Federated Garden Club. In addition, CAES OAIS staff speaks to numerous lake associations, town meetings, and student groups. We have made our information freely and readily available via our website. Included are digitized interactive lake maps, our herbarium, and publications (https://www.portal.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 to prevent future problems and the associated control expenditures.

Northern Hydrilla (*Hydrilla verticillata* ssp. *lithuanica*): Discovery and Establishment Outside the Connecticut River

Dr. Jeremiah R. Foley IV, Summer E. Stebbins, Riley Doherty, Nicholas P. Tippery, and Gregory J. Bugbee. Funded by the Connecticut Agricultural Experiment Station Office of Aquatic Invasive Species (CAES OAIS).

The main objective of this research is to document the first spread and establishment of northern hydrilla (*Hydrilla verticillata* ssp. *lithuanica*) from the Connecticut River into other waterbodies in Connecticut and Massachusetts. Following its initial discovery in the Connecticut River, surveys from 2017 to 2019 found hydrilla covering over 344 hectares across 113 kilometers of river. In 2023, eight new sites were surveyed after reports of hydrilla outside the river. Genetic analyses confirmed that 75% (n = 6) of the new infestations were northern hydrilla and 25% were wandering hydrilla (H. verticillata ssp. peregrina). Most infestations occurred near public or private boat ramps, implicating watercraft movement as the primary vector of spread. The study included East Twin Lake, Amos Lake, Middle Bolton Lake, Lake Pocotopaug, Congamond Lakes, and Pameacha Pond, with some infestations near high-use fishing tournament sites.

OAIS hosts an aquatic plant camp at the Avery Point UCONN Campus.



Distribution of *Hydrilla verticillata* subsp. *lithuanica* in the Connecticut River and the six new infestations in waterbodies within or bodering Connecticut, US

Impact:

- Northern hydrilla (*H. verticillata* ssp. *lithuanica*) is rapidly expanding beyond the Connecticut River, threatening native aquatic ecosystems.
- Recreational boating, especially fishing tournaments, likely serves as a major vector for spread.
- Increased monitoring and stricter decontamination protocols at boat ramps are critical to limit further spread of this highly invasive subspecies.

Evaluation of *Laricobius* Species as Biological Control Agents for Hemlock Woolly Adelgid
Ashleigh P. Hillen, Dr. Jeremiah R. Foley IV, Dr. Aaron D. Gross, Dr. Albert E. Mayfield III, Dr. Jacob Williams, Dr. Kang Xia, Dr. Scott M. Salom, Thomas J. McAvoy, Dr. Steven D. Barnett, Ryan Mays, Andrew Dechaine. Funded by the USDA Forest Service Forest Health Protection

The main objectives of these studies were to evaluate the effects of imidacloprid soil treatments on the subterranean survivorship of *Laricobius* spp., biological control agents for hemlock woolly adelgid (HWA), and to assess the predation and fecundity rates of *Laricobius* species under laboratory conditions. Field studies demonstrated that recent soil drench and tablet applications of imidacloprid significantly reduced *Laricobius* adult emergence after one year but not after two years, while soil injection posed the least risk. Laboratory studies showed that *Laricobius osakensis* and *Laricobius nigrinus* consumed significantly more HWA than the native *L. rubidus* and produced higher numbers of eggs, with *L. osakensis* predicted to have the greatest population-level impact on HWA suppression. Larval predation rates were similarly high across all species, but adult performance varied. These results inform integrated pest management (IPM) strategies that combine chemical and biological controls for HWA.

Impact:

- Soil injection of imidacloprid is less disruptive to *Laricobius* subterranean survivorship compared to drench or tablet applications.
- *Laricobius osakensis* demonstrates the greatest potential among evaluated species for reducing HWA populations through higher feeding and fecundity rates.
- Timing of biological control agent releases relative to chemical treatments is critical to maximize establishment and efficacy of *Laricobius* spp. in HWA management programs.

DEPARTMENT OF PLANT PATHOLOGY AND ECOLOGY

The Department of Plant Pathology and Ecology is led by Vice Director and Chief Scientist, Dr. Lindsay Triplett, and has had six research scientists and one active emeritus scientist who were supported by one full-time technician. The Plant Disease Information Office serves the citizenry and agricultural industries of Connecticut and provides vital support to other Connecticut state agencies and CAES departments. The department maintains active cutting-edge research programs that address important disease problems caused by bacterial, fungal, nematode, and viral pathogens of crops and trees important to Connecticut while also addressing national and international issues.

Characterize a disease resistant apple variety.

During the survey of a collection of apple varieties from the Cornell apple germplasm, and heirloom apple varieties, we identified an apple cultivar that is resistant to fire blight. When inoculated with *Erwinia amylovora*, flowers dried and fell off, displaying a hypersensitive response. More then 30 different *E. amylovora* strains from all three major phylogroups all suggests disease resistance phenotype. Grafts were made thanks to Joe Liquori which allowed growth chamber research to determine the effector protein in *Erwinia amylovora* triggered the disease resistance in the host. Mutation of one of the T3 effector genes, eop1, caused the pathogen to gain virulence on this disease resistant apple variety, but not fully restoring the total virulence, suggesting this effector acts as an avirulent factor in this host-pathogen interactions although this resistance could be muti-locus. Further research in characterizing the resistance protein in the host that interacts with the avirulent protein is on going through co-IP experiment.

Figure. Fire blight resistance apple cultivar showing a healthy apple fruit next to an infected flower that is dried and fell off from the flower cluster.

Impact: Although fire blight tolerance has been reported, true fire blight resistance in apple has never been reported before. Identifying this resistance cultivar will allow the identification of resistance gene in the host, therefore, has potential to breed new disease resistant apple cultivars. The current cultivar also has value to be directly adopted by growers who do not have a need to store apples long term, especially the organic growers.

Identify yeast-like fungi on apple flowers that induces host immunity and use them to control fire blight

Microbiome on plants is well recognized for its potential to influence plant disease occurrence through impacting the pathogen-host interactions. Fire blight, caused by a bacterial pathogen *Erwinia amylovora*, is a devastating disease of apple and pears. Blossom blight stage of fire blight infection, in which *E. amylovora* multiplies epiphytically on flower surfaces such as stigma and stamen, prior to entering host through the hypanthium, is a critical step of the disease cycle. Previous research investigating the function of microbiome on fire blight mostly focused on the microbiome-pathogen interactions, however, to what extent the microbiome interacts with the host, and whether/how such interactions influence disease outcome is less understood. This year we increased our culture collection of yeasts to 1583 yeasts isolates have been

obtained. We further developed a 96 well plate assay to screen these yeasts for their ability to induce PR2 gene in Arabidopsis, which removed the seasonality of this research and increased the efficiency of the screening. The selected yeasts were further confirmed for the immune induction by spraying to apple flowers. 46 yeast isolates were identified for the strong induction for the expression of *PR-1* and *PR-2*. One of the lab members also developed a PEG mediated T-DNA mutagenesis of some of the candidate yeasts to functionally characterize the mechanism for the plant immune induction in such yeasts. f

Figure. Different yeast species isolated from apple, crab apple and pear flowers collected in CT and OR.

Impact: This research improved our understanding of the immune induction function of the plant microbiome. It also provides valuable disease management tools for fire blight, especially for organic apple productions as antibiotic use was banned since October 2014. Information gained in this project has yielded a scientific paper in Phytopathology. Relative information was also summarized into a trade journal article (Good Fruit Grower) and is disseminated to apple growers nation-wide. A USDA-NIFA grant was funded to further support this line of research, and one research article (Mukhtar et al.) was submitted to Environmental Microbiology.

Quorum Sensing Mediated Bacterial Interspecies Communication in Soybean Rhizosphere

Rhizosphere harbors a diverse group of microbes including bacteria belonging to different species and families. These diverse bacteria co-colonize in the same ecological niche, prom the questions whether and to what extent bacteria of different species communicate with each other, and what biological consequence it confers to the plant fitness and health. Quorum sensing (QS) is an important microbial communication method in which bacteria produce diffusible auto inducer signaling molecules to the environment and can be perceived by QS receptors and alter gene expression once its concentration is above a threshold. Most research on QS focused on its function in controlling bacterial behavior within a single species and there is a knowledge gap whether bacteria belonging to different families and species can communicate through QS. Using shotgun metagenomic sequencing, we identified that several QS systems such as AHL, HSQ, and COM class in soybean rhizosphere. Interestingly, the detected QS systems is enriched in rhizosphere as compared to the bulk soil, suggesting that plants are recruiting bacteria with QS to colonize on them. Using analytical approaches, a diverse group of AHL molecules were identified within soybean rhizosphere, including C4, C6, C8-AHL and 3-oxo-C8, 3-oxo-C10-AHL which are also enriched in soybean rhizosphere as compared to bulk soil. LC-HRMS analysis and genome sequencing of individual bacterial strains isolated from the soybean rhizosphere identified both AHLs and QS genes that are shared among bacteria (such as C4, C6 and C8, LasI, RhlI, PhzI, CepI and TofI genes) and AHLs and QS genes that are unique to individual species and strains (such as 3-oxo-C12 and CinI, EsaI and PqsH genes). Finally we showed that AHL producing bacteria *Pseudomonas* LFS074 and *Burkholderia* LFS061 with C6, C8 and C14-AHL molecules induced the phosphate solubilization and siderophore production in AHL negative strains Bacillus LFS077 and LFS086. Community structure analysis suggests the inoculated microbes are indeed colonizing the soybean roots. Findings from this study suggest that bacteria of different species indeed communicate with each other through QS, and such communication may have important implications to plant growth and fitness.

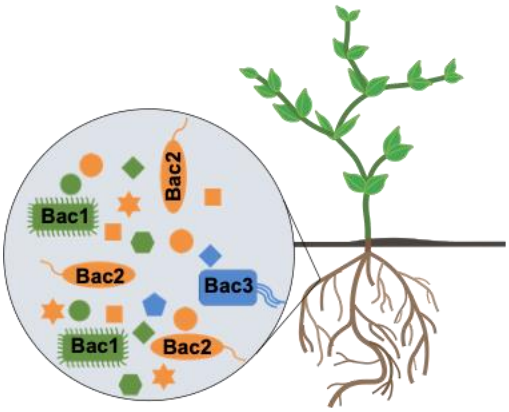


Figure. Illustration of QS in rhizosphere bacteria.
Impact: This research provided evidence suggesting that bacteria belonging to different groups, sharing the same environmental niche, can communicate to each other through quorum sensing. By supplying the matching QS signals, we are able to enhance the plant growth promotion traits of the beneficial microbes.

Da Silva Lab:
Tunable release of dsRNA molecules into plants from sustainable nanocarriers: A novel management tool for viral pathogens
Investigators: Washington da Silva, Nubia Zuversa-Mena, and collaborators from the University of Minnesota
Summary: Plant viruses cause an estimated $30 billion in crop loss every year worldwide and there is no viricide available for direct control of these pathogens. Scientists at CAES have identified specific ribonucleic acid (RNA) molecules that induce RNA interference (RNAi), an evolved plant defense mechanism that we are seeking to activate or enhance, in plants and this can prime plants to successfully resist viral diseases. As part of a USDA-NIFA grant of $636,000.00 recently awarded by our research group, CAES scientists are now working on developing a delivery system for these RNA molecules to protect crops against these devastating pathogens.
Impact: The results from this research have the potential to change the way we protect plants and to create sustainable plant virus disease control strategies that will help to mitigate crop losses due to virus diseases in CT potato farms. We have designed and synthesized several nanoparticles to act as nanocarriers for the sustainable delivery of dsRNAs to suppress plant virus infections in plants (Fig. 1) and are now testing their efficacy in protecting crops in the greenhouse and in field experiments.

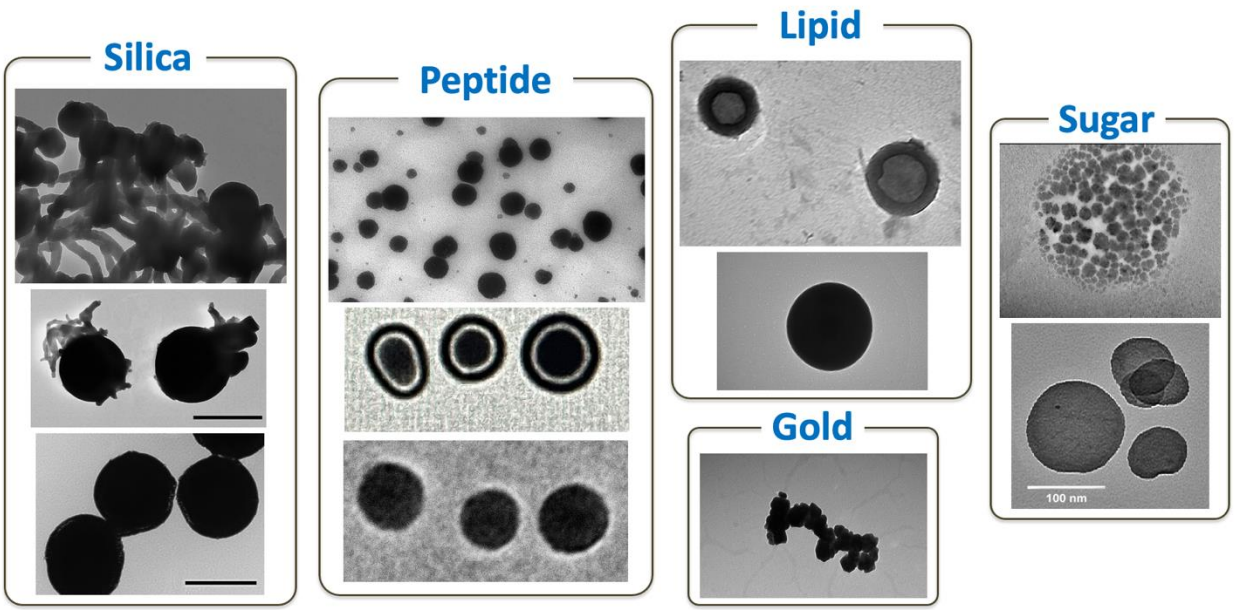


Figure 1 – Transmission Electron Microscopy (TEM) images of the nanocarriers of nucleic acid developed in the da Silva Lab for plant viruses control strategy.

Testing siRNA molecules to control PVY infections

Investigator: Washington da Silva

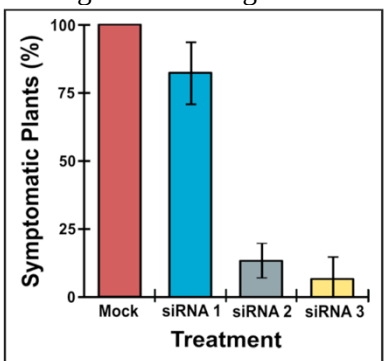


Figure 2. Percentage of symptomatic plants (n=10) post treatment with siRNAs (from 3 different PVY-genomic regions). Infected plants displaying PVY symptoms were treated with siRNAs and evaluated 2 weeks later for further PVY symptoms expression. 90% of plants treated siRNA 3 recovered from the viral infection.

Summary: Potato virus Y (PVY) is the major virus pathogen of potatoes and there is no viricide available to manage PVY infections in the field. In an effort to develop a viricide to efficiently control PVY in the field, the da Silva lab team is testing several small interfering RNA (siRNA) molecules as antivirals. These molecules induce RNA interference (RNAi) mechanism in plants that result in the control of the target virus.

Impact: Our effort has already yielded some positive results. We discovered a few siRNA molecules that when sprayed in tobacco plants (a lab host for PVY testing) protect the plants against PVY infection (Fig. 2). We are characterizing these molecules for further studies and to potentially develop an antiviral formulation for practical application.

Test dsRNA molecules to control fusarium infection on melon and watermelon plants.
Investigator: Washington da Silva
Summary: Fungal pathogens are one of the major threats to food production worldwide, accounting for an estimated loss of over US$200 billion annually, directly impacting global food security. The current strategies to manage fungal diseases are based, largely, on the use of chemical fungicides, host resistance, and cultural practices such as crop rotation. However, pathogens can develop resistance to fungicides over time and the indiscriminate use of agrochemicals has led to severe negative environmental impact, especially causing harm to humans and non-target organisms. The da Silva Lab group is working on developing a dsRNA-based technology to help provide sustainable alternatives for fungal disease control.
Impact: We will screen several dsRNA molecules that were synthesized from the *Fusarium oxysporum* genome. The goal is to pinpoint locations in the fusarium genome that can be used for the suppression of this group of pathogens in vitro and in vivo (melon plants) to create a biocompatible fungicide that can be easily adopted by growers worldwide. This is a project in collaboration with Prof. Marcia Michelle de Ambrosio (UFERSA – Brazil).

Forest Health Monitoring
Oak Wilt (Marra Lab)
Oak wilt, a devastating vascular wilt disease that kills trees in the red oak group (red oak, scarlet oak, black oak, pin oak, bear oak, in Connecticut) within a single season, re-appears regularly in nearby parts of New York State (Brooklyn, Long Island). Caused by the ascomycete fungus, *Bretziella fagacearum*, oak wilt remains an imminent threat to Connecticut's urban, suburban, and natural forests. Dr. Marra has assumed responsibility for monitoring for oak wilt in Connecticut. Because symptoms of the disease, characterized by rapid crown dieback and, in some cases, premature defoliation, can be easily confused with other biotic and abiotic factors, a proper and complete diagnosis of oak wilt must be completed in the laboratory, involving attempts to culture the fungus from properly collected material, as well as DNA extraction and PCR. The fungus spreads rapidly via root grafts and is easily vectored by native sap beetles, making timely diagnosis essential, should *B. fagacearum* be confirmed. Standard practice for regulatory response and intervention in currently affected states, ensconced in state law, involves removal and delimitation; Connecticut currently has no such regulatory response protocols in place. Dr. Marra continues to educate the public about oak wilt, through presentations to, and interactions with, landscape and tree-care professionals, tree wardens, and those enrolled in Master Gardener classes.
Impact: Oak wilt is a devastating disease that threatens Connecticut's abundant stocks of trees in the red oak group. Based on the trajectory of outbreaks in neighboring New York state, the disease is most likely to turn up in residential areas, which makes scouting and surveys futile. We are therefore dependent on the informed vigilance of tree-care professionals, which includes arborists, tree wardens, and other landscape managers. Also essential is the ability of the CAES staff to act quickly in diagnosing and confirming the presence of *Br. fagacearum*, and communicating this to the state's DEEP, which will be responsible for developing a response protocol, such as those now established in New York, Minnesota, Wisconsin, and other states dealing with this lethal and easily spread disease. This past year, Dr. Marra responded to six email queries about oak wilt; photographs and descriptions were ample evidence that these were not oak wilt.

Beech Leaf Disease (Marra Lab)
First found in Connecticut in 2019 on American beech (*Fagus grandifolia*) in lower Fairfield County, by 2021 beech leaf disease (BLD), caused by the foliar nematode, *Litylenchus crenatae mccannii* (*Lcm*), was confirmed in all eight CT counties. Dr. Marra continues to receive, and respond to, phone and email inquiries from CT stakeholders, including tree-care professionals. Through interviews with print, radio, and television media, press releases, and public presentations, Dr. Marra continues to educate the Connecticut public regarding this disease. Through a cooperative agreement with the USFS, Dr. Marra installed 11 long-

term BLD monitoring plots in 2020 that conform to a plot design implemented in all states cooperating in the plot network. Dr. Marra's CT plots are distributed throughout the state and in all 8 counties, and are re-measured by Dr. Marra annually following protocols standardized by the USFS, which is the recipient and user of these data. Beech leaf disease in the spring of 2024 was not substantially different – neither worse nor better – than in 2023, with large areas of understory beeches flushing few or no leaves due to aborted buds; what few leaves did flush were heavily symptomatic, predominately shrunken, curled, and heavily necrotic. Overall, BLD in New England and New York has been found to be more widely distributed, and of greater severity, than the disease's earliest manifestations, in 2012-2015, in Ohio, western NY and PA, and Ontario, CA. The severity has elicited an outpouring of public inquiries and concerns, many of which have been directed to Dr. Marra, requiring many hours of time spent responding. Additionally, Dr. Marra was interviewed by various local media, which helped to educate the public about BLD. Since 2019, Dr. Marra has been an active and contributing member of the Beech Leaf Disease Working Group, comprising researchers from throughout the affected region. This past year much progress has also been made in planning an expedition to Japan, funded by the International Programs Division of the USFS, for the months of September and October 2024, to study the pathosystem there, and to survey for and collect nematode specimens for DNA fingerprinting. Collaborators – nematologists and pathologists – in Japan have been engaged in solidifying the expedition's itinerary and logistics.

For purposes of studying pathways of spread, and the origin, of the BLD nematode, Dr. Marra developed a DNA fingerprinting system for Lcc/Lcm, through the identification of 18 candidate microsatellite loci using a whole-genome sequence obtained from Lcm the previous year. The focus for the past year has been on optimizing the fingerprinting system for efficient high-throughput genotyping. After screening these 18 loci against a collection of nematodes from various parts of the current BLD distribution, two loci were omitted, resulting in 16 loci being used in four multiplexed sets of four loci each. During this past year, Dr. Marra generated a hierarchically structured meta-population sample consisting of 32 nematodes from each of 31 long-term BLD monitoring plots. From each plot, beech buds were collected from September through November from symptomatic beech saplings at each of the four cardinal microplots along the perimeter of the plots; Dr. Marra collected samples from nine plots in CT and three plots in MA, and cooperators and colleagues collected the remaining plot samples. Eight nematodes were isolated from one bud from each of the four cardinal microplots, constituting the 32 nematodes for the plot, and representing the ostensibly maximal genetic diversity at that plot. After single-nematode DNA extractions, DNA was verified using a cytochrome oxidase (CO1) qPCR assay, then used in two rounds of multiplex PCR to generate 16-locus genotypes ("fingerprints") for each of the 864 nematodes. Colleagues in Japan collected *F. crenata* buds from trees exhibiting typically mild symptoms from three locations all within the central Chubu region, approximately 250 km apart from each other: Niigata, Nagano, and Shizuoka (Figure 1). Prior to shipping, buds were fixed in DESS to kill and preserve nematodes. Buds were sampled similarly to those from North American plots, to generate a collection of 178 nematodes from these three regions. DNA was extracted and processed as for the North American nematodes. The contrast between the extremely high allelic diversity at all 16 loci in the Japanese samples, and the very low allelic diversity among the North American samples, as shown in Table 1, supports the hypothesis that the appearance of the BLD nematode in North America represents a severe population "bottleneck," resulting for one or several recent introductions. It should be noted that the Japanese sammple is not representative of the extent and range of the nematode and F. crenata in Japan. Dr. Marra has been using DNA extracted from both North American and Japanese nematodes to sequence the entire 1,722 base-pair mitochondrial cytochrome oxidase gene (CO-1) to determine the extent of differentiation between the Japanese and North American subspecies. The process has been encumbered by efforts to identify PCR primers that will amplify and sequence reliably in both populations of the nematode, but progress has been made, and this project is nearing completion. The results so far indicate limited allelic diversity, in the form of single-nucleotide polymorphisms (SNPs) among Japanese nematodes, while all North American nematodes share a single CO-1 genotype.

Impact: Beech leaf disease is shaping up to be one of the most devastating tree diseases in the past century, ranking with chestnut blight, beech bark disease, and emerald ash borer as generating fundamental changes to forest ecology and forest structure. Understanding the fundamental nature of the nematode's ability to

exert such damage on American beech, compared to the ability of Japanese beech – as well as, apparently, some cultivars of European beech – to stave off the worst effects of the nematode, will be the focus of our studies.

Figure 1: BLD nematodes from Japan, in 2023, came from three areas in the Chubu region of Japan: three trees from Nagano; five trees from Niigata; and nine trees from Shizuoka.

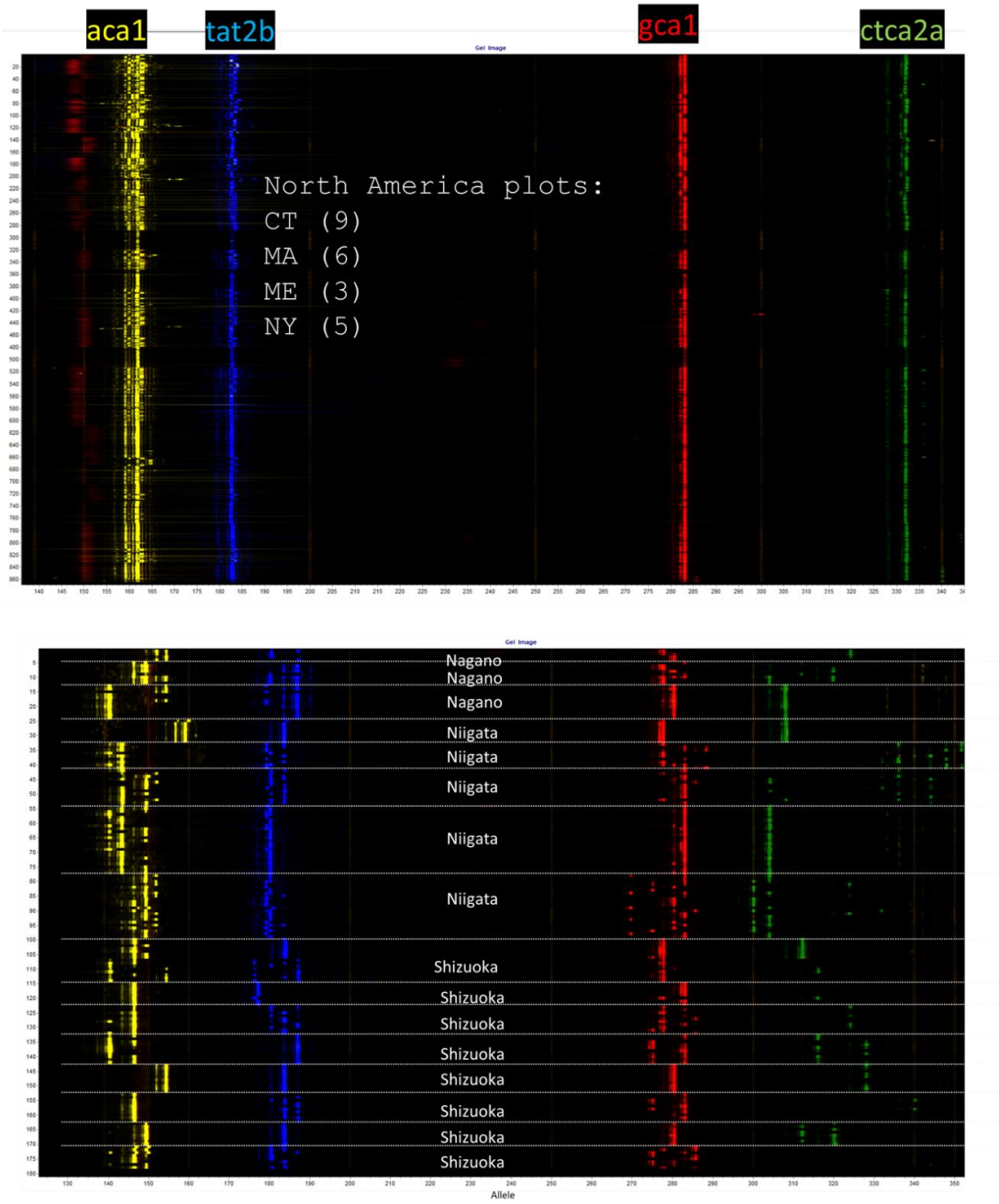


Figure 2: DNA fingerprints at 4 loci (multiplex group 2). Upper panel shows the genotypes of 864 nematodes from long-term BLD monitoring plots in CT, MA, ME, NY, and PA. Lower panel shows genotypes of 178 nematodes from trees (separated by dotted lines) from three areas in the Chubu region of Japan. Note the limited number of alleles in North America compared to the high allelic diversity in this small region of Japan.

Table 1: Alleles at each of the 16 microsatellite loci used to DNA-fingerprint beech leaf disease nematodes from North American and Japan. Numbers in cells are the lengths, in nucleotides, of the PCR amplicons, and typically vary in length by the number of microsatellite-motif repeats.

mpx2								mpx3								mpx4								mpx5							
tat2b		ctca2a		aca1		gca1		ttc2		agc4		agaa1		ttg1		agtg1		tat3b		agc2		tca1		aga1		ctg1		caa1		tgt2	
NA	Japan	NA	Japan	NA	Japan	NA	Japan	NA	Japan	NA	Japan	NA	Japan	NA	Japan	NA	Japan	NA	Japan	NA	Japan	NA	Japan	NA	Japan	NA	Japan	NA	Japan	NA	Japan
	177		300		140		270		NA		359		108		290		107		204		185		331		269		292		151	334	
	181		304		143		275				362		112		293		111		210		188	337	337		272		295	154	154	343	343
184	184		312		147		278				367		116	298	295		113		212		191		341		274		298		156		346
187	187		316		149		280			370	370		128	300	300		116		214		195		344		276		301		159		352
			320		152	283	283			373	373		132	302	302		120		217	198	198		346		277		304		161		355
			324		154	286	286			376	376		136		305		124		221		201		349	279	279		307		164		358
		328	328	159	159		288				378	140	140				128		224	203			352	282		310	310				361
		332	332	163						382		144	144			133	133	227	227				355			313	313				364
		336	336	165								148	148			137	137	234					358			316	316				367
		340	340	169								152	152			141	141		241				361				319				370
		344	344	171									155			146	146		244				367				322				373
			348										158				148		247				381				325				375
			352										160				150		250				410								
			367										162				152		253				449								
			371										166				164		317				496								
			375										168				172		326												
			379										169				177														
			382										186				181														
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Rocha Lab

Development of two species of root-knot nematodes in response to temperature

Investigators: Raquel Rocha and collaborators from the Federal University of Ceara, Brazil

Summary: Each year, plant parasitic nematodes (PPNs) cost the global economy roughly $173 billion and account for up to 13% of losses in crop production. Out of the numerous PPNs that can harm crops, the root-knot nematode (RKN, *Meloidogyne* spp.) is the most harmful soilborne pest found in U.S. soils. Managing RKN is challenging because the group comprises over 100 species and races, has a broad host range of more than 5,000 plant species, and is widespread across temperate and tropical climates. Once established in a field, it is nearly impossible to eradicate the nematode. In the U.S., RKN is widely prevalent, and species distribution is determined by the ability of the nematode to successfully overwinter in colder areas. However, warmer winter temperatures, as evidenced by the shift to new hardiness zones to nearly 50% of the country, are enabling an expanded incidence of tropical RKN species to higher latitudes.

Amidst these challenges, the research on the behavior, development, and infectivity of *M. hapla and M. incognita*, RKN representatives adapted to different climates across the US and widely prevalent in CT, takes on a crucial role. This study is currently investigating the relationship between temperature, nematode behavior, and disease progression. Its aim is to identify potential physiological and biochemical temperature adaptations that vary across different species and life stages of the nematode, thereby shedding light on a significant aspect of RKN management.

Impact: Fluctuations in temperature impact multiple steps of plant disease development in many systems; however, little is known about how plant-parasitic nematodes adapt to those changes in the soil or inside the host. The proposed project will yield new insights into the components driving the interaction between RKN and its host and how their association responds to different temperatures potentially encountered by the nematode in the field. This will provide a foundational knowledge of the mechanisms that integrate nematode-environmental adaptation and parasitism and can be further utilized to identify nematode environmental-vulnerable targets for effective control and management, thereby offering a promising future for crop production.

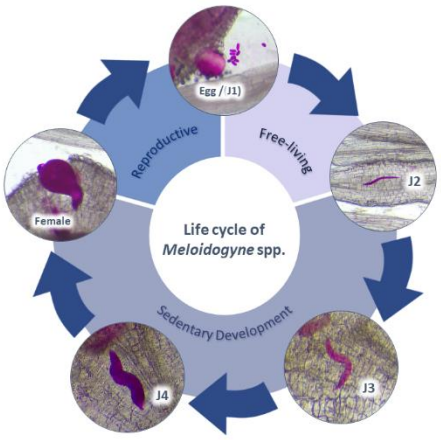


Figure - Life cycle of root-knot nematodes with specified stages and behaviors.

Mining conserved effector candidates in root-knot nematodes, *Meloidogyne* spp.

Investigators: Raquel Rocha

Summary: Root-knot-nematodes (RKN, *Meloidogyne* spp.), a cosmopolitan distributed taxon, are the most damaging group of plant parasitic nematodes able to infect virtually all crops. Using a hollow, protrusible mouth-spear called a stylet, the nematode mechanically penetrates and migrates through the host root system, avoiding detection and reprogramming host cell structure and function by secreting a cocktail of

proteins called effectors. These effectors are produced by RKN's highly specialized secretory esophageal gland cells, whose roles differ throughout the nematode life cycle, from infection to reproduction.
Therefore, our research group has devised an innovative method to isolate the primary secretory cells of RKN adult females. Combined with RNA sequencing and data mining, this method has led to identifying a group of predicted secreted proteins without any associated functional annotation but conserved across multiple species of root-knot nematodes. These novel candidates encode recently discovered virulence-like properties and represent a significant opportunity to provide new insights into the virulent factors necessary to support the late phases of the RKN. This discovery can potentially revolutionize our understanding of RKN and pave the way for more effective strategies to combat them.
Impact: The identification and functional characterization of specific nematode effectors and the discovery of their host targets are central to deciphering and understanding plant-nematode interactions. Such knowledge is of *critical need* in modern plant breeding, as RKN effector/host target interactions are essential for the identification of both host Resistance (*R*) and Susceptibility (*S*) genes and, ultimately, in the development of durable nematode-resistance in crops of interest.

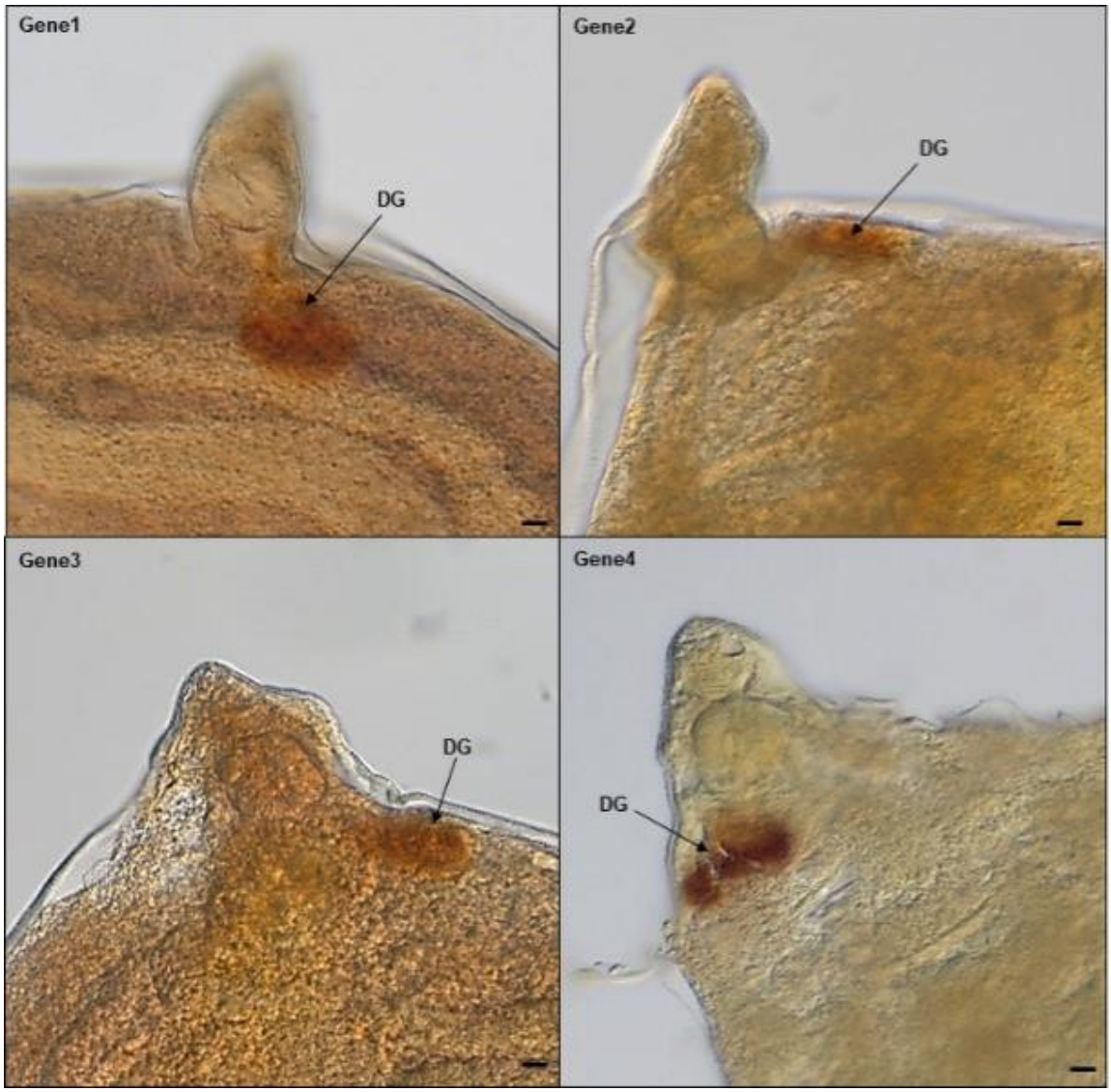


Figure - Detection of dorsal gland (DG) effector candidate transcripts by in situ hybridization of *Meloidogyne* adult females. Scale bar = 10 μm

Disease Survey

Rainy and wet weather conditions during the past and current growing seasons favored fungal, nematode, and bacterial diseases on trees, shrubs, herbaceous ornamentals, lawn grasses, fruits, and vegetables. Dr. Yonghao Li assisted by Ms. Felicia Millett in the Plant Disease Information Office (PDIO) diagnosed a wide range of fungal, bacterial, viral, nematode, and abiotic diseases during the year 2023-2024.

Woody Ornamentals:

Beech leaf disease, first confirmed in the state in 2019, remained a serious threat to beech trees and raised a big concern to the homeowners and professionals. Distorted leaves and unopened dead leaf buds caused severe diebacks and decline of the infected beech trees. On eastern white pine, brown spot needle blight was prevalent and caused browning of old needles and early defoliation in June (Figure 1). Septoria leaf spot of lilac was favored by wet summer weather conditions last year and caused severe leaf blight and defoliation (Figure 2). A significantly increased number of black knot incidences and severe damage were found this year although this disease is common on cherry and plum trees. Boxwood blight was prevalent in landscapes and gardens, and the disease was also confirmed in a nursery. Excessive water and saturated soil from heavy thunderstorms favored Phytophthora root rot on woody ornamentals including rhododendron, lilac, boxwood, and Japanese yew (Figure 3). Rhizosphaera needlecast and Stigmina needlecast remained two major foliar diseases on spruce trees. Gymnosporangium rust diseases were found on various host plants, such as apple, pear, serviceberry, and cedar trees. Anthracnose diseases were found on many species of trees, such as sycamore, dogwood, hickory, maple, beech, hornbeam, and oak. Powdery mildew was diagnosed on leucothoe, beech, sycamore, maple, and serviceberry trees.

Figure 1. Brown spot needle blight of eastern white pine: browning of old needles (left), green new needles (middle), fungal fruiting bodies on brown needles (right).

Herbaceous Ornamentals:

Pythium root rot was found on ranunculus (Figure 4) and hellebore in a farm and a nursery, respectively. Powdery mildew was prevalent on African violet, peony, phlox, petunia, beebalm, and rudbeckia. Botrytis blight was found on lavender, peony, tulip, snapdragon, hosta, epimedium, and lily. Rust diseases were found on hibiscus, iris, fern, and ornamental grasses. Daylily fungal leaf streak was confirmed in a daylily production field. Phytophthora root rot was problematic on lavender plants in nurseries and landscapes. Rhizoctonia damping-off was found on larkspur. Thielaviopsis root rot was found on helichrysum and nepeta. Hosta X virus was detected in hosta (Figure 5). Tobacco rattle virus was confirmed on epimedium and anemone (Figure 6). Bacteria leaf spots were found on greenhouse-grown hibiscus. Fungal leaf spot remained a common disease on iris, hosta,

geranium, and rose campion.

Figure 2. Septoria leaf spot on lilac. Leaf blight (left), brown spots on a leaf (right top), and fungal sporulation on a leaf (right bottom).

Figure 3. Phytophthora root rot in a Japanese yew hedge

Figure 4. Pythium root of ranunculus

Figure 5. Hosta X virus on hosta

Figure 6. Tobacco rattle virus on anemone

Vegetables and crops:

In a commercial greenhouse, powdery mildew and Rhizoctonia webbing blight caused severe damage on chervil and rutabaga, respectively (Figures 7 and 8). A severe outbreak of tomato spotted wilt virus on tomato plants was reported on a farm, which resulted from the infected tomato seedlings in a greenhouse where mixed bedding plants grew. Botrytis blight/canker was found on greenhouse-grown basil plants. Septoria leaf spot remained a major disease of garden tomatoes. Fusarium wilt of tomato became prevalent in vegetable gardens. Herbicide injury was problematic on tomatoes and cabbages in home gardens which were near lawns. Bacterial leaf spot and Phytophthora blight remained major problems on peppers. Powdery mildew, anthracnose, and bacterial angular leaf spot were major disease problems on cucurbits. Bacterial black rot was prevalent on cabbages and kales. Verticillium wilt was a major disease on eggplant.

Figure 7. Powdery mildew of chervil

Figure 8. Rhizoctonia webbing blight of rutabaga

Tree and Small Fruits:

Fungal leaf spot and black knot disease was prevalent on cherry and plum trees (Figure 9).

Rust, Fabraea leaf spot, and sooty blotch were problematic on pear trees. Cedar-apple rust, scab, fire blight, Marssonina blotch, and black rot were prevalent on apple trees. Peach leaf curl and peach brown rot were problematic in orchards this year. Black rot, powdery mildew, downy mildew, and anthracnose were commonly found on grapevines. Phytophthora root rot was confirmed in a cranberry field. Rust disease was found on raspberry and blueberry bushes. Armillaria root rot was diagnosed on a raspberry bush. Phomopsis canker, Botryosphaeria canker, and mummy berry were major diseases of blueberry. Orange rust was found on blackberry (Figure 10).

Figure 9. Black knot on a cherry tree

Figure 10. Orange rust of blackberry

Turf:

Brown patch and dollar spot were prevalent in the summer 2024 because of humid and warm weather conditions. Other diseases that were common in lawns are summer patch, red thread, pink patch, Pythium blight, anthracnose (Figure 11), Bipolaris leaf spot (Figure 12), powdery mildew, and rust. Slime mold and mushrooms in lawns raised residence's concerns.

Figure 11. Anthracnose fungal fruiting structures on a turfgrass blade.

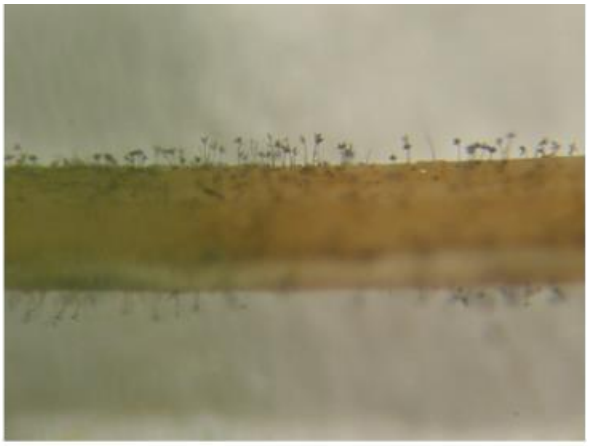


Figure12. Fungal spores of Bipolaris leaf spot on a brown blade of turfgrass.

Weeds:

This spring, numerous maple seedlings emerged in lawns, gardens, and containers, which was concerned by homeowners and landscapers because the seedlings resemble poison ivy or unidentified weeds. Control and removal of running bamboo, poison ivy, and Japanese knotweed continued to be an issue between neighbor's properties. Controlling of oriental bittersweet, bindweed, curly dock, garlic mustard, Japanese stiltgrass, mugwort, mullein, phragmite, pokeweed, porcelain berry, spurge, sumac, thistles, tree of heaven, trumpet vine, and Virginia creeper in residential properties and gardens is a frequently asked question. Common weeds that were found in lawns were crabgrass, annual bluegrass, bittercress, cinquefoil, common chickweed, dandelion, mouse-ear chickweed, clover, ground ivy, yellow nutsedge, purslane, red sorrel, wild garlic, wild violets, and wood sorrel. Perennial grassy weeds, such as nimblewill, creeping bentgrass, zoysia grass, orchardgrass, tall fescue, quackgrass, and rough bluegrass were problematic in lawns because there are few, if any, effective selective herbicides available.

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.

In 2023, three hundred and six samples, among 312 vegetable seed samples receive, were tested for seed germination rates because the other six samples did not have enough seeds for the test. Among the tested vegetable seed samples, two hundred forty-eight samples passed the standard germination test, but the other 58 samples did not meet their label claims and the Federal standard. Summarized by seed sources, all samples from one company passed the standard germination test, but one or more samples from the other six companies failed the test. Among 53 tested vegetable species, all samples in 26 species passed the standard germination test; the other 27 species had one or more samples that failed the test. Poor germination rates and heavy mold were found on okra, parsnip, and rhubarb samples. Seed samples were examined for prohibited noxious weed seeds and no noxious weed contaminants were found in the tested samples. A total of seven crop and pasture mixture samples for 2022 were tested for purity and germination rates. The results showed that only one sample, Fall Rye Seed, passed both standard purity and germination tests, but the other six samples had one or more ingredients that did not meet the labeling claims and purity or germination standards. For the sample Diceros Orchard Grass, neither purity nor the germination rate met the labeling claims. Winter rye in both Moshers and VNS Winter Rye samples passed germination test, but the purity did not meet the labeling claims. The purity of the sample Crimson Clover VNS met the labeling claim, but the germination rate did not meet the labeling claim and standards. Purity and germination tests for the 15 grass and crop seed samples are in process.

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 9 samples from the Connecticut Department of Consumer Protection at the request of the Department of Analytical Chemistry at the Experiment Station.

Citizen Inquiries

Plant Disease Information Office

Dr. Li assisted by Felicia Millett answered 3,318 plant health and plant-related inquiries from Connecticut citizens. Most inquiries were on ornamentals, trees, and shrubs (71.5%), but other categories, such as food crops (12.5%) and turf grasses (3.0%), were also well represented. A moderate percentage (13.0%) of inquiries fell into the miscellaneous category, which included identification of various plants, weeds, and mushrooms, and information about pesticides and their relationships to health and environmental concerns. Most inquiries were from commercial growers and plant care professionals (35.5%) and Connecticut homeowners (56.0%). Other sources of inquiries include UConn cooperative extension (0.9%), CAES (3.6%), and others (health departments, news, municipals, other agencies, and organizations) (4.0%). A further breakdown of inquiries showed that 26.0% of the questions came in by phone, 21.8% came by email, 17.7% came in by mail, and 34.5% were sent in person. To respond to inquiries, 1,783 letters and email messages with attached files of fact sheets were sent from the PDIO. Many citizens opted to download fact sheets posted on the CAES website in lieu of letters since this gave them instant access to the information of concern.

The Role of Predators in the Rhizosphere

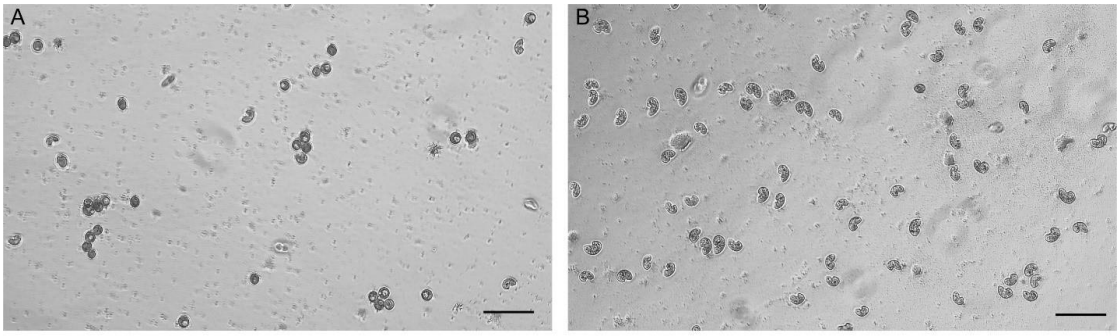
Triplett Laboratory

Protists are single-celled organisms that prey on bacteria. Protists can impact plant health by changing the community of bacteria that live on root surfaces; by feeding on bacteria that lack predation defenses, they can increase the growth of predation resistant bacteria, including some beneficial colonists of plants. Drs. Lindsay Triplett, Stephen Taerum, and Blaire Steven have previously characterized the protists living on plant surfaces, and identified how roots and leaves shape the protist community. In their current $819,000 USDA-funded project, the team is seeking to understand which bacteria are helped by protists in the rhizosphere, and how protist-bacterial partnerships could benefit crops. The project identified 30 groups of root-associated bacteria that colonize both protists and the root microbiome- in total, 47% of the microbiome of protists could colonize plants, and made up 10% of the rhizosphere microbiome of inoculated plants.

By sequencing the protist cultures and their bacteria, we discovered that many of these bacteria had plant beneficial properties, indicating that protists could be used in agriculture to increase the survival of certain helpful bacteria. The most common trait among the protist-partnering bacteria was the production of auxin, a plant hormone that controls growth and drought resistance. We found that ten different protist cultures all produced auxin, but only when bacteria were present. Addition of auxin significantly increased the growth yield and cell size of protists from different kingdoms of life, indicating this is a widespread signaling molecule among ancient life. Auxin also helped bacteria grow when protists were present, suggesting that auxin production could benefit bacteria through interkingdom signaling. The final year of the project

Based on the progress of the current work, Dr. Triplett and Taerum were recently awarded part of a $3.5 million USDA grant to understand the effect of organic management on different predators, and are working with

Impact: Understanding the patterns and mechanisms of protist signaling to rhizosphere bacteria will help us



understand the survival of beneficial microbes in the soil, and help formulate inoculants with improved survival capacity.
Figure Caption: The Triplett lab is investigating how the plant hormone auxin (IAA, right) changes the growth of protists and bacteria in the rhizosphere.

Metabolic interactions of *Erwinia amylovora* and Apple in the establishment of Fire blight
Schultes Laboratory
Summary: Dr. Schultes investigates the metabolic requirements of *Erwinia amylovora* to establish the fire blight disease, a devastating disease of apples and pears. In the fire blight disease cycle *E. amylovora* inhabits different plant locations presenting the pathogen with unique nutrient landscapes. This past year we have investigated the requirement of aspartic acid and tyrosine in the ability of *E. amylovora* to grow on stigma surfaces and in developing apple fruit. Aspartic acid, asparagine and glutamine are the major nitrogen transport molecules in apple trees. In the winter these amino acids are stored in the roots and come spring are remobilized to travel through xylem from root to sink tissues – namely flowers and developing leaves. The peak of aspartic acid, asparagine and glutamine concentration in xylem sap overlaps flowering time and corresponds to the major infection period of *E. amylovora*. In *Escherichia coli* two genes AspC and TyrB encode for aminotransferases both of which function to complete the last step in aspartic acid and tyrosine synthesis. Through heterologous complementation studies we determined that the *E. amylovora AspC* and *TyrB* orthologs are also dual function for aspartic acid and tyrosine synthesis. Allelic exchange mutants of *EaAspC* and *EaTyrB* were generated in *E. amylovora* and reveal that the dual function of each encoded amino transferases also completes aspartic acid and tyrosine synthesis.
Standardized laboratory-based stigma growth and immature fruitlet virulence assays were performed to determine if aspartic acid and tyrosine are required for population growth and virulence. For stigma growth experiments, fresh filed grown flowers are harvested and the stigmas inoculated with *E. amylovora* strains then incubated at 28*C. Inoculated stigmas are harvested on day 1, 2, and 3 and the *E. amylovora* the populations determined. Results show that growth of single *aspC* or *tyrB* mutants is robust and equal to or close to WT populations levels, whereas double *aspC tyrB* mutant population is substantially less by still orders of magnitude greater than starting populations (Fig. 1A). Further stigma growth experiments using phenylalanine, aspartic acid or tyrosine supplementation reveal that tyrosine is the limiting amino acid for wild type levels of growth of the double mutant strain (Fig. 1B). To investigate virulence and growth in apple fruits growth assays were used to monitor the virulence phenotype and population growth of WT, single and double *aspC*, *tyrB* mutant strains. Phenotypic analysis reveals that both single and double mutant strains show similar levels of browning and ooze formation after six days (Fig. 1C). *E. amylovora* single and double mutant populations were robust and similar to WT indicating that neither aspartic acid nor tyrosine was limiting for manifestation of virulent growth and population (Fig. 1D). Our results show that *E. amylovora* strains that are auxotrophic for aspartic acid and tyrosine can proliferate as epiphytes on the apple flower stigma surface as well as displaying robust growth as endophytes in immature apple fruitlets. Interestingly previous analysis of the amino acid content of stigma exudate reveals limited levels of free amino acids, far below what is needed for the robust growth observed in our stigma growth assays. It is likely that abundant glycoproteins in the exudate serves as amino acid sources once degraded by proteases and imported into *E. amylovora*. Further studies on the roles of *E. amylovora* secreted proteases might play in stigma growth are underway.

VALLEY LABORATORY

Scientists at the Valley Laboratory conduct research on insects, diseases, mycology, integrated pest management, soil nutrition, and weeds of concern to commercial agriculture and homeowners in Connecticut. The Valley Laboratory, located in Windsor, was originally established in 1921 to conduct tobacco research and has conducted a century of research and service to the State of Connecticut. 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.

The Tobacco Experiment Station in the 1920's

Activities on the Farm

There were a total of 34 experimental plots at the Valley Laboratory Research Farm during the past year. Ten CAES scientists (Six VL scientists, four New Haven scientists) and one UCONN extension faculty member are using 26 plots. Additional six plots were maintained by the Farm Manager as rotation crops, vegetable for foodbank or for seed collection. Valley Laboratory scientists also conducted experiments in many plots off site, such as in growers' fields, the CAES 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. Li 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.

Total produce donated for 2023: 6025lbs.

We also lend our irrigation equipment to the Epilepsy Foundation of CT, for their annual fundraiser.

RESEARCH ACTIVITIES

DR. CAROLE CHEAH

Biological Control of Hemlock Woolly Adelgid

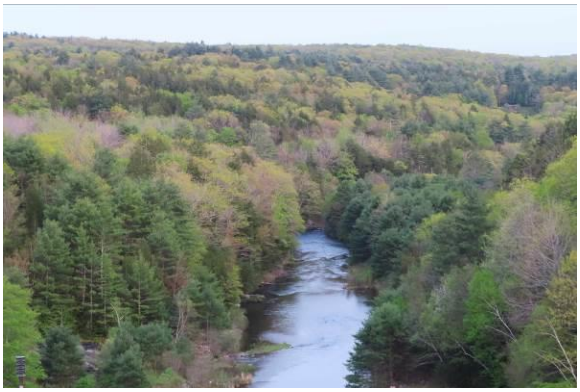
Project: Development and evaluation of strategies for protecting and sustaining the essential eastern hemlock resource in Connecticut

Type of research: McIntire-Stennis (CONH00820)

Grant funds to support project: NIFA, Farmington River Coordinating Committee, Lower Farmington River and Salmon Brook Wild and Scenic Committee

Eastern hemlock, *Tsuga canadensis*, is the sixth most common tree species, and now, the most abundant conifer in Connecticut forests. Hemlocks are an important component of watershed forests that capture, filter, store and protect Connecticut's drinking water reservoirs. Eastern hemlocks are long-lived, and are considered a foundation species for many animal and plant communities. Two non-native insect pests remain the most serious stressors to hemlock survival and sustainability: the hemlock woolly adelgid, *Adelges tsugae* (HWA) and the elongate hemlock scale, *Fiorinia externa* (EHS). At present, there is no available biological control for EHS, which has more chronic impacts on hemlocks. Although severe winters can periodically significantly reduce HWA populations, such events are not predictable and with warming winters, surviving HWA can explode and reinvade hemlock stands very rapidly, causing serious damage and weakening the trees.

Unlike other states, Connecticut does not use chemicals to control HWA on state lands, land trust preserves, municipal open space, bird sanctuaries, water company watershed forests and other private forests. Connecticut's major strategy to mitigate HWA damage in our hemlock forests since 1995 utilizes the introduced specialist ladybeetle HWA predator, *Sasajiscymnus tsugae*, for biological control of HWA. This species is still the only biological control agent for HWA widely available to the public through the sole commercial company rearing *S. tsugae*, Tree Savers from Pennsylvania. The rearing methods for *S. tsugae* used by Tree Savers are based on the original research on biology and life cycle of *S. tsugae* and rearing methods developed by Dr. Cheah at the Valley Laboratory and represent technology transfer from original research to the commercial sector. Connecticut's experience using *S. tsugae* as the sole HWA biological control agent since 1995 has helped the majority of our natural and landscape hemlocks survive and remain generally healthy with minimal hemlock mortality over three decades. Biological control releases with *S. tsugae* provide a critical, important, alternative strategy to manage HWA infestations, especially in sensitive wetland and riparian corridors. This biological control strategy is also very popular with homeowners and the general public who do not want to use chemicals to control HWA. As most of Connecticut's hemlocks occur on private lands, expansion of biological control with *S. tsugae* beyond state lands is an important mission to target other Connecticut hemlock forests threatened by HWA resurgence and spread. Dr. Cheah has developed, coordinated and trained a network of state, municipal and private collaborators composed of town conservation commission members, land trusts (LT) members, volunteer organizations, students, staff from nature centers, bird sanctuaries, private lake associations, water company foresters etc. and federal and other funding sources to achieve this.



Views of the Upper Farmington River, Hartland, and the Lower Farmington River, Bloomfield in 2023

The Farmington River is Connecticut's first federally designated Partnership Wild and Scenic River. The Upper Farmington Wild and Scenic designation, spanning 5 towns in North West Connecticut, was achieved in 1994 and expanded in 2019. In 2024, through funding from the Farmington River Coordinating Committee (FRCC), 5,000 *S. tsugae* were purchased and strategically released along the Upper Farmington and expanded to its tributaries to control HWA. The FRCC has supported these biological control efforts annually since 2021. Partners in 2024 for the Upper Farmington River biological control program are FRCC, Dr. Cheah, CT DEEP Foresters (for state forest sites), Canton Conservation LT, New Hartford LT, and Roaring Brook Nature Center, part of the Childrens Museum Group. Biological control releases of *S. tsugae* through FRCC to protect hemlocks in this watershed now total 16,250 from 2021 – 2024. All 5 member towns (Canton, New Hartford, Barkhamsted, Hartland and Colebrook) had HWA biocontrol releases implemented along the Farmington River and its tributaries at 5 state forests and a wildlife management area (Nepaug Werner's Woods, American Legion, Peoples, Tunxis and Algonquin State Forests, Cedar Swamp WMA), 2 land trust preserves in Canton and 4 land trust preserves in New Hartford. Releases were initiated along 7 major tributaries which feed into the Upper Farmington River. In 2024, releases were also continued along Sandy Brook in Algonquin State Forest in Colebrook to protect the Sandy Brook Natural Area Preserve and the Kitchel Wilderness Natural Area Preserve, which are preserves of special recognition in Connecticut.



Releasing *S. tsugae* along East Mountain Brook with New Hartford Land Trust volunteers in 2024


National Park Service community planner and volunteers releasing *S. tsugae* at Mathies Grove, Peoples State Forest in Barkhamsted

The Lower Farmington River and Salmon Brook were also designated Partnership Wild and Scenic Rivers in 2019 and span 9 towns from Burlington and Hartland to Windsor. The recent Connecticut collaborative program for biological control of HWA, launched by Dr. Cheah in 2020, was expanded to include the Lower Farmington River and Salmon Brook in 2023. Funding in 2024, the second year in this program, was provided by the Lower Farmington River and Salmon Brook Wild & Scenic Committee (LFSWS) to purchase an additional 6,000 *S. tsugae* for implementation in the watershed. Partners in 2024 are LFSWS, Dr. Cheah, the Farmington River Watershed Association, McLean Game Refuge, CT DEEP Forestry, State Parks and Wildlife Division; Simsbury LT, Eversource and the Towns of Bloomfield, Simsbury and Windsor. Six towns received releases of ladybeetles to mitigate HWA spread and damage in May 2024: Avon, Bloomfield, Burlington, Granby, Simsbury and Windsor. Releases were made at 2 state forests, 1 state park, 1 WMA and 1 Farmington River water access area in Avon. Releases were also made at 3 town parks in Simsbury, Bloomfield and Windsor, 3 town-owned forests which protect an important aquifer in Simsbury, 1 Simsbury land trust preserve and Eversource owned watershed forest along the Farmington River in Avon. Implementation of biological control of HWA was also made along 8 important tributaries of the Lower Farmington and Salmon Brook. This collaborative program has now implemented biological control of HWA on a landscape scale for the entire Farmington River and Salmon Brook from rural towns such as Hartland and Barkhamsted to suburban and urban towns such as Bloomfield and Windsor. As of June 30, 2024, the Wild and Scenic River collaborative program for the Upper and Lower Farmington River and Salmon Brook had released over 11,000 *S. tsugae* in 2024 alone in 11 Connecticut towns in the wild and scenic corridor.


Town of Simsbury staff and volunteers helped release *S. tsugae* in Ethel Walker Woods, Simsbury open space


Eversource staff help release *S. tsugae* into watershed forests of the Lower Farmington River in Avon

Dr. Cheah continues to publicize and educate the public on the availability of this biological control strategy, train and help with HWA scouting and guide optimal implementation of *S. tsugae*. Forests where *S. tsugae* have been recently released are showing very low levels of HWA, even along rivers where winter survival was higher. Ample precipitation in 2023 into 2024 has also enabled tremendous hemlock recovery in 2024.

In 2024, foresters from the South Central Regional Water Authority also consulted with Dr. Cheah and have established an annual biological control release program to manage HWA in an important hemlock watershed forest in Bethany. A private fishing club in Newtown requested advice and were guided in their hemlock restoration efforts and HWA mitigation using *S. tsugae*. A private lake community in Norfolk previously guided to implement biological control releases, continued their *S. tsugae* releases to protect lacustrine hemlock forests.

The total number of *S. tsugae* officially released in Connecticut exceeds 270,000 from 1995-2024, excluding smaller homeowner releases.

Dr. Cheah also continued to address numerous enquiries on the invasive Mile-a-Minute (MAM) weed, tracks weevil dispersal and establishment from reports and provided outreach on the biological control program for MAM which was implemented and monitored in collaboration with Donna Ellis, retired from the University of Connecticut. Over 60,000 specialist herbivorous weevils, *Rhinoncomimus latipes*, which feed and reproduce only on MAM, have been released in 27 Connecticut towns from 2009-2019. Weevils continue to be reported from non-release areas indicating dispersal and further establishment, 4 years after releases ceased. Dr. Cheah updates the annual map of Connecticut towns with confirmed MAM reports and continues to track weevil establishment from public reports.

Impacts:

- The collaborative Connecticut biological control program for HWA is very successful and is rapidly gaining popularity amongst the public. This is another example of technology transfer from the research findings of Dr. Cheah that biological control with *S. tsugae* can be a useful tool for all communities, state, private and municipal partners for managing HWA at a landscape level and in sensitive riparian environments without the use of chemicals for restoring and conserving eastern hemlock forests.
- Biological control also offers a safe and attractive alternative to homeowners seeking to protect landscape hemlocks on private properties and residential areas where chemical control is not desired. This strategy minimizes the need and application of annual prophylactic chemical treatments for HWA
- Mature hemlock forests can be protected from salvage as increasingly important carbon dioxide sinks in a warming world and biological control with *S. tsugae* is an important tool for that
- Connecticut has the longest running HWA biological control program in the USA at 29 years since 1995. Long term impacts of HWA biological control in Connecticut show that eastern hemlocks are a resilient tree species which can recover from biotic and abiotic stressors, which is important to the multiple and diverse avian, amphibian, fish and mammal species which are dependent on the hemlock ecosystem
- Ecosystem benefits from biological control with *S. tsugae* include mitigating tree mortality in reservoir watershed forests, protecting private property landscapes, protecting forests in natural areas, preserving popular hiking and recreation trails in open space and land trusts, conservation of wildlife and avian habitats.

Insect Management

Dr. Richard Cowles:
Dr. Cowles is working in several areas. His largest project currently is to find effective ways to manage beech leaf disease, caused by a foliar nematode. These efforts are based on the likely bottlenecks in the nematode life cycle: one is when they migrate from the leaves to the buds. Understanding the chemical ecology of these nematodes may disclose materials that could interrupt colonization of buds. The other is to interrupt their modification of the beech leaf tissue within the bud. The development of hyperplastic tissue may be required for their successful establishment in leaves as they grow out from buds. This can be interrupted by activating the trees' systemic acquired resistance pathways, as has already been shown to occur with potassium phosphite. There are many other activators of the SAR system, some of which may be useful. Another large project is to discover which chemicals may be useful for preventing needle loss on conifers harvested as Christmas trees. Two avenues are being investigated, applying a foliar spray of synthetic auxins prior to harvest to block ethylene-mediated stress response, and the other is to find products that can be added to water when trees are being displayed that will reduce or stop needle loss. Several chemicals look promising, including low concentrations of aspirin, which mimics salicylic acid, 2-amino isobutyric acid, and synthetic auxins.

Impact statement:
Growers continue to report improved growth of Christmas trees when using the slow-release nursery fertilizers at the time of planting. One farm in Connecticut reported that this approach may improve their profitability more than $100,000 per year. Growers are starting to adopt the use of imazapic herbicide to suppress the growth of grass within their Christmas tree farms (this is a current project, in collaboration with Dr. Aulakh). This has the benefit of reducing the need for mowing, which saves fuel and helps to prevent soil compaction. One of the insecticides tested in a collaborative project with Canadians is being adopted by growers there for management of conifer root aphids. For growers in the U.S., the root dip procedure with bifenthrin to prevent loss of roots from white grub feeding has the side benefit of protecting those trees from conifer root aphids and destructive tunneling against the root surfaces by ants. Arborists have widely adopted the treatment measures we have investigated for managing beech leaf disease on landscape ornamental beech trees.

Dr. Cowles has found through several experiments that the insecticide acetamiprid (Tristar) is exceptionally effective for managing armored scales in Christmas trees. When applied close to bud break timing, this insecticide has several favorable characteristics. Compared to the neonicotinoids imidacloprid (effective against balsam twig aphids but not scales) and dinotefuran (effective against scales but not aphids), acetamiprid has much lower potential to cause harm to pollinators, both because it has a short soil half-life, and so will be unlikely to be carried from roots to nectar and pollen from flowering groundcovers, and it is intrinsically much less toxic to honey bees. Growers in 2024 in Connecticut and in several other states have begun to use acetamiprid in place of the more toxic or less effective alternatives.

Beech leaf disease is a rapidly emerging pest that threatens to eliminate beech from Connecticut forests. In collaboration with Dr. LaMondia and others, Dr. Cowles has screened several products to evaluate whether they may be of value to protect landscape or forest beech trees from the foliar nematode that causes the leaf disease. One of the effective active ingredients, oxamyl, is too acutely toxic to applicators to be considered a practical option, unless it is formulated in trunk injection capsules. Two other ingredients, fluopyram and potassium phosphite, can be highly effective to either kill the nematodes (fluopyram) or to protect the trees' health (potassium phosphite). In collaboration with industry leaders, Drs. Cowles and LaMondia have greatly advanced the understanding of options for managing this disease and have been providing practical advice to arborists and homeowners on best practices.

Farmers and homeowners find it difficult to protect plant material from browse damage by white tailed deer.
Dr. Cowles has discovered a simple way to make a highly effective sprayable deer repellent using non-toxic ingredients, namely lanolin (from sheep wool) and an emulsifier. Non-replicated tests in the landscape and on farms have demonstrated that his recipe can provide upwards of eight weeks of protection against deer damage, at a cost in raw materials of about $15 per acre. Farmers from Maine to Virginia have been adopting this recipe for use on their own farms, which is suitable for use on both ornamental landscape plants and edible crops.

Weed Science (Dr. Jatinder Aulakh)

1. **Christmas tree tolerance and weed efficacy of Frequency (topramezone) and Mission (flazasulfuron) herbicides (Continuing trial):**

Dr. Aulakh is conducting field research trials on Frequency (topramezone) and Mission (flazasulfuron) herbicides safety and weed efficacy in Christmas tree plantations since 2023. Experiments have been repeated for the second year in Enfield and at the Valley laboratory in Windsor, CT in multiple Christmas tree species.

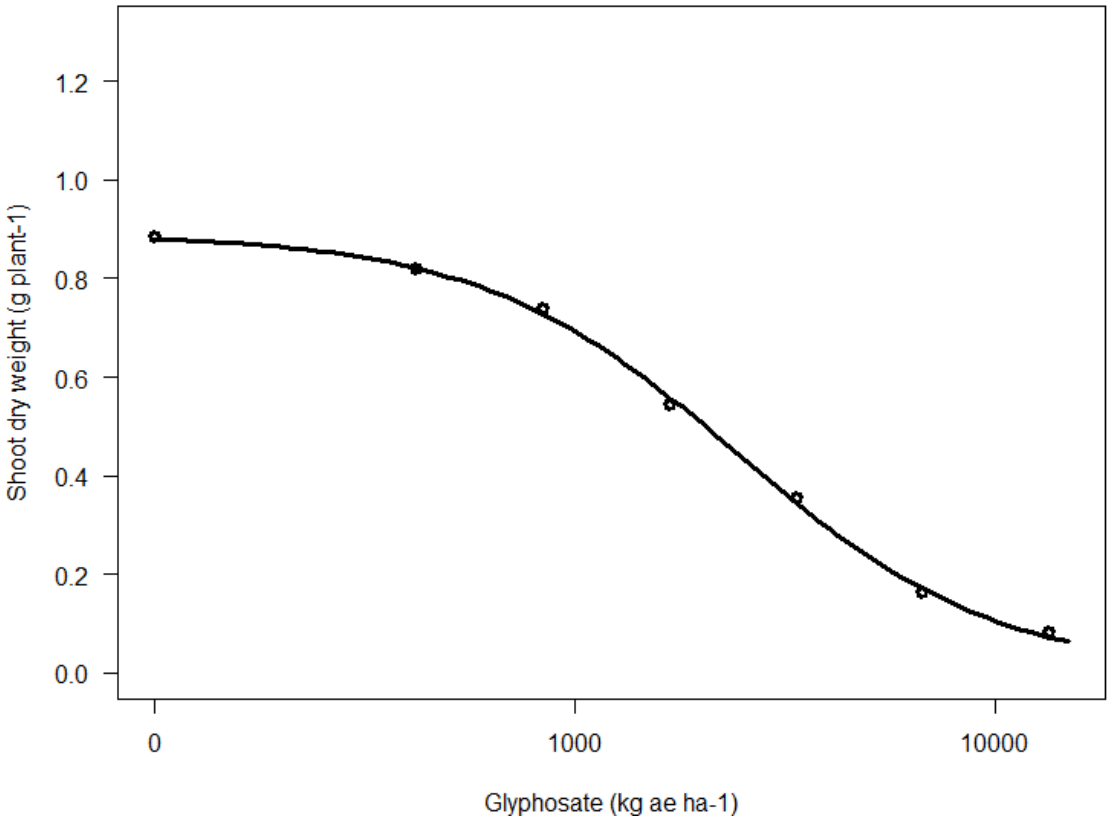

Pictures 1-2. Frequency and Mission herbicide safety trials in field planted Fraser x balsam hybrid firs in Enfield, CT. Nontreated control (left) and Frequency herbicide weed control (right).


Pictures 3-4. Mission herbicide weed control (left) and injury on Fraser x balsam hybrid firs (right) in Enfield, CT.

Findings and Impacts: Frequency and Mission herbicides were highly effective in controlling horseweed, common ragweed, and crabgrass. The Mission herbicide resulted in chlorotic injury to the new growth whereas the Frequency herbicide was highly safe even when applied over-the-top. When used according to the labelled rate both herbicides will provide effective early season control of commonly encountered annual broadleaf and grassy weeds and some problematic perennial weeds like horsenettle and yellow nutsedge in Christmas tree plantations.

2. Herbicide Resistance levels and Mechanisms in Common Waterhemp and Palmer Amaranth Biotypes in Connecticut (continuing trials).

Dose response trials were repeated in 2024 at the Valley laboratory to confirm the levels of glyphosate resistance in common waterhemp biotype in Connecticut. The Connecticut biotype required ~11.8 kg ha^{-1} of glyphosate for 90% control (ED_{90}) which was about 14 times higher than the labelled rate (0.84 kg ae ha^{-1}). Further research will be conducted in 2024 to determine the molecular and/physiological mechanisms of observed glyphosate resistance in this biotype.



Pictures 5-6. Common waterhemp growth three weeks after treatment with different rates of glyphosate herbicide when treated at 4-inch stage (top). Shoot dry weight reduction under different glyphosate rates (bottom).

Findings and Impacts:
Herbicide resistance levels in common waterhemp to ALS-inhibitor and EPSPS-inhibitor herbicides have been determined through multiple dose-response studies. We have understood the glyphosate resistance mechanism in the CT biotype of Palmer amaranth in 2023 (Multiple copies of EPSPS gene). In 2024, we will determine the mechanism of glyphosate resistance in Connecticut biotype of common waterhemp. Results from these studies will be shared with the corn and vegetable growers to diversify their weed management practices for timely and effective control of herbicide resistant weeds and prevent their further spread

3. Evaluation of Different Types of Mulches for Mugwort Control (Continuing trial):

Mugwort (*Artemisia vulgaris*) is a serious threat to the diversity of native flora, especially the early successional species. Historically, mugwort invasion was confined to roadsides, floodplains and riparian areas, rights-of-way, and in turf and landscape settings. In the last two decades, mugwort has begun encroaching into new areas including annual row crops, hayfields, pastures, and turfgrass. Mugwort can be controlled with herbicides such as aminopyralid and glyphosate etc. However, there is a growing demand for non-chemical control for mugwort management. A field experiment is in progress since summer 2022 at Windsor Valley laboratory to evaluate the effectiveness of Clear and black plastic mulches and woodchips.

Pictures 7-8: Mugwort in the control plot (left) and in black plastic mulch plot (right) at Windsor Valley Lab in 2024.

Findings and Impacts: Mugwort was controlled 99% or higher with black plastic mulch that resulted in > 99% elimination of rhizome biomass (picture 5). Clear plastic was more effective than woodchips mulch with 78% reduction in aboveground mugwort shoot biomass and 70% reduction in below ground rhizome biomass. Woodchips mulch was not very effective in Mugwort control.

4. Ornamental Plant Safety Trials (continuing trials):

Ornamental plant safety and weed control efficacy of new herbicides were conducted in multiple ornamental plants that include balloon flower, big bluestem grass, cotoneaster, Joe-pye weed, thyme, Virginia rose, winterberry, Alberta dwarf spruce, and many other Christmas tree species. These studies will help in developing safe use practices for these new products and comparing their weed control efficacy and safety with the conventional preemergence herbicides.

Pictures 9-10: Ballon flower response to Fuerte and Pendulum herbicides in 2023 at Valley Lab Windsor, CT.

Findings and Impacts: The 2023 ornamental plant safety trials discovered several safe, economical, and effective preemergence herbicides for ballon-flower (Pendulum and Fuerte), big bluestem (Biathlon, Fortress), cotoneaster (Fuerte), common winterberry (Fuerte), Joe-pye-weed (Fortress), creeping thyme (Pendulum), Alberta dwarf spruce (Fuerte).

Tobacco Disease Research (Dr. James LaMondia)

Dr. LaMondia conducts an ongoing cigar wrapper tobacco 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. An inbred line, C9, was initially released in 1991 and is still being produced as a wilt and TMV resistant cultivar. In 2011, 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 subsequently licensed. D1 and D2 have been recently released as new cultivars with resistance to wilt, TMV and black root rot. The B1, B2, D1 and D2 cultivars have been licensed to a local seed company. Three new broadleaf lines, Nutmeg, Mojito and Roundtip 2 are being trialed and in the early stages of release. Nutmeg has a broadleaf Havana pedigree, Mojito has a broadleaf and Criollo pedigree and Roundtip 2 has a shade tobacco and broadleaf pedigree. Additional breeding lines with resistance to target spot, black shank, brown spot, and bacterial wilt are being evaluated for disease resistance and agronomic characteristics.

Boxwood Blight Resistance 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 has collaborated with researchers across the United States to create a standard protocol for boxwood evaluations that can be conducted across institutions. This includes rating cultivars against previously tested plants to assign a scaling of 1 (most susceptible) to 5 (least susceptible). The evaluation program began in 2018 and has grown in subsequent years to include hundreds of selections from multiple commercial breeding programs being assayed at the Valley Laboratory. The ratings conducted at the Valley Lab are being used by plant breeders to assess tolerance and to select for disease resistant cultivars. We observed a very good range of responses in percent leaf infection, leaf and stem lesions per plant and percent defoliation. The very susceptible varieties such as *B. suffruticosa* were severely diseased and *B. suffruticosa* was eventually killed. There is significant potential for the development and release of blight resistant boxwood cultivars in the future.

Mycology Research (Dr. DeWei Li)

Dr. DeWei Li conducts research on fungal taxonomy, indoor molds of human health concern, fungal succession on water-damaged building materials, infiltration of fungi from outdoors into residences and mushroom cultivation as well as conducting some phytopathological studies.

Intercropping morel mushrooms in Christmas trees: This project is a new 2-year project to develop a new intercrop, morel mushroom for Christmas tree farms started in May 2023. The cultivation is being conducted at Valley Lab, Humming Grove Farm and Jones Family Farms. A white pine Christmas tree plot has been set up at VL in 2023 and expanded in 2024. Four small hoophouses and a large one have been built for the study. Inoculation was carried out in the fall, 2023. More strains were ordered. More inoculum preparation is underway.

Impact: Morel is a high-value gourmet mushroom. This study is to help Christmas tree farmers to develop a new crop: morel mushrooms. It can be marketed as fresh and dried produce. Fresh wine cap mushrooms have been sold at $35-50/pb. Grocery stores, restaurants and farmers' markets are potential venues for this produce. The new crop will increase their profit in the future.

Fungal taxonomic study. This collaborative study with James LaMondia, Neil Schultes, Rich Cowles and mycologists from several countries: Brazil, Canada, China, Cuba, Mexico, has led to discovery of 14 new fungal species: *Alternaria cunninghamiicola*, *A. dongshanqiaoensis*, *A. hunanensis*, *A. kunyuensis*, *A. longqiaoensis*, *A. shandongensis*, *A. xinyangensis*, *Biscogniauxia sinensis*, *Colletotrichum nanjingense*, *Colletotrichum siamense*, *Fusarium fujianense*, *F. guizhouense*, *F. hunanense*, and *Pestalotiopsis jiangsuensis*.

Impact: Discovering and describing new fungal species add very important information to fungal diversity in the world and for the studies, such as plant disease management, biological resources, biodiversity, fungal taxonomy, aeromycology, fungal ecology and fungal biology. Determination and identification of fungal plant pathogens, which cause significant losses to farmers, are an important service to local economy, agriculture, CT farmers and other areas. These studies are imperative for identifying fungi and determining the causal agents. The newly described species add new information to fungal diversity, resources and conservation and utilization.

New species, *Fusarium fujianense* (Figs 1, 2)

Figure1. *Fusarium fujianense*, (LC14) **A–D** colonies on PDA, SNA, OMA, and CMA, respectively, after 5 days at 24 °C in the dark **E, F** sporodochia formed on PDA **G, H** aerial conidiophores, phialides, and microconidia **I–L** sporodochial conidiophores, phialides, and macroconidia **M** mesoconidium (1-septate) and macroconidia (4–6-septate). Scale bars: 200 μm (**E, F**); 10 μm (**G–M**).

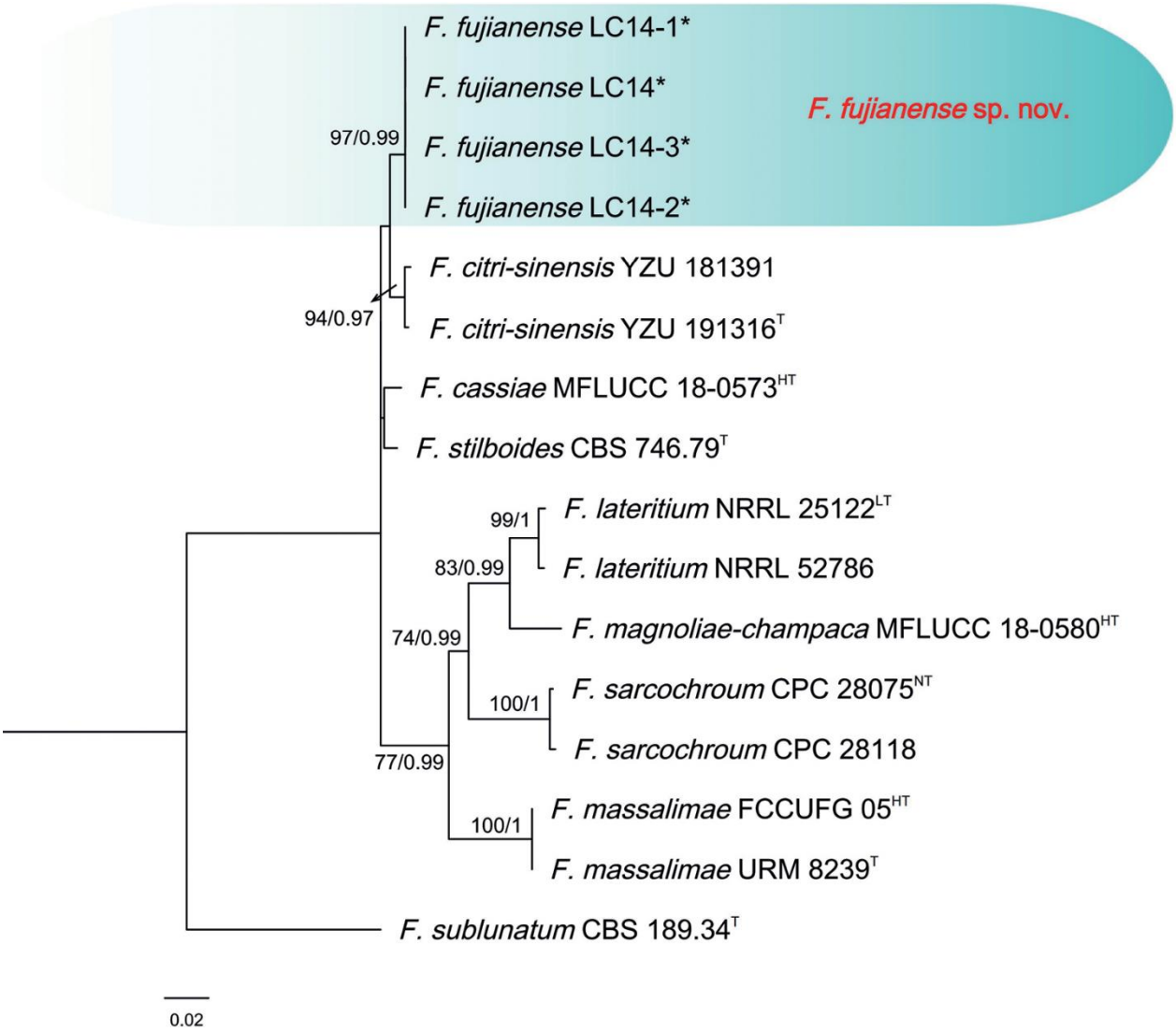


Figure 2. Figure 2. Phylogenetic relationships of 16 isolates of the *Fusarium lateritium* species complex with related taxa with concatenated sequences of the *TEF-1α*, *RPB2*, and *RPB1* loci using Bayesian inference (BI) and maximum likelihood (ML) methods. Bootstrap support values from ML ≥ 70% and BI posterior values ≥ 0.9 are shown at nodes (ML/BI). *Fusarium sublunatum* CBS 189.34^{T} was the outgroup. * indicates strains of this study. ^{T} indicates the ex-type strains. ^{LT}: Ex-lectotype, ^{NT}: Ex-neotype, ^{HT}: Ex-holotype.

Study on new plant diseases. A number of newly emerged diseases: *Diaporthe acuta* causing leaf blight of *Acer palmatum*, *Erysiphe alphitoides* causing powdery mildew of *Cocculus orbiculatus*, *Alternaria arborescens* and *A. italica* causing leaf blotch on *Celtis julianae*, *Colletotrichum siamense*, a novel causal agent of *Viburnum odoratissimum* leaf blotch. These studies are a collaboration with several plant pathologists/mycologists/scientists at CAES and in China.

Impact: These newly emerged diseases are causing severe damage to the ornamental and landscape plants. Determination and identification of these fungal plant pathogens are imperative for disease management and future studies for fully understanding life cycles of the diseases to determine proper methods to control these diseases.

Plant Pathology Research (Dr. Nate Westrick)

Strawberry Disease Research

Strawberries are among the most economically important crops in Connecticut, with farms across the state providing both fruit to the community and acting as a major driver of agrotourism through U-pick operations. While Connecticut's cold winters have historically protected this crop from many of the pathogens that plague strawberries in the southern US, rising global temperatures have led to the introduction of multiple new pathogens that have been a major focus of the Westrick Lab. The first of these diseases is Anthracnose Crown Rot (ACR), which was first identified in the state in the summer of 2022 and caused the near total collapse of multiple fields in 2023 (Fig 1). The Westrick Lab characterized the causative agent as *Colletotrichum siamense* and a publication describing the first incidence of this pathogen in New England is currently under review in *Plant Disease*. Given the many unknowns surrounding this pathogen, Dr. Westrick was awarded a CAES Board of Control Research Award to evaluate varietal susceptibility and management ACR. While largescale field trials are currently underway at both the Valley Laboratory and Lockwood Farm, preliminary research has demonstrated that this pathogen is highly resistant to certain common fungicides and chemical control requires treatment of bare root plants with specific phenylpyrrole fungicide treatments prior to planting. Additionally, preliminary data suggests that sporulation of *C. siamense* is highly suppressed by UV light, possibly explaining the explosion of the disease during a year in which Connecticut experienced both record rains and wildfire smoke events that led to long stretches of darkness during the summer of 2023. Dissecting the virulence mechanisms of this pathogen will require the sequencing and analysis of genomes from multiple strains of this pathogen, and with this goal in mind Dr, Westrick participated in an international Fungal Pathogen Genomics workshop on the Wellcome Genome Campus in Hinxton, UK this past summer.

Figure 1. Field symptoms of anthracnose crown rot (ACR) on *cv.* AC Valley Sunset. A) Mortality and wilting symptoms observed in the field, B) Mid-stage ACR showing severe wilting and death of lower leaves, C) Late-stage ACR, D) Cut crown from strawberry showing canonical red marbling associated with ACR.

Figure 2. Field symptoms of *Neopestalotiopsis* spp. on *cv.* Ruby June. A) Wilting symptoms observed in the field, B) Typical *Neopestalotiopsis* spp. leaf spots with presenting as a diffuse black halo with a light brown center, C,D) Petiole lesions caused by *Neopestalotiopsis* spp.

The second disease characterized in the state was a petiole blight caused by the fungal pathogen *Neopestalotiopsis rosae*, which was identified in a northern Connecticut farm and led to the complete collapse of (Figure 2). *Neopestalotiopsis* has become a growing problem in strawberry production across the United States and is an endemic issue in the southeastern US, Midwest, and Canada, suggesting that it is likely capable of causing major disease issues in Connecticut as well. My lab published the first report of *Neopestalotiopsis* in New England and has since identified low virulence isolates likely native to the state, moderate virulence isolates introduced from Canada, and highly virulent isolates taken from diseased plants imported from North Carolina. Currently there is no data on the relative susceptibility of northern strawberry varieties to this disease, so my lab is conducting a large-scale screen to identify resistant/susceptible varieties prior to the disease becoming a major issue in the state.

Impacts:

- Characterized the causative agents of two aggressive new strawberry diseases in Connecticut, leading to one accepted publication and one currently in review.
- Generated data on the efficacy of specific fungicides to control ACR, leading to actionable information for growers. Given the capacity of ACR to destroy an otherwise productive field, the application of these recommendations has the potential to save growers tens of thousands of dollars each year.

Ongoing work:

- Largescale field trials to establish varietal susceptibility to ACR are underway at the Valley Laboratory and Lockwood Farm. Both trials will be repeated in 2025.
- Greenhouse trials to establish the susceptibility of major northern strawberry varieties of *Neopestalotiopsis*. Efforts will give growers in the region important information about a critical new pathogen before it becomes a major issue in the state.
- Experiments will be continued to establish the factors affecting sporulation of *C. siamense*. This will be critical to identifying the effect that future extreme climate events, including wildfires and excessive rain, will have on the virulence and spread of this pathogen.
- Additional experiments are currently underway to optimize the chemical control of this pathogen through the combination of synthetic fungicides and chemical inducers of plant systemic acquired resistance.

Future work:

- To continue research on ACR, will be submitting a Specialty Crop Block Grant to the Connecticut Department of Agriculture in January 2025.
- To continue research on the effect of climate change and extreme weather events on strawberry disease progression, Dr. Westrick will be submitting a grant proposal to the USDA National Institute of Food and Agriculture (NIFA) in Fall of 2024

- To continue research on *Neopestalotiopsis* disease of strawberry, Dr. Westrick will be submitting a grant proposal to the North American Strawberry Growers Association (NASGA) in November 2024.

Outreach:

- To support strawberry growers in the state, Dr. Westrick has conducted 6 farm visits, analyzed 32 diagnostic samples, and responded to 21 inquiries over phone/email.

White Mold (*Sclerotinia sclerotiorum*)

Sclerotinia sclerotiorum is a broad host range fungal pathogen capable of infecting many dicotyledonous crops, including soybean, canola, and sunflower, and can cause billions of dollars in losses a year across the United States. A major limitation to the control of this disease is a lack of durable genetic resistance within existing dicot germplasm, undermining traditional resistance breeding. The Westrick Lab has conducted extensive work on the genetics of *S. sclerotiorum* virulence with the intention of identifying disease control strategies, and this year published on a novel laccase gene that appears critical for the pathogens capacity to infect plants. Additionally, when this laccase is silenced through RNA interference (RNAi), soybean plants appear dramatically more resistant to the pathogen. Given the promise of RNAi to control this disease, we are actively working with our collaborator Dr. Mehdi Kabbage from the University of Wisconsin – Madison, to generate stable transgenic soybean lines fully resistant to *S. sclerotiorum*.
While these resistant plants are promising, there are no silver bullets in plant disease management and the overuse of any given disease control strategy is likely to fail under enough disease pressure. This has led both to projects focused on evaluating the resiliency of RNAi in controlling fungal disease and projects focused on better understanding the mechanism of non-host resistance to this pathogen. With support from USDA HATCH, my lab is currently evaluating the functional host range of *S. sclerotiorum*, which previously has been identified as specifically a pathogen of dicotyledonous crops, but more recently has been reported as a possible endophyte of monocots as well. We have evaluated the susceptibility of over 100 species to *S. sclerotiorum*, spanning 28 Orders of monocots, dicots, gymnosperms, and ferns. Early data from this study has demonstrated that *S. sclerotiorum* has the capacity to infect many species, including Maize, Rye, and Ginkgo, assumed to be non-hosts of this pathogen. This data has sparked a collaboration between my lab and Dr. Richard Webster at North Dakota State University, in which we are seeking to evaluate the functional effect of *S. sclerotiorum* on grain crops under field, laboratory, and greenhouse conditions. Currently, sunflower fields have been planted at the Valley Laboratory and the Griswold Research Center to establish long term disease nurseries to facilitate this research.
Impacts:

- Published a manuscript in Communications Biology on a novel laccase gene critical to *S. sclerotiorum* virulence, which provides an avenue for novel control of this incredibly important pathogen.
- Generated transgenic soybean plants with the potential to provide durable resistance to *S. sclerotiorum.*

Ongoing work:

- Performing a largescale taxonomic evaluation of *S. sclerotiorum*'s host range and the novel mechanisms used by some non-hosts to suppress infection.
- Confirming the efficacy and resilience of RNAi in controlling *S, sclerotiorum* across broad populations.
- Optimizing the efficacy of RNAi for fungal disease control through the evaluation of hypermobile double stranded RNA.

Future work:

- To continue research on the efficacy of RNAi in controlling *S. sclerotiorum*, Dr. Westrick will be submitting a grant proposal to the USDA National Institute of Food and Agriculture (NIFA) in Fall of 2024
- To continue research on the mechanism of non-host resistance used to control *S. sclerotiorum*, Dr. Westrick will be submitting a grant proposal to the USDA Agricultural Research Service National Sclerotinia Initiative in January of 2025.

Boxwood Blight Research Program

Boxwood blight is a fungal disease of boxwoods which has cost nurseries, businesses, and homeowners millions of dollars across the US and is of major concern in Connecticut. Dr. Jim LaMondia began a program to evaluate the susceptibility of different boxwood cultivars in collaboration with multiple commercial nurseries and that work is being continued in the Westrick Lab. Hundreds of commercial breeding lines are evaluated every summer for their susceptibility to boxwood blight on a scale of 1-5, accounting for lesion formation and defoliation, and the elite lines will be used to breed the next generation of disease tolerant boxwood. These breeding programs are critically important for reducing the incidence of boxwood blight in Connecticut while providing landscapers with cultivars that have important horticultural traits. Dr. Westrick is additionally collaborating with Dr. Srikanth Kodati at the University of Connecticut on a project focused on developing chemical control mechanisms for this pathogen with a lower environmental footprint than traditional fungicides. This includes the use of both antidesiccants and novel formulations of nano copper produced at CAES to control the disease in field and greenhouse settings.

Ongoing work:

- Currently performing greenhouse evaluations on >100 breeding lines for their susceptibility to boxwood blight.
- Collaborating with Dr. Srikanth Kodati in the development of novel chemical control mechanisms for boxwood blight under field and greenhouse conditions.

Outreach:

- Dr. Westrick participates as a part of the Boxwood Blight Insight Group, a national collaboration of researchers from across the US generating research on boxwood blight biology and management.
- Dr. Westrick has consulted with nursery owners about the development of internal boxwood blight screening programs to facilitate accelerated resistance breeding efforts in the future,

Tobacco Disease Work

The Valley Laboratory was founded in 1921 as the Tobacco Substation and since then has had a critical role in supporting tobacco growers around Connecticut. Despite the many challenges in growing cigar wrapper tobacco, it remains one of the largest crops in the state, with roughly 3,000 acres grown a year, and is the single most valuable specialty crop crown in Connecticut. To support tobacco growers, Dr. Westrick participated in the annual Tobacco Research Meeting organized by Dr. Jim LaMondia and will be taking over the organization of the meeting in winter 2025. Dr. Westrick has additionally been responsible for regular analysis of tobacco diagnostic samples, field visits, and phone inquiries to support growers.

Outreach:

- To support tobacco growers in the state, Dr. Westrick has conducted 2 farm visits, analyzed 12 diagnostic samples, and responded to 15 inquiries over phone/email.

VALLEY LABORATORY SERVICE ACTIVITIES

Requests for Information

A total of 6,291 inquiries were answered at the Valley Laboratory during the past year. Nearly 48% of these queries were answered by Ms. Rose Hiskes in the inquiry office (66% of these from the public sector) and remainders were answered by the scientists. The majority of inquiries answered by Ms. Hiskes concerned arthropod (24%), diseases (18%), pesticides (12%), horticulture (8%) and weeds 7%. Most concerned landscape and nursery (49%), vegetable (7%) and structural entomology (8%). All scientists and many of the staff at the Valley Laboratory assist growers and homeowners.

All Valley Laboratory scientists contribute to the service effort. Scientists made 90 presentations to grower, professional and citizen groups (attendees: 5,835 people), were interviewed 7 times and made 219 visits to commercial nurseries, greenhouses, farms, forests and landscapes to diagnose complex problems or conduct research projects. Dr. LaMondia maintains surveillance to notify the Connecticut River Valley growers about the presence and likely threat of tobacco blue mold disease in North America and inform about management options. His laboratory conducted 141 nematode diagnostic tests and conducts testing as an APHIS certified pinewood nematode export testing facility.

Soil Testing

A total of 3,930 soil tests were expertly performed by Ms. Diane Riddle during the past year. About 40% were performed for commercial growers and 60% for homeowners. Of the commercial samples submitted, 23% were for landscapers; 5% for tobacco growers; 2% for vegetable growers, 1.7% for municipalities, 3% for golf course superintendents; 0.1% for nursery growers; 0.5% for small fruit, and 0.9% for research. Thirty tobacco seed germination tests were conducted.

Impact:

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

The Gordon S. Taylor Conference Room

Many agricultural organizations used the conference room at the Valley Laboratory regularly for their meetings in the past. This room has been temporarily converted to Dr. Nate Westrick's office.

Valley Lab Diagnostic Office Insect, Disease and Plant Health Survey, 2023 – 2024

Ms. Rose Hiskes diagnosed a wide range of insect, disease, weed and plant health problems on herbaceous and woody ornamentals, lawns, vegetables, fruit and Christmas trees for homeowners, commercial businesses, other government agencies and nonprofits. Inquiries come in as phone calls, emails, mail or in person as a walk-in or via the drop off bin outside.

Insects

Landscape plants in Connecticut are attacked by many insects. Say's Trig, a bush cricket, *Anixipha exigua*, was found eating oriental bittersweet growing in the inkberry to the right of the entry doors of the Valley Lab on October 6. Ethan Paine, a technician at the lab, found the crickets feeding at 9:30 pm and got them to fall into a cup of soapy water. Damage to the foliage looked like slug damage without the slime trail (Figure 1). Similar damage came in in September on weeping redbud and Katsura trees. Time will tell if this insect becomes a long term problem in landscape.

Figure 1. Say's Trig, bush cricket, with damage to Oriental bittersweet vine. ©CAES Rose Hiskes

The spotted lanternfly has a breeding population in Bloomfield on land trust property. No one has brought one into our office as of July 12, 2024. Citizens are being educated about this insect.

A cut flower grower came in with larkspur, *Consolida ajacis,* plants that were yellowing and turning black. Microscopic examination showed cyclamen mites feeding mainly on flowers but on foliage as well. Given the grower was organic, rogueing the plants was the best option.

Diseases

Landscape plants in Connecticut also suffer from fungal, bacterial or viral diseases. Beech leaf disease, caused by the nematode *Litylenchus crenate* subspecies *mccannii* continues to ravage beech trees in north central Connecticut. Twice yearly applications of poly-phosphite products limit the damage the foliar nematode can do to the beech leaves.

An echinacea flower was brought in with small plants growing out of the disc flowers. At first it was diagnosed as vivipary which is when seeds germinate while still on the mother plant. Dr. Jim LaMondia recognized it as a symptom of aster yellows (Figure 2). Aster yellows is a mycoplasma disease in the plants vascular system that is spread by the aster leafhopper. Many herbaceous plants are susceptible to aster yellows. Removing the plants as soon as symptoms are noticed is the best way to limit damage from this disease.

Homeowners and landscape maintainers brought in common lilac samples with severe leaf spotting. After incubation, a fungus, *Pseudocercospo*ra spp. was found. This leaf spot quickly became a leaf blight, affecting entire leaves. Sanitation as these affected leaves fall will lower the amount of fungal spores around to infect next year's leaves as they emerge in the spring. If the bush is severely compromised over multiple seasons a protectant fungicide applied according to label directions as leaves emerge may manage the disease.

Maples in large parts of Eastern Connecticut showed signs of scorch last fall in early September and dropped leaves early as they turned brown. No fungus was found. Environmental conditions such as excessive rainfall and high temperatures may have combined to cause this situation.

Figure 2. Aster yellows damage to Echinacea flower. ©CAES, Rose Hiskes

Weeds

Running bamboo, while not on Connecticut's invasive plant list, does pose problems in landscapes. Glastonbury has passed a law in addition to state law's regarding this plant which can run underground for 75' and then send up a stem or culm. An identification training was held with the Glastonbury environmental planner and tree warden so they will be able identify *Phyllostachys* species.

A citizen from Glastonbury called to report poison hemlock in his front yard. After a field visit and sample taken, Rose Hiskes, with the help of the state botanist, identified it as spotted water hemlock. Four additional towns submitted reports in July 2023. This native plant is poisonous if ingested and can cause skin reactions. The increased rainfall we have been getting means more marsh and wetland areas where this plant likes to grow.

Weather and Plant Health

The weather in Connecticut continues to change. For April, May and June, temperatures were up to 4°F higher than the NOAA 30-year average. Rainfall for that period switched from being above the NOAA 30-year average for April to being just under 1.4" less for June. The combination of higher temperatures and lower rainfall exacerbates plant problems. If solar radiation and winds are high as well, plants dry out very quickly. There were seven days 90°F and above in the month of June. The only substantial rainfall for the month occurred from June 22 – 23 in the amount of 1.53".

INFORMATION AND DIAGNOSTIC OFFICE TOTALS

Scientist/Tech	Inquiries	Samples IDed/tested	Visits	Talks	Talk Attendees	Interviews	Soil test
Aulakh	400		25	5	270	1	
Cheah	530	2	147	34	2292	4	
Cowles	420	32	15	29	2568	1	
LaMondia	1112	141 nematode samples	17	2	190	1	
Li	41	29	2	1	60		
Westrick	36	48	8	7	240		
Riddle	751						3930
Hiskes	3001	867	5	12			
VL Totals	6291	1119	219	90	5835	7	3930

3001 total inquiries answered. Homeowner inquiries: 61%. Commercial inquiries: 34%. Samples and digital images analyzed: 867

Problems

arthropod	24 %
disease	18 %
pesticide	12 %
cultural	10 %
horticulture	8 %
weed	7 %

Site

landscape	50 %
lawn	13 %
structural	11 %
vegetable	7 %
field crops	4 %
fruit	3 %

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