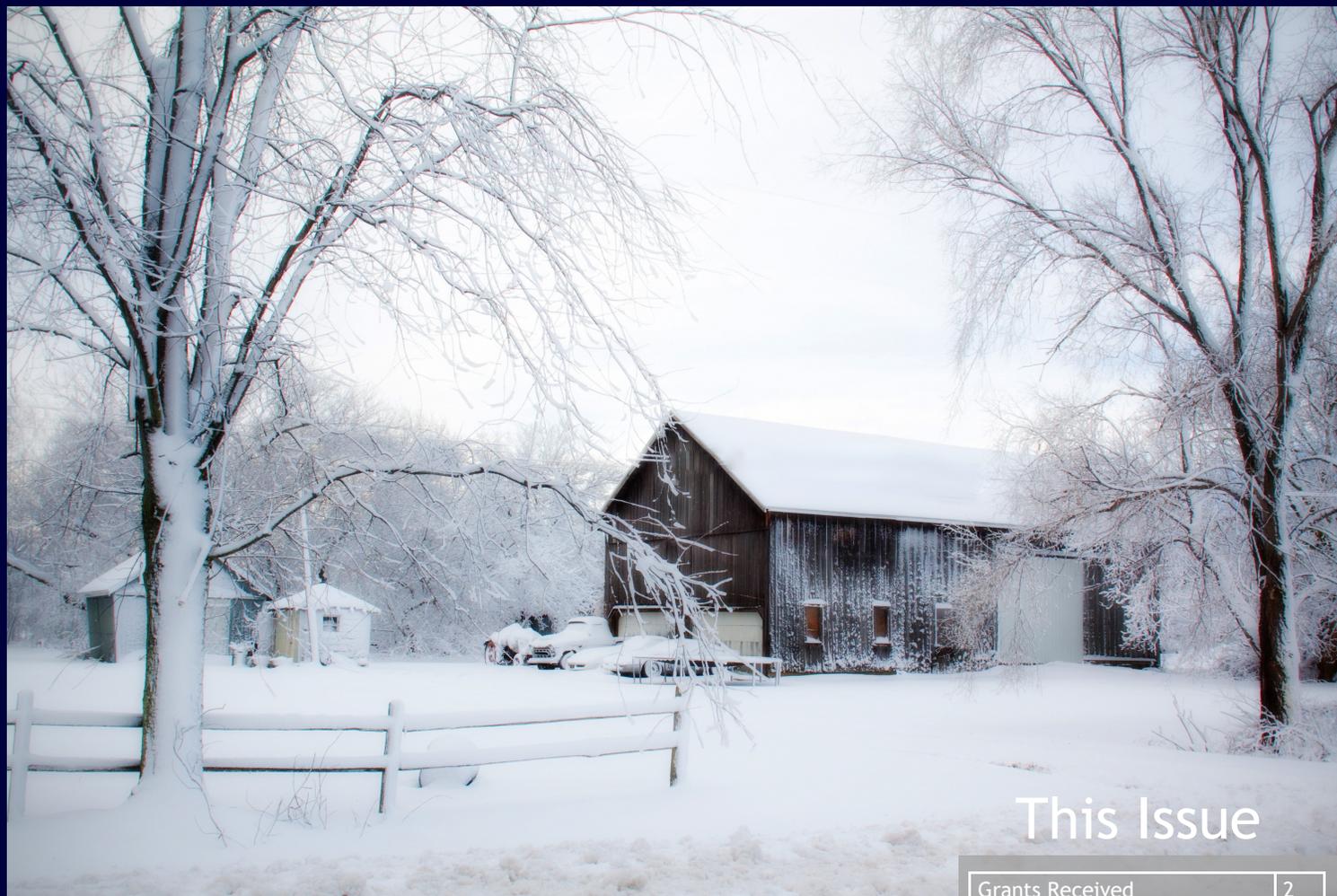


Station News

The Connecticut Agricultural Experiment Station
Volume 11 Issue 12 | December 2021



This Issue

Grants Received	2
Administration	2
Analytical Chemistry	3
Entomology	4
Environmental Sciences	5
Forestry and Horticulture	6
Plant Pathology and Ecology	8
Valley Laboratory	10
Dept. Research Updates	10
Journal Articles Approved	14
New Staff, Students, and Volunteers	15

The mission of The Connecticut Agricultural Experiment Station is to develop, advance, and disseminate scientific knowledge, improve agricultural productivity and environmental quality, protect plants, and enhance human health and well-being through research for the benefit of Connecticut residents and the nation. Seeking solutions across a variety of disciplines for the benefit of urban, suburban, and rural communities, Station scientists remain committed to "Putting Science to Work for Society", a motto as relevant today as it was at our founding in 1875.



CAES

The Connecticut Agricultural Experiment Station

Putting Science to Work for Society since 1875

GRANTS RECEIVED NOVEMBER 2021

DR. SUSANNA KERIÖ (PI) “Application of media composition, temperature adjustments, and silver compounds to improve somatic embryogenesis in Chinese chestnuts” \$9,702.

The project will test the impact of media composition, temperature adjustments, and silver compounds on somatic embryogenesis (SE) success in Chinese chestnuts. Somatic embryogenesis success has been high with American chestnuts and hybrids with high American chestnut heritage, but low with pure Chinese chestnuts and in hybrids with high Chinese chestnut heritage. The project is a collaboration with Prof. Scott Merkle (University of Georgia) and will build upon the SE protocols and media tested in the Merkle lab for chestnuts with high Chinese heritage. On the long term, the project will support the efforts to develop blight-resistant trees.

ADMINISTRATION

DR. JASON C. WHITE participated in the monthly CT Laboratory Preparedness Teams call with the CT Department of Public Health and others (November 1); participated in a Zoom call with collaborators at the NSF Center for Sustainable Nanotechnology (CSN) and Tuskegee University to discuss a joint grant proposal (November 1); held a Zoom call with Prof. Soledad Peresin of Auburn University to discuss collaborative research on nano-enabled agriculture (November 2, 9); met by Zoom with Prof. Philip Demokritou of Rutgers University and Prof. Benedetto Marelli of MIT to discuss a joint NSF proposal (November 2); with **DR. YI WANG**, hosted a Zoom call with collaborators at the University of Massachusetts to discuss ongoing experiments (November 2); with **DR. SARA NASON** and **DR. NUBIA ZUVERZA-MENA**, participated in a Zoom meeting with collaborators at the University of Minnesota and Yale University to discuss progress on a joint NIEHS grant (November 3); participated in the CSN weekly All-Hands call (November 3); with **DR. CARLOS TAMEZ**, participated in a Zoom call with collaborators at the University of Minnesota to discuss joint experiments (November 4); with **DR. JOSEPH PIGNATELLO**, participated in a Zoom call with staff of the University of Connecticut Technology Commercialization Services to discuss CAES patenting and intellectual property assistance (November 4); gave a virtual seminar at the 2021 Annual Sustainable Nanotechnology Organization (SNO) Conference titled “Nanoscale Sulfur to Suppress Fungal Disease and Increase the Biomass and Yield of Tomato” (November 5); attended the 2021 Annual American Society of Agronomy-Crop Science Society of America-Soil Science Society of America (ASA-CSSA-SSSA) meeting in Salt Lake City, Utah, and gave an invited lecture titled “Tuning Agrochemical Chemistry at the Nanoscale to Enhance Stress Tolerance, Crop Nutrition, and Yield” (November 7-10); with **DR. CHRISTIAN DIMKPA**, participated in a Zoom call with colleagues at the Botswana University of Agriculture and Natural Resources and the Botswana Institute for Technology Research and Innovation to explore the possibility of a formalized partnership on nano-enabled agriculture (November 11); held a Zoom call with Prof. Vinka Craver of the University of Rhode Island to discuss USDA NIFA research programs (November 12); served as a panelist on a virtual NSF grant panel in the Chemical, Bioengineering, Environmental and Transport Systems Division (CBET) (November 15-16); participated in a Zoom call with officials from the USDA and the National Nanotechnology Coordination Office (NNCO) to discuss dissemina-

tion of CAES research findings on nano-enabled agriculture (November 17); met with Professor Swadesh Santra of the University of Central Florida to discuss collaborative research (November 17); participated in a Zoom call with representatives from FEMA, USDA, UConn, and the CT Department of Agriculture to discuss preparation of a public webinar on urban agriculture (November 17); participated in a Zoom call with representatives of USDA and the University of Massachusetts to begin planning a workshop on toxic metals in food (November 17, 23); traveled to the University of Central Florida in Orlando and gave an invited lecture titled “Tuning Agrochemical Chemistry at the Nanoscale to Enhance Stress Tolerance, Crop Nutrition, and Yield” (November 18-19); participated in a CSN All Faculty call (November 18); with **DR. WADE ELMER** and **DR. YI WANG**, hosted a Zoom meeting with collaborators at the University of Massachusetts to discuss progress on a joint USDA grant (November 22); with **DR. YI WANG**, participated in a Zoom call with collaborators at Rutgers University and Nanyang Technological University in Singapore to discuss progress on a joint research project (November 23); with **DR. WADE ELMER** and **DR. JAYA BORGATTA**, hosted a Zoom call with collaborators at Johns Hopkins University to discuss progress on a joint research project (November 23); spoke with Bill Hobbs, a reporter for *estuary* magazine, about a story he is writing about CAES (November 23); hosted the November meeting of CAES J-1 Visa recipients (November 29); and participated in the annual PhD Committee meeting of Jesus Cantu, a PhD student at the University of Texas El Paso (November 30).

ANALYTICAL CHEMISTRY

DR. CHRISTINA ROBB attended the Renishaw webinar on Raman Spectroscopy (November 2); participated in the 2021 Eastern Analytical Symposium (EAS) as well as the following events: Executive Committee meetings of the EAS (November 1, 8, 15); EAS Board Meeting (November 14); with **DR. RAVIKUMAR PATEL**, co-presented “The Analysis of Phytohormones” (November 14); and presented “Molecular Indicators of *Abrus precatorius*,” in conjunction with Kirk Gaston of the Forensic Chemistry Center of the FDA, in the EAS Forensic Analysis session (November 15); attended the SelectScience Virtual Biopharmaceuticals Summit presentation titled “Protein LC-MS Evolved: Characterization Tools for New Assays in Bioanalysis” by Dr. John Kellie, GSK (November 9); and participated in the APHL Food Chemistry Workgroup Monthly Call (November 10).

MS. TERRI ARSENAULT attended the National Hemp Regulators conference (November 16-18) and presented on hemp testing. Topics covered included evaluation of test reports, what dry weight means when it comes to hemp regulations, and what measurement uncertainty means. Attended the monthly webinar series of the Rapid Response Team (November 4) and the monthly meeting of the local chapter (November 10); and attended the monthly meeting for the FDA laboratory flexible funding program for human and animal feed (November 8).

DR. NUBIA ZUVERZA-MENA participated in a group meeting with **DR. SARA NASON**, **DR. JASON WHITE**, and collaborators from the University of Minnesota and Yale on a PFAS-phytoremediation enhancement NIH-NIEHS project (November 3); with **DR. SARA NASON**, interviewed four candidates from over fifty Post-Doctoral applicants for a project to assess the effects on contaminants from stormwater infiltration in treated wastewater (November 8-12); attended the monthly meeting for J-1 Visa recipients (November 29); trained visiting staff and

CAES personnel on various inorganic analyses (November 9); attended the virtual Dept. of Analytical Chemistry's monthly quality meeting (November 18); had a "meet and greet" conversation with an undergraduate to advise on a career in science (November 29); and presented "Estrategias de Nanotecnología hacia una Agricultura Sustentable" at the agronomy applied sciences and biotechnology multidisciplinary society (SOMUCAAB), a Mexican National virtual conference (November 24).

ENTOMOLOGY

DR. KIRBY C. STAFFORD III co-chaired a symposium at the annual meeting of the Entomological Society of America in Denver, Colorado (50 attendees) (October 31); co-chaired a meeting of the Changing Dynamics of Tick Ecology, Personal Protection, and Tick Control Subcommittee of the Tick-Borne Disease Working Group (November 10); was interviewed about ticks by John Silva, WTIC News 1080 (November 12); was interviewed about the gypsy moth by Tomoya Ishida, University of Cambridge (November 16); co-chaired a meeting of the Changing Dynamics of Tick Ecology, Personal Protection, and Tick Control Subcommittee of the Tick-Borne Disease Working Group (November 17); was interviewed about lone star ticks by Theresa MacPhail, an independent writer (November 23); participated in a meeting of the Pollinator Advisory Committee (November 30); and presented a talk on strategies and challenges to tick control for the Texas Tick Working Group (November 30).

MS. TIA M. BLEVINS participated in a quarterly Microsoft Teams call with our region's Export Certification Specialist from USDA-APHIS-PPQ where he answered questions from Authorized Certification Officials, provided export program updates, and gave brief trainings on topics including certifying nursery stock to Canada, and certifying house plants (November 17).

DR. MEGAN LINSKE was nominated to serve on the Wildlife Society Leadership Institute Committee (November 5); held the first CAES Postdoc Association Committee meeting as Chairperson (November 9); held the annual fall meeting for the Northeast Section of the Wildlife Society's Executive Committee as Section President (November 15); was elected to serve on the 2022 Northeast Fish and Wildlife Agency's Annual Conference Planning Committee (November 18); and was nominated to serve on the Wildlife Society's Wildlife Publications Awards Committee as the Northeast Section Representative (November 29).

DR. GOUDARZ MOLAEI presented an invited talk titled "A Grim Public Health Outlook: Climate and Ecological Changes, Accelerating Range Expansion of Tick Vectors, and Rising Tide of Tick-borne Diseases" to the Guilford Garden Club (50 attendees) (November 10); with **DR. ANDREA GLORIA-SORIA**, submitted a joint proposal titled "Influence of Genetic Background on the Host Choice of *Culex pipiens* Complex and the Risk of Human Infection with West Nile Virus" for consideration by The Louis A. Magnarelli Post-Doctoral Program (November 19); submitted a joint proposal with **DR. DOUG BRACKNEY** titled "Using Xenosurveillance to Decipher the Eco-Epidemiology of Eastern Equine Encephalitis Virus in the Northeast United States" for consideration by The Louis A. Magnarelli Post-Doctoral Program (November 22); and directed the CAES Tick Testing Laboratory; of the 533 submissions, blood-engorged adult blacklegged ticks were tested for Lyme disease, babesiosis, and anaplasmosis, and results were reported.

DR. GALE E. RIDGE was interviewed about the invasive jumping worms by Liz Dupont Diehl for the Windsor and Bloomfield Journals (November 9).

DR. CLAIRE E. RUTLEDGE conducted a live-stream lecture titled, “The Biological Control of Emerald Ash Borer” for a graduate Forest Health seminar at the University of Vermont (45 adults) (November 1); did a live-stream lecture for the annual meeting of the Connecticut Association of Conservation and Inland Wetland Committees on “Emerald Ash Borer and Spotted Lanternfly” (90 adults) (November 6); and did a live-stream lecture for the Town of New Canaan’s Conservation Commission on the spotted lanternfly (5 adults) (November 15).

DR. VICTORIA L. SMITH attended the annual meeting of the US Forest Service Cooperators, held at Hotel Vermont, Burlington, VT (November 2-3), where information on aerial survey, gypsy moth egg mass survey, and other forest-related operations were reported, and **DR. SMITH, MS. TIA BLEVINS,** and **MR. JEFF FENGLER** received Certificates of Appreciation from USDA Associate Deputy Administrator Carlos Martinez, for “Partnership, Cooperation, and Leadership in Safeguarding American Agriculture from Ralstonia Race 3 Biovar 2.”

DR. KIMBERLY A. STONER met with Sean Cleary, staff of the Environment Committee of the Connecticut state legislature, about possible pollinator health legislation (November 12); and chaired the Pollinator Advisory Committee to the Environment Committee of the Connecticut state legislature (November 30).

ENVIRONMENTAL SCIENCES

DR. JOSEPH PIGNATELLO gave a talk titled “Newly Discovered Driving Forces for Sorption of Some Organic Compounds to Pyrogenic Carbons” (approx. 30 attendees), and co-authored a second talk by **DR. ZHENGYANG WANG** titled “Dynamic Aggregation of Humic Acid in the Absence and Presence of Added Low-Molecular-Weight Acids” (approx. 30 attendees) at the annual meeting of the Soil Science Society of America in Salt Lake City, UT (November 9); and gave a talk titled, “Absorption and Hydrolysis of Sulfuryl Fluoride in Alkaline Hydrogen Peroxide Solutions” at the virtual Methyl Bromide Alternatives and Outreach annual meeting (approx. 40 attendees) (November 16).

DR. PHILIP ARMSTRONG was interviewed about the impact of climate change on mosquito species distribution and seasonality in Connecticut by a reporter from the journal *Front Matter* (November 12).

DR. DOUG BRACKNEY gave an invited virtual lecture titled, “Anatomical Barriers to Transmission: An Arbovirus Tale” in the Department of Biological Sciences at Texas Tech University (approx. 35 attendees) (November 3).

MS. ANGELA BRANSFIELD participated in the Association of Public Health Laboratories’ Educational Activity Biorisk Management Perspectives: Then and Now (November 1); participated in the Federal Select Agent Program’s Multiagency Informational Meeting to discuss select agent and toxin reporting requirements (November 3); participated in the American Biological Safety Association’s 2021 Select Agent Workshop Session #1 Updates from FSAP Directors and DOT Inspections - PHMSA Inspection Process & Division 6.2 Transportation (November 4); and participated in the American Biological Safety Association’s 2021 Select Agent Workshop Session #2 select agent and biosafety topics (November 9).

MR. GREGORY BUGBEE gave a virtual presentation on composting, sponsored by the C.H. Booth Library (approx. 30 attendees) (November 9); was interviewed about composting by the *Newtown Bee* (<https://www.newtownbee.com/11292021/library-welcomes-soil-scientist-speaking-about-composting/>) (November 10); with **MS. SUMMER STEBBINS**, gave a talk titled, “Lake Chaffee Aquatic Plant Survey Results 2021” to the Lake Chaffee Improvement Association in Ashford (approx. 25 attendees) (November 10); and gave a talk on lawn care to the North Haven Garden Club at the North Haven Recreation Center (approx. 25 attendees) (November 23).

DR. SARA NASON served as a panelist for the virtual SETAC Exploring Career Choices event (approx. 30 students) (November 10); presented a poster titled, “Effects of Stormwater Infiltration on Composition of Treated Wastewater” at the virtual 2021 Society of Environmental Toxicology and Chemistry (SETAC) North America Meeting (November 14-18); attended virtual meetings of the Benchmarking and Publications for Non-Targeted Analysis Working Group (November 19, 22, 30); and her work on chemicals in municipal wastewater found during COVID-19 was featured in various press articles during November:

- <https://newsroom.wiley.com/press-releases/press-release-details/2021/Chemicals-in-wastewater-may-help-track-COVID-19-/default.aspx>;
- <https://www.miragenews.com/chemicals-in-wastewater-may-help-track-covid-665323/>;
- <https://www.news-medical.net/news/20211103/Research-could-lead-to-new-methods-for-tracking-COVID-19.aspx>.

DR. ZHENGYANG WANG gave a talk titled, “Dynamic Aggregation of Humic Acid in the Absence and Presence of Added Low-Molecular-Weight Acids” at the Soil Science Society of America International Annual Meeting in Salt Lake City, UT (approx. 30 attendees) (November 7-10).

FORESTRY AND HORTICULTURE

DR. JEFFREY S. WARD spoke on “Management Influences Aboveground Forest Carbon Storage and Sequestration in Mature Oak Forests: 38 Year Results” at the virtual Society of American Foresters National Convention (88 attendees) (November 4); participated in a virtual Technical Advisory Committee meeting for New England Forestry Foundation’s North Central and Transition Hardwoods Exemplary Forestry standards (November 10); met with Great Mountain Forest Executive Director Tamara Muruetagoiena, Trustee Chair John Coston, and Vice Chair Heather Thomson to discuss forest management and stewardship (November 12); attended the McIntire-Stennis Cooperative Forestry Research and Renewable Resources Extension Act Program FY2021 virtual Administrative Meeting (November 15); gave an invited lecture titled, “A Short History of the Connecticut Forest” for the Gardeners of Simsbury (19 attendees) (November 16); met with Gabriel Horton (USAG West Point, NY), Nels Barrett (NRCS regional ecologist), Donald Parizek and Milton Vega (NRCS CT), Olga Vargas (NRCS NY), and Fred Schoenagel (NRCS NJ) to discuss influence of soils on forest composition (November 16); and gave a talk titled, “A Short History of the Connecticut Forest” at the Waterbury Senior Center (23 attendees) (November 17).

DR. SUSANNA KERIÖ gave a talk titled, “Nanoparticles as Tree Care Agents: Chestnuts as a Case Study” at the Society of American Foresters virtual convention

(37 participants) (November 4); attended the Society of American Foresters virtual convention (November 3-6); participated on Yale’s Biosafety Committee (November 18); and participated in the CT Urban Forestry Council’s virtual meeting (November 18).

DR. LEIGH WHITTINGHILL held a virtual meeting with Baikun Li (UConn, Department of Civil and Environmental Engineering) to discuss her projects developing soil monitoring probes, my research directions, and potential collaborations between the UConn team and The CAES (November 1); met with Domingo Medina (Peels on Wheels) to discuss local urban agriculture issues, what they do, Dr. Whittinghill’s research, and potential future collaborations (November 3); gave invited talk titled, “Urban Vegetable Production and Green Roofs” for the UConn Plant Science and Landscape Architecture Friday Seminar series, Storrs (20 attendees) (November 12); gave an invited talk titled, “Increasing Urban Agricultural Productivity Through Innovative Production Practices” for the Sussex Plant Biology Symposium hosted by Yale University (55 attendees) (November 12); and held a virtual meeting with Patrick Doyle, Knox Foundation (Hartford), to discuss what they do, projects Dr. Whittinghill has planned, and possible future collaboration (November 29).

MR. JOSEPH P. BARSKY met with Donald Parizek and Milton Vega (USDA-NRCS) to discuss the results of a cooperative project regarding soil mapping on CAES forest research sites (November 29).

The 2021 Connecticut-FFA Forestry Career Development Event

On November 19, 2021, the Department of Forestry and Horticulture hosted the Connecticut-FFA Forestry Career Development Event (CDE) at the Lockwood Farm Pavilion. This year’s Forestry CDE evaluated students’ general forestry knowledge, forest mensuration, forestry business management, forestry related equipment, tree disorder identification, and tree identification.



Thirty-six students from nine State FFA Chapters participated in this year's event, with the four-student team from E.O. Smith High School Agricultural Education Program taking first place. Students from E.O. Smith FFA will represent The State of Connecticut in regional and national competition at the 2022 Eastern States Exposition and the 2022 National FFA Convention in Indianapolis, IN.

We would like to thank Eric Hansen of Ferrucci & Walicki, Alex Amendola of South Central Connecticut Regional Water Authority, and Annie Shutts Mixsell of the City of New Haven for their assistance.

DR. SCOTT WILLIAMS, MICHAEL SHORT, J. P. BARSKY, and **ERIN REILLY** of the Department of Forestry and Horticulture, and **DR. MEGAN LINSKE** of the Department of Entomology organized and oversaw the event.

PLANT PATHOLOGY AND ECOLOGY

ANNOUNCEMENT: The fifth Plant Health Fellows internship program will be held at The CAES in the summer of 2022, with ten CAES scientists serving as mentors. The application deadline is February 25, 2022. Please spread the word to talented undergraduates with 2+ semesters of college! Application instructions can be found at <https://www.southernct.edu/plant-health-fellows>.

DR. WADE ELMER participated in Workplace Discrimination Investigation UPDATE Training (75 attendees) (November 3); participated in a Working Lands Alliance meeting (76 attendees) (November 10); participated in the APS Press Quarterly Conference call (9 attendees) (November 3); gave a presentation via Zoom titled, "Nano-Cu for Plant Health" at the online Materials Innovation for Sustainable Agriculture 2021 conference (34 participants) (November 12); attended the Sussex Plant Biology Symposium (November 12); attended via Teams the CT Management Advisory Council Meeting (82 attendees) (November 17); participated in the monthly APS Foundation Committee meeting (9 attendees) (November 17); participated via Zoom in a monthly APS Press Update conference with authors of the *Compendium of Citrus Diseases* (5 attendees) (November 19); with **DRS. JASON WHITE, YI WANG,** and colleagues from the University of Massachusetts, participated in a Zoom conference for a NIFA grant project on nano S (7 attendees) (November 22); with **DRS. JASON WHITE, CHRISTIAN DIMKPA, JAYA BORGATTA, ISHAQ ADISA,** and colleagues from Johns Hopkins University, held a Zoom conference for a NIFA grant project on nano P (7 attendees) (November 23); with **DRS. JASON WHITE, MILICA PAVLICEVIC,** and **YI WANG,** held a Zoom conference with colleagues from the University of Parma, Italy, on nanoparticles and biochar (November 23); and held a Zoom conference with Drs. Robert McGovern and Meg McGrath concerning their Springer publication (3 attendees) (November 23).

MS. ROSE HISKES presented "What's New in the Diagnostic Office" to the Hill and Dale Garden Club of South Glastonbury (20 attendees) (November 11); and was interviewed by Nancy Marek, a PhD Student in Natural Resource Economics at UConn, on invasive plant management as part of a National Science Foundation grant for building an invasive plant removing robot.

DR. YONGHAO LI participated in the National Plant Diagnostic Network Online Communication and Web Portal Committee meeting via Zoom (6 adults) (November 10).

DR. RAVIKUMAR PATEL, with **DR. CHRISTINA ROBB**, presented “The Analysis of Phytohormones” at the Eastern Analytical Symposium (EAS) in Princeton, NJ (870 attendees) (November 14).

DR. ROBERT E. MARRA presented a talk titled, “Tropical Storms, Hurricanes, Super Storms” to the New Britain Garden Club at the Shuttle Meadow Country Club in Kensington (17 participants) (November 11); and met with Dr. Craig Broderson, Yale School of the Environment, to discuss a research collaboration on beech leaf disease (November 12).

DR. NEIL SCHULTES presented a seminar titled, “Probing Metabolite Requirements for *Erwinia amylovora* Disease Establishment” at the Department of Plant Pathology and Environmental Microbiology at Pennsylvania University, State College, PA (45 adults) (November 1).

DR. LINDSAY TRIPLETT presented an invited virtual seminar titled, “Bacteria at the Interface of Antimicrobials and Predators” for the UC Riverside Department of Microbiology and Plant Pathology (36 attendees) (October 7); presented via Zoom a short oral presentation titled, “Uncovering the Dark Matter of the Plant Microbiome: The Ecology and Function of Microeukaryotes on Plant Hosts” at the Sussex Plant Biology Symposium (47 attendees) (November 12).

DR. QUAN ZENG attended the faculty meeting of the Plant Science and Landscape Architecture, University of Connecticut (November 11), and the Northeast Tree Fruit Working Group winter seminar planning meeting (November 12).

DR. SYLVESTER AIGBE is a plant pathologist working with Dr. Wade Elmer on nanoparticles and diseases in GMO crops. Dr. Aigbe is from Ambrose Alli University, Ekpoma, Nigeria, and serves as President of the Nigerian Society of Plant Pathology. He is funded by the British Society of Plant Pathology as part of their senior Fellowship program.



Dr. Sylvester Aigbe holding a cassava plant, a dominant food source for Africans and South Americans.

DR. JATINDER S. AULAKH attended the Connecticut Invasive Plant Working Group steering committee meeting and Invasive Plant Council meeting (November 9).

DR. JAMES LAMONDIA was interviewed about goldencreeper (*Thladiantha dubia*), a new invasive weed in Connecticut, by Earth Matters columnist Robert Miller of the *News-Times* (November 2); gave a talk titled, “Connecticut Cigar Wrapper Leaf: Disease Management Approaches” to the North Carolina Tobacco Extension Agent Training meeting (50 attendees) (November 9); taught a lecture and laboratory section about Nematology as a part of the University of Connecticut Fundamentals of Plant Pathology class (22 attendees) (November 10); and provided a recorded webinar titled, “Fungicides and Management Implications for Boxwood Health” to AmericanHort (November 12).

DR. DEWEI LI participated in the virtual 2021 Biennial MassMyco Meeting and gave a presentation titled, “De-Wei’s Recent Mycological Research” (40 attendees) (November 6).

DEPARTMENTAL RESEARCH UPDATES NOVEMBER 2021

ADMINISTRATION

1. Zhao, L., S. Chen, X. Tan, X. Yan, W. Zhang, Y. Huang, R. Ji, and **Jason C. White**. 2021. Environmental implications of MoS₂ nanosheets on rice and associated soil microbial communities. *Chemosphere*, 133004.

Abstract: Molybdenum disulfide (MoS₂) is a transition metal dichalcogenides (TMDCs) material that is seeing rapidly increasing use. The fascinating properties of MoS₂ enable application in a variety of disciplines, which will result in significant environmental release. Here, the impact of MoS₂ nanosheets on rice and associated soil microbial communities was evaluated at the phenotypic, physiological, and metabolic level. Rice plants were grown for 4 weeks in a natural paddy soil amended with either 1T or 2H phase MoS₂ nanosheets at 10 and 100 mg/kg. The 1T MoS₂ nanosheets have a significantly greater dissolution rate (58.9%) compared to 2H (4.44%) MoS₂, resulting in a higher bioaccumulation of Mo in rice leaves (330 mg/kg) compared to 2H MoS₂ (174 mg/kg). However, high bioaccumulation of Mo in rice plant did not induce overt phytotoxicity, and the biomass, photosynthetic pigments, and malondialdehyde (MDA) content of rice were unchanged upon exposure to both phases of MoS₂ nanosheets at both doses. Gas chromatography-mass spectrometry (GC-MS) based metabolomics reveals that MoS₂ in soil systematically enhanced the carbon and nitrogen related metabolic pathways in exposed the plants. Soil 16S rRNA gene sequencing data showed minimal impact of 1T nor 2H MoS₂ exposure on the soil microbial community structure and diversity, including no changes in the abundance of N₂-fixing related groups. The findings indicate that exposure to MoS₂ nanosheets has a negligible impact on rice and the associated soil microbial community.

2. Qu, H., C. Ma, W. Xing, L. Xue, H. Liu, **Jason C. White**, G. Chen, and B. Xing. 2021. Effects of copper oxide nanoparticles on *Salix* growth, soil enzyme activity and microbial community composition in a wetland mesocosm. *Journal of Hazardous Materials*, 127676.

Abstract: A model wetland environment with *Salix integra* ‘Yizhibi’ as a target woody plant species was established to investigate the effects of copper oxide nanoparticles (CuO NPs; the equivalent amount of Cu at 0, 100 and 500 mg/kg) on plant growth, soil enzyme activity and microbial community composition. Ionic Cu (100 and 500 mg/kg) and bulk-sized CuO particles (BPs, 500 mg/kg) were included as controls. CuO NPs, BPs and CuSO₄ powder were directly added to the wetland environment to simulate the natural release of CuO NPs. The results suggested Cu mainly distribute in the surface soil of 0-5 cm after 110 days of experiment. In 10-15cm soil layer, the Cu concentration in CuO treatment (NPs and BPs) was higher than that in ionic treatment. Plant biomass (dry weight, DW) was decreased by 24.5-50.3% in NP500 and ionic Cu treatments, while NP100 and BP500 treatments increased DW by 11.0 and 53.7%, respectively, as compared to the control ($P < 0.05$). CuO (NPs and BPs) and ionic Cu had inhibitory effects on the activity of invertase, urease and cellulase in soil. CuO NPs significantly decreased the activities of peroxidase and polyphenol oxidase, while ionic Cu treatments increased peroxidase activity, BPs and ionic Cu (500 mg/kg) increased the polyphenol oxidase activity. Bacterial community richness and diversity were reduced across all the Cu treatments; however, exposure to NP500 and BP500 significantly increased the richness and diversity of fungal community. Principal coordinate analysis suggests soil microbial community was significantly altered by Cu types and dose. Linear discriminant analysis coupled with effect size analysis suggests that in comparison with ionic Cu and CuO BPs, the presence of CuO NPs uniquely enriched the bacterial families Nitrosomonadales, Rhodocyclales, Desulfurellales, Holophagales Cytophagia, Anaerolineae and the fungal families Thelephoraceae, Hypocreales-fam-Incertae-sedis, Sporidiobolaceae and Corynesporascaceae. Overall, our findings demonstrate that both particle size and dose regulate the impact of CuO on soil microbial ecology and woody plant growth, which deepens our understanding on the environmental fate and ecological risks of CuO NPs in willow forested wetland ecosystems.

3. Aytac, Z., J. Xu, S. Kumar, **Brian D. Eitzer**, T. Xu, N. Vaze, K. W. Ng, **Jason C. White**, M. B. Chan-Park, Y. Luo, and P. Demokritou. 2021. Enzyme- and relative humidity-responsive antimicrobial fibers for active food packaging. *ACS Applied Materials & Interfaces* 13(42):50298-50308.

Abstract: Developing sustainable and biodegradable active food packaging materials that enable the precision delivery of antimicrobial active ingredients (AIs) to enhance food safety and quality is of great significance. Here, biopolymer based, biodegradable enzyme- and relative humidity (RH)-responsive antimicrobial fibers were developed using electrospinning of cellulose nanocrystals (CNCs), zein (protein), and starch that incorporated a cocktail of both free nature derived antimicrobials such as thyme oil, citric acid, and nisin and their corresponding cyclodextrin-inclusion complexes (CD-ICs). The fibers were designed to release the free AIs and CD-ICs of AIs in response to enzyme and RH triggers, respectively. Scanning electron microscopy (SEM) analysis revealed fiber diameters of 225 ± 50 nm. The successful synthesis of CD-ICs of AIs was confirmed using X-ray diffraction (XRD). Fourier transform infrared spectrometry (FTIR) confirmed the incorporation of free antimicrobials in the structure of the multi-stimuli responsive fibers. The antimicrobial activity of the stimuli responsive fibers against the food related pathogens *E. coli* and *L. innocua* was significant, reducing populations by ~5 log in 24 hours contact time with a fiber mass per surface area of 10.9 m²/g. For the fungal species *A. fumigatus*, the fibers reduced populations by >1 log in 24 hours. Concentration-dependent enzyme

triggered release of Ais, as well as AI release at 95% RH, were confirmed in controlled environmental conditions. Biodegradable, biopolymer based, nontoxic, multi-stimuli responsive antimicrobial fibers have great potential for widespread use in sustainable food packaging systems.

ENTOMOLOGY

1. Duan, J. J., R. G. Van Driesche, J. Schmude, R. Crandall, Claire Rutledge, N. Quinn, B. H. Slager, J. R. Gould, and J. S. Elkinton. 2021. Significant suppression of invasive emerald ash borer by introduced parasitoids: Potential for North American ash recovery. *Journal of Pest Science* 1-10. <https://doi.org/10.1007/s10340-021-01441-9>.

Abstract: Successful management of invasive forest pests with sustainable approaches, such as biological control, is critical to the restoration of the affected or damaged forest ecosystems. Several parasitoids introduced from Northeast Asia were released between 2015 and 2017 in several northeastern states of the USA for biocontrol of the invasive emerald ash borer (EAB), *Agrilus planipennis*. Using life tables to estimate the pest population growth rate, we evaluated the impact of two introduced parasitoids (*Spathius galinae* and *Tetrastichus planipennisi*) on EAB population dynamics in five ash-dominated hardwood forests in three Northeastern U.S. states. We observed ~76% decrease in average densities of live EAB larvae to a low density (< 7 live larvae per m² of tree phloem) from 2015 to 2020. This reduction in pest density was driven primarily by the significant increase in parasitism rates (from 35 to 78%) by *S. galinae*, along with low-to-moderate levels of mortality from local generalist natural enemies, such as woodpeckers. *Spathius galinae* alone caused a 31-57% reduction in the net pest population growth rate from 2018 to 2020. These findings demonstrate that in the recently invaded ash forests in the Northeastern USA, timely introduction of specialized natural enemies, such as *S. galinae*, along with local generalist natural enemies, may significantly suppress the invasive pest populations to low densities, allowing surviving trees to recover.

ENVIRONMENTAL SCIENCES

1. Armstrong, Philip M., and Theodore G. Andreadis. 2021. Ecology and epidemiology of eastern equine encephalitis virus in the northeastern United States: An historical perspective. *Journal of Medical Entomology* Nov. 4: Epub ahead of print. PMID: 34734628.

Abstract: In the current review, we examine the regional history, ecology, and epidemiology of eastern equine encephalitis virus (EEEV) to investigate the major drivers of disease outbreaks in the northeastern United States. EEEV was first recognized as a public health threat during an outbreak in eastern Massachusetts in 1938, but historical evidence for equine epizootics date back to the 1800s. Since then, sporadic disease outbreaks have reoccurred in the Northeast with increasing frequency and northward expansion of human cases during the last 20 yr. *Culiseta melanura* (Coquillett) (Diptera: Culicidae) serves as the main enzootic vector that drives EEEV transmission among wild birds, but this mosquito species will occasionally feed on mammals. Several species have been implicated as bridge vectors to horses and humans, with *Coquillettidia perturbans* (Walker) as a leading suspect based on its opportunistic feeding behavior, vector competence, and high infection rates during recent disease outbreaks. A diversity of bird species are reservoir competent, exposed to EEEV, and serve as hosts for

Cs. melanura, with a few species, including the wood thrush (*Hlocichia mustelina*) and the American robin (*Turdus migratorius*), contributing disproportionately to virus transmission based on available evidence. The major factors responsible for the sustained resurgence of EEEV are considered and may be linked to regional landscape and climate changes that support higher mosquito densities and more intense virus transmission.

2. Nason, Sara L., E. Lin, K. J. Godri Pollitt, and J. Peccia. 2021. Changes in sewage sludge chemical signatures during a COVID-19 community lockdown, part 2: Nontargeted analysis of sludge and evaluation with COVID-19 metrics. *Environmental Toxicology and Chemistry*, <https://doi.org/10.1002/etc.5226>.

Abstract: Sewage sludge and wastewater include urine and feces from an entire community, and it is highly likely that this mixture contains chemicals whose presence is dependent on levels of SARS-CoV-2 in the community. We analyzed primary sewage sludge samples collected in New Haven, Connecticut, USA, during the initial wave of the COVID-19 pandemic using liquid chromatography coupled with high-resolution mass spectrometry and performed an exploratory investigation of correlations between chemical features and COVID-19 metrics including concentrations of severe acute respiratory syndrome-coronavirus 2 (SARS-CoV-2) RNA in the sludge and local COVID-19 case numbers and hospital admissions. Inclusion of all chemical features in this analysis is key for discovering potential indicator compounds for COVID-19, whose structures may not be known. We found correlations with COVID-19 metrics for several identified chemicals as well as many unidentified features in the data, including three potential indicator molecules that are recommended for prioritization in future studies on COVID-19 in wastewater and sludge. These features have molecular weights of 108.0935, 318.1214, and 331.1374. While it is not possible to achieve prediction of COVID-19 epidemiological metrics from the one data set used in the present study, advances in this research area are important to share as scientists worldwide work on discovering efficient methods for tracking SARS-CoV-2 in wastewater and the environment.

3. Place, B. J., E. M. Ulrich, J. K. Challis, A. Chao, B. Du, K. Favela, Y.-L. Feng, C. M. Fisher, P. Gardinali, A. Hood, A. M. Knolhoff, A. D. McEachran, Sara L. Nason, S. R. Newton, et al. 2021. An introduction to the Benchmarking and Publications for Non-Targeted Analysis Working Group. *Analytical Chemistry*, <https://doi.org/10.1021/acs.analchem.1c02660>.

Abstract: Non-targeted analysis (NTA) encompasses a rapidly evolving set of mass spectrometry techniques aimed at characterizing the chemical composition of complex samples, identifying unknown compounds, and/or classifying samples, without prior knowledge regarding the chemical content of the samples. Recent advances in NTA are the result of improved and more accessible instrumentation for data generation and analysis tools for data evaluation and interpretation. As researchers continue to develop NTA approaches in various scientific fields, there is a growing need to identify, disseminate, and adopt community-wide method reporting guidelines. In 2018, NTA researchers formed the Benchmarking and Publications for Non-Targeted Analysis Working Group (BP4NTA) to address this need. Consisting of participants from around the world and representing fields ranging from environmental science and food chemistry to 'omics and toxicology, BP4NTA provides resources addressing a variety of

challenges associated with NTA. Thus far, BP4NTA group members have aimed to establish a consensus on NTA-related terms and concepts and to create consistency in reporting practices by providing resources on a public Web site, including consensus definitions, reference content, and lists of available tools. Moving forward, BP4NTA will provide a setting for NTA researchers to continue discussing emerging challenges and contribute to additional harmonization efforts.

JOURNAL ARTICLES APPROVED NOVEMBER 2021

Hu, J., W. Jia, X. Yu, X. Zhang, C. Yan, **Jason C. White**, J. Liu, G. Shen, and X. Wang. Carbon dots improve the nutritional quality of coriander (*Coriandrum sativum* L.) by promoting photosynthesis and nutrient uptake. *Environmental Science: Nano*.

Li, Yonghao. Dutch elm disease. *CAES Fact Sheet*.

Wang, Yi, C. Deng, S. Sharma, Z. Wang, G. Navarro, C. Li, **Christian Dimkpa**, L. Zhao, **Blaire T. Steven**, **Jacquelyn LaReau**, O. Parkash Dhankher, B. Xing, J. Gardea-Torresdey, **Wade Elmer**, and **Jason C. White**. Nanoscale-specific accumulation and bioassimilation of sulfur: Time and coating specific modulation of metabolomic and transcriptomic pathways in diseased tomato (*Solanum lycopersicum*). *Nature Nanotechnology*.

Yue, L., Y. Feng, C. Ma, C. Wang, F. Chen, X. Cao, J. Wang, **Jason C. White**, Z. Wang, and B. Xing. Molecular mechanisms of early flowering in tomato induced by manganese ferrite ($MnFe_2O_4$) nanomaterials. *ACS Nano*.

Zhi, Y., X. Li, F. Lian, **Jason C. White**, Z. Wang, and B. Xing. Nanoscale iron trioxide stimulates the synthesis of auxins analogs in artificial humic acids that significantly enhance rice growth. *ACS Nano*.

Zuverza-Mena, Nubia, **Carlos Tamez**, **Jaya Borgatta**, T. M. Guardado-Alvarez, and **Jason C. White**. Chapter 12 - Biodegradation of plants laden with ENMs: Environmental effects. Elsevier.

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STATION NEWS



HELEN SIEGEL is a current Ph.D. candidate at the Yale School of the Environment under Dr. James Saiers. Her current research interests are in groundwater quality in rural parts of the Appalachian Basin where growth of hydraulic fracturing operations have been particularly intense. Many residents are dependent on domestic groundwater sources for drinking water and other uses. As an extension of that work, she is collaborating with Dr. Sara Nason to screen for PFAS/PFOA compounds in groundwater and surface water samples from areas of intense oil and gas drilling in northern West Virginia.

CADEN CLOUTIER is a student intern under the supervision of Dr. Andrea Gloria-Soria in Environmental Sciences. At CAES, he will be looking at local mosquito populations and the presence of *Aedes aegypti* infection using PCR techniques. He is currently a Junior at Albertus Magnus College in New Haven pursuing a B.S. in Biology with a possible minor in Chemistry. He intends to follow the Pre-Med/Pre-Pharm pathway, having ambitions of pursuing an advanced degree in medicine. He has experience in inpatient nursing care, working specifically with patients who have dementia, diabetes, and immunodeficiency diseases. At Albertus, he is a member of the baseball team, the STEM Scholar Program, and the Science Club, and also works at the Academic Success Center as a tutor.





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