Station News

The Connecticut Agricultural Experiment Station
Volume 15 Issue 1 | January 2025

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

This Issue

ADMINISTRATION

JASON C. WHITE, PH.D. participated in a Teams call with Prof. Zsolt Pap from the Babeș-Bolyai University in Romania to discuss a joint US-Romania grant application (December 2, 9); along with **Nubia Zuverza-Mena, Ph.D., Jingyi Zhao, Ph.D.,** and **Sara Nason, Ph.D.** participated in a Zoom meeting with collaborators at Yale University and the University of Minnesota for a joint NIEHS grant (December 3); participated by Teams in a Editorial Board meeting for the International Journal of Phytoremediation hosted by Taylor Francis (December 2); participated in the weekly NSF Center for Sustainable Nanotechnology (CSN) all hands call by Zoom (December 4); met with colleagues at the University of Minnesota and Convergent Bioscience to discuss collaborative experiments (December 4, 10, 19); met by Zoom with Prof. Jorge Gardea-Torresdey of the University of Texas El Paso to discuss collaborative research (December 4); met by Zoom with two post-doctoral researchers from Brazil to discuss a collaborative research stay at the CAES (December 5); along**. CHRISTIAN DIMKPA, PH.D.** and **Sudhir Sharma, Ph.D.** met by Zoom with collaborators at Stonybrook University and Johns Hopkins University to discuss collaborative experiments (December 5); along **Nubia Zuverza-Mena, Ph.D.** and **Milica Pavlicevic, Ph.D.** met by Teams with colleagues at the University of Texas El Paso and the University of Rhode Island to discuss a collaborative USDA project (December 5); hosted the monthly CAES j-visa recipient meeting (December 6); met by Zoom with Prof. Yiming Sun of Utah State University to discuss a collaborative USDA proposal (December 6); met with an official from HNG Agri and Flower House to discuss a collaborative student exchange program with Nepal (December 9); met with colleagues from Finland to discuss CAES participation in an EU food defense and safety proposal (December 9); participated by Zoom in the AgInnovation Northeast Region quarterly meeting (December 12); along with **Yi Wang, Ph.D.** and **Alvaro Gustavo Garcia Lira, Ph.D.** participated in a Teams meeting with colleagues at Louisiana State University and Auckland University to discuss progress on a collaborative USDA project (December 12); hosted the quarterly CAES Safety Committee meeting (December 13); along with **Carlos Tamez, Ph.D.** met with Ms. Supreetha Sivaraj of the University of California Riverside to discuss collaborative experiments (December 13); along with **Nubia Zuverza-Mena, Ph.D.** and **Mandeep Kaur, Ph.D.** met by Teams with colleagues at Rutgers University and the New Jersey Institute of Technology to discuss progress on a collaborative USDA project (December 16); along with**. Raja Muthuramalingam, Ph.D.** met with colleagues at UConn and Carlton University to discuss collaborative research (December 17); met with Dr. Yilin Zhang of MIT to discuss his research and CAES programs (December 18); met by Teams with officials from the CT Department of Consumer Protection Division of Drug Control to discuss the Adult Use Cannabis Testing Program (December 18); hosted CT Representative Brian Lanoue and staff to discuss the CT Farm Soil PFAS testing program (December 19); along with **Megan Linske, Ph.D.** met with colleagues at the Yale University School of Public Health to discuss collaborator One Health research projects (December 19); participated in the CAES Association Council meeting (December 19); met by Teams with collaborators at the University of Florida and the University of Central Florida to discuss collaborative research (December 20); and along **Sudhir Sharma, Ph.D.** met by Zoom with colleagues at Columbia University to discuss progress on a collaborative USDA research project (December 23).

PUBLICATIONS:

1. Noori, A.; Corbelli, L.; Lincoln, E.; Thomas, S.; **Jones, J.; Nason, S. L.; White, J. C.**, Lewis, R.; Haynes, C. L. (2024). Phytotoxicity and phytoremediation potential of *Lemna minor* exposed to perfluorooctanoic acid (PFOA). *Front. Plant Sci*. Volume 15; DOI: 10.3389/fpls.2024.1493896

Abstract: Perfluorooctanoic acid (PFOA) is one of the highly toxic compounds which was phased out of application in consumer products in 2015 due its harmful effects on human and environmental health. However, this chemical was in use for many years and is still found in water resources. This study focuses on the physiological response of duckweed (Lemna minor) exposed to PFOA so as to determine phytotoxicity and the potential of this aquatic species to remove PFOA from the environment. A time dependent phytotoxicity assay showed that exposure to 0.1 µg/L PFOA for 14 days resulted in 15-25% more chlorosis than in controls. Exposure to 0.1µg/L of PFOA for seven days resulted in a 3% reduction in photosynthetic pigments compared to the control group, though this reduction was not statistically significant. Exposure to PFOA resulted in the significant reduction of essential elements K, Cu, Fe, Mn, Zn, Mo in L. minor by 40, 33, 42, 35, 31, 40%, respectively. Additionally, PFOA accumulated in L. minor with an average bioaccumulation factor of 56±7. Overall, the results show that L. minor can tolerate up to 0.1 µg/L PFOA and can remove over 50% of PFOA from water. This study provides invaluable information regarding the phototoxicity impacts of PFOA on aquatic species and the potential for aquatic phytoremediation of PFOA.

2. Kong, M.; Jing, J.; Wang, F.; Huang, H.; Xu, H.; He, W.; Ma, C.; Shen, Y.; **Elmer, W.; White, J. C.** (2024). CuO nanoparticle size controls inhibition of *Fusarium graminearum. ACS Agric. Sci. Technol.* 4, 12, 1301–1312. DOI: 10.1021/acsagscitech.4c00501

Abstract: The application of nanoparticles (NPs) in agriculture has increased significantly in recent years. Strategies involving the foliar use of NPs can significantly improve plant resistance to soilborne fungal diseases. NPs have been shown to be transported from leaves to roots, with potential release to the rhizosphere, although the precise mechanisms for reduced infection and damage from soilborne pathogens are complex, likely varying with disease system, nanoparticle type and growth conditions. In this study, we investigated 100 ppm Cu NPs of different sizes [sCu NPs, 20-50 nm and lCu NPs, 100 nm], along with 200 ppm CuSO4, for potential ability to inhibit Fusarium graminearum PH-1 in an in vitro leaf bioassay, as well as an in vivo assay on wheat leaves. Three days after treatment, the Cu salt and NPs (20-50 nm) both restricted fungal growth on wheat leaves in vitro. Laser scanning confocal microscopic observations revealed the Cu NPs (20-50 nm) inhibited F. graminearum growth by direct effects on the hyphae, spores, and conidial spore germination. Reactive oxygen species (ROS) were significantly increased by 214.84 and 191.55 J/cm2 in the hyphae and conidia when treated with Cu NPs (20-50 nm), respectively; intracellular ROS content also increased with Cu NPs (100 nm), although inhibition on the conidial spore germination was limited. Cu NPs also compressed the membrane, which was different than the Cu ion-induced ROS that caused cell membrane damage and apoptosis. We observed the smaller NP size (20-50 nm) had greater toxicity than the larger size (100 nm). The study

demonstrates that Cu NPs may have multiple mechanisms of pathogen control, and consequently, may have greater versatility than conventional Cu products as part of sustainable nano-enabled agriculture.

3. Boukhalfa, R.; **Dimkpa, C. O.; Deng, C.; Wang, Y.;** Ruta, C.; Calabrese, J. G.; Messgo-Moumene, S.; **Bharadwaj, A.; Muthuramalingam, R**.; **White, J. C**.; De Mastro, G. (2024). Encapsulation in silica nanoparticles increases the phytotoxicity of essential oil from *Thymus vulgaris* in a weed species. *ACS Agric. Sci. Technol.* 4, 12, 1321–1331. DOI: 10.1021/acsagscitech.4c00580

Abstract: Weed control poses significant challenge to agriculture, warranting the development of effective but environmentally safe herbicides. Encapsulation of plant essential oils (EOs) with herbicidal properties in nanoscale polymers can offer high loading capacity, as well as controlled and tunable agrochemical delivery. This study investigated the use of encapsulated thyme EO against redroot pigweed (Amaranthus retroflexus L.), a difficult-to-control weed resistant to multiple herbicides. Three volumes of thyme EO (500, 750 and 1000 µL) were encapsulated in a silica nanoparticles (SiNPs) suspension to achieve 250 µL/mL (hereinafter ‘‘500’’), 375 µL/mL (hereinafter ‘‘750’’), and 500 µL/mL (hereinafter ‘‘1000’’) EO concentrations. The efficacies of these preparations were compared to that of pristine EO. The loading efficiencies were 26%, 42%, and 64% for the ‘‘500’’, ‘‘750’’, and ‘‘1000’’ EO preparations, respectively. TEM revealed spherical and regular SiNPs with a size range of 220-300 nm. FT-IR confirmed EO loading by the presence of characteristic peaks of isoprenoids and isomeric compounds. Herbicidal bioassays with pristine thyme EO in post-emergence treatments on A. retroflexus seedlings exhibited significant ($p \leq 0.05$) concentration-dependent herbicidal activity, reducing shoot biomass by 85% at the highest tested concentration (‘‘1000’’), compared to the Control (Tween 20). Encapsulation with SiNPs enhanced the herbicidal efficacy at the highest concentration by 96%. Compared to the pristine EO, EO-SiNPs also induced significant ROS production at the highest concentration, leading to cell membrane damage and imbalanced antioxidant system, as demonstrated by increased shoot malondialdehyde content (40%) and activities of the antioxidant enzymes, APX (65%), CAT (52%), and SOD (36%). These results suggest significant potential for developing an effective nano-bioherbicide using thyme EO encapsulated in SiNPs.

4. Guo, Y.; Gan, Y.; **White, J. C**.; Zhang, X.; Wei, D.; Liang, J.; Wang, Y., Song, C. (2025). Fe_2O_3 nanoparticles facilitate soybean resistance to root rot by modulating metabolic pathways and defense response. *Pest. Biochem. Physiol.* 208, 106252. DOI: 10.1016/j.pestbp.2024.106252

Abstract: Four doses of Fe2O3 NPs suspension (10, 50, 100, and 500 mg/L) and one dose of EDTA-FeNa2 solution (10 mg/L) were foliar applied to two soybean (Glycine max) varieties (ND12 and C103) with Fusarium oxysporum. Notably, soybean disease indices were significantly reduced following foliar application of Fe2O3 NPs. At 50 mg/L Fe2O3 NPs, disease indices were reduced by 60.29% and 43.75% in ND12 and C103, respectively; these values were significant better than EDTA-FeNa2, which reduced disease indices by 22.02-28.10% compared to infected control. Furthermore, root biomass increased by 54.28% and 42.95%; chlorophyll a increased by 31.03% and 43.78%; SOD activity increased by 40.82%

and 45.59%; and GmPAL expression increased by 16.64 and 7.23-fold with 50 mg/L Fe2O3 NPs on ND12 and C103, respectively, compared to the infected control. Importantly, the control efficiency of Fe2O3 NPs was 3-6 times higher than that of EDTA-FeNa2. Metabolomic analysis indicated that 50 mg/L Fe2O3 NPs significantly increased the metabolite content of TCA biomolecules in both soybeans; for example, citric acid increased by 102.06% and 29.88% compared to the infected control. The results suggest that Fe2O3 NPs mitigate root rot through multiple mechanisms, including augmentation of antioxidant enzyme activity to mitigate disease-induced oxidative stress, activation of relevant defense genes to enhance resistance, and increased levels of TCA and amino acid metabolites to provide energy for soybean response. These findings underscore the significant potential of Fe2O3 NPs in disease suppression for sustainable agriculture.

5. Xu, X.; Hao, Y.; Cao, Y.; Jia, W.; Zhao, J.; **White, J. C.;** Ma, C. (2025). Nanoscale-boron nitride positively alters rhizosphere microbial communities and subsequent cucumber (*Cucumis sativa*) growth: A metagenomic analysis. *Sci. Tot. Environ*. 958, 178115. DOI: 10.1016/j.scitotenv.2024.178115

Abstract: Nanomaterials have garnered significant attention for their multifunctional applications in agriculture, prompting investigations into their impacts on plant development and soil microbial populations. Understanding the potential repercussions of nanomaterials application on fundamental components in soil is vital for evaluating their appropriateness and safety in agriculture. Here, soil application of 10 mg/kg nanoscale boron nitride (nano-BN) led to a 15.8% increase in the fresh weight of cucumber seedlings compared to the control. In addition, nano-BN increased the shoot content of total chlorophyll, protein and amino acids. Compared to ionic B, nano-BN more effectively provided plants with this essential micronutrient without triggering toxicity response. nano-BN amendment also increased levels of IAA and cytokinins in cucumber seedlings while decreasing ABA content to foster optimal plant growth. In the rhizosphere, nano-BN application elevated levels of DOM and DOC, subsequently enhancing soil enzyme activities such as sucrase and cellulase. Metagenomics was employed to investigate the impacts of nano-BN on soil carbon and nitrogen cycling, as well as the soil microbiome. The upregulation of genes associated with fermentation pathways with nano-BN suggests enhanced carbon cycling. In addition, nano-BN upregulated a number of functional genes involved in nitrogen-based processes, leading to a significant increase in microorganisms harboring nitrogen-fixing genes, including Phenylobacterium, Novosphingobium, and Reyranella. The data suggests a viable technique for increasing the soil nitrogen content, thereby stimulating plant growth and potentially reducing the need for synthetic nitrogen application. Overall, these findings provide valuable insight into the application of nano-BN in agriculture to sustainably increase crop productivity and enhance the efficiency of carbon and nitrogen cycling.

ANALYTICAL CHEMISTRY

CHRISTIAN DIMKPA, PH.D. attended the 12th African Materials Research Society (AMRS) meeting in Kigali, Rwanda during December 14 and 19, 2025. Dr Dimkpa gave a presentation entitled ‘‘The other side of hemp (*Cannabis sativa*): a veritable plant for agricultural nanotechnology’’. He also chaired a session on Materials for Agriculture. The AMRS was attended by over 300 participants from around the world, including those from NSF.

PUBLICATIONS:

1. Wang, Y., Deng, C., Zhao, L., **Dimkpa, C. O., Elmer, W. H., Sharma, S.,** Wang, Z., Dhankher, O. P., Xing, B., **White, J. C.** (2024). Reply to the Letter to the Editor: Nanotechnology papers with an agricultural focus are too frequently published with a superficial or poor understanding of basic plant and soil science - A critical comment to recent papers in *ACS Nano* 18, 11813−11827. DOI: 10.1021/acsnano.4c14632

ENTOMOLOGY

PHILIP ARMSTRONG, SC.D. met with members of the CDC-sponsored Training and Evaluation Centers in Vector-Borne Diseases and presented student training and mentoring plans at CAES (December 5); participated in a panel discussion on decision-making and risk communication during mosquito-borne disease outbreaks at the Annual Northeastern Mosquito Control Association Meeting Plymouth, MA (December 10); met with other members of the Connecticut Mosquito Management Program from CT DPH, DEEP, DoAg, and UCONN to update the EEE response plan (December 17); met with colleagues from Texas Tech University to discuss submission of a NIH grant on modeling EEE virus transmission dynamics (December 18)

ANGELA BRANSFIELD participated in a CAES Health and Safety Committee meeting (December 13); participated in a CAES DEI meeting (December 19).

KELSEY E. FISHER, PH.D. presented "Monarch butterfly biology, ecology, and conservation needs" for the University of Bridgeport virtual Biology Department Seminar Series (December 2); met and brainstormed with Erik Dopman (Tuffs University) and Brad Coates (USDA-ARS-CICGRU) about collaborative opportunities (December 4); met to discuss CT SWAP Priority Actions with CT DEEP and other insect conservation experts (December 6); presented about bumblebees for third graders at Forest Elementary School with Mayor Borer (~100 students; December 9); traveled to Ames, IA to attend and present "Old pest, new problem: Bt resistance in European corn borer in North America" at the Iowa State University Integrated Crop Management conference (December 11-12); attended a FWS virtual presentation to go over the proposed threatened designation for the monarch butterfly for federal protections under the Endangered Species Act (December 12); met with CT DEEP to discuss a response for public comment to the proposed threatened designation for the monarch butterfly for federal protections under the Endangered Species Act (December 17); presented "Bumblebees and Blueberries" at the New England Fruit and Vegetable Growers conference in Manchester, NH (December 19); met and brainstormed with Erik Dopman (Tuffs University) and Brad Coates (USDA-ARS-CICGRU) about collaborative opportunities (December 20).

MEGAN LINSKE, PH.D. was interviewed by Johanna Ravenhurst (New England Center of Excellence in Vector-Borne Diseases) to discuss professional experience working in tick surveillance and research (December 3); gave an invited lecture titled "Systemic Acaricidal Treatment of White-footed mice (*Peromyscus leucopus)* Against Juveniles Blacklegged Ticks (*Ixodes scapularis*) in Connecticut" at the Northeastern Mosquito Control Association, Inc. 70th Annual Meeting in Plymouth, MA (195 attendees; December 7); participated in a meeting with collaborators from Banfield Bio, Inc. and Centers for Disease Control and Prevention (CDC) Division of Vector-Borne Diseases to discuss acquisition of new research project and funding (December 7 & 17); participated in Sandra Zapata-Ramirez's (Southern Connecticut State University) Master's thesis defense and presentation as a committee member (December 12).

TANYA PETRUFF presented a talk entitled "A Detailed Look at the Increase of *Aedes albopictus* throughout Connecticut" at the 2024 annual meeting of the Northeastern Mosquito Control Association held at Hotel 1620 in Plymouth, MA. (December 9-11; 195 attendees) She was also elected to the NMCA Board of Directors as a 3-year b

CHRIS MAIER, PH.D discussed action items to be included in the State Wildlife Action Plan during a Zoom meeting with DEEP officials and others (December 6).

GOUDARZ MOLAEI, PH.D. presented an invited talk, "Emerging Ticks and Tick-borne Pathogens and Ensuing Public Health Challenges" to Connecticut Valley ASM Meeting- Research Seminar Series at Quinnipiac University (December 2); attended the NewVec-NEVBD-VectorED virtual annual meeting (December 5); attended the Cross CoE (NewVec-NEVBD-…) Lyme Disease Vaccine Communication virtual meeting (December 11); attended the NEVBD-TEC Advisory Board Session virtual meeting, Re: Professional Needs Assessment Results (December 13); provided the state legislators with a brief tour of the CAES Tick Testing Laboratory; and met (virtual) with Drs James Shepherd and Lauren Pischel of Yale school of Medicine to discuss and further plan an IRB application for a joint research project between CAES and Yale University on lone start tick and alpha-gal syndrome (AGS, aka red meat allergy) (December 23).

JACOB RICKER participated in a joint tabletop exercise concerning *Ralstonia* with National Plant Diagnostic Network, and National Plant Board, and APHIS (December 10).

JOHN SHEPARD participated in a Board of Directors meeting of the Northeastern Mosquito Control Association (12 participants) (December 8) . Presented "Arbovirus Activity in Connecticut, 2024" and was elected to serve as the 1st Vice President at the 70th Annual Meeting of the Northeastern Mosquito Control Association, Plymouth, MA, (195 attendees) (December 9-11) met with other members of the Connecticut Mosquito Management Program from CT DPH, DEEP, DoAg, and UCONN to update the EEE response plan (December 17).

VICTORIA SMITH, PH.D. participated in the webinar "Integrated Pest Managment for Oak Wilt and Sudden Oak Death", presented by the US EPA Center for Integrated Pest Management (December 10).

TRACY ZARRILLO participated in a ZOOM meeting with Laura Saucier of CT-DEEP and **Drs. Kelsey Fisher, Chris Maier**, and Ray Simpson to discuss the action items for state listed invertebrates in the upcoming 2025 CT-SWAP (December 6); met with Jackson Smith of William Kenny Associates via ZOOM to discuss a collaborative project about native bees and a proposed solar farm installation in CT (December 18); organized and chaired a ZOOM meeting of New England bee researchers to discuss our collaborative regional analysis of New England bees (December 19).

PUBLICATIONS:

1. Dweck H. K. M. (2024). Protocol for single sensillum recording from labial olfactory sensory fields in spotted lanternfly. STAR Protocol 5(4): 103469. DOI: 10.1016/j.xpro.2024.103469

Abstract: Measuring the electrophysiological responses of olfactory receptor neurons (ORNs) to odorants in spotted lanternfly (SLF) (*Lycorma delicatula*) is crucial for understanding how this invasive sap-feeding planthopper locates host plants, aggregates, and mates. Here, we present a protocol for single sensillum recording from SLF labial ORNs to measure their sensitivity, specificity, and response dynamics to odorants. We describe the steps for preparing odorant cartridges, mounting the labium, setting up the electrophysiology rig, recording neuronal responses to odorants, and analyzing data.
oard member.

ENVIRONMENTAL SCIENCE & FORESTRY

SCOTT C. WILLIAMS, PH.D. gave invited lecture titled "Late Fall Synthetic Acaricide Application is Effective at Reducing Host-Seeking Adult and Nymphal *Ixodes scapularis* Abundances the Following Spring" at the 70th Annual Northeast Mosquito Control Association Meeting in Plymouth, MA (195 attendees) (December 10); attended the joint CAES-CT DEEP Forest Health meeting with Senior Staff from CT DEEP Forestry Division (December 16); interviewed by Max Engel and Michael Gaynor of Senior Vocational Services about graduate school options and future employment options (December 16); participated in a Zoom meeting with BanfieldBio on a recently funded CDC grant looking at effectiveness of botanical formulations in managing ticks in peridomestic habitats (December 17); participated in a Zoom call with staff from the CDC Division of Vector-Borne Diseases on progress made on a funded integrated tick management project (December 18).

NATALIE BAILEY presented a talk on tick control and tick-borne disease transmission alongside **Jessica Brown, Ph.D.** at Southern Connecticut State University (18 attendees) (December 2); participated in a collaborative Zoom call with members of Banfield Biologic NIH SBIR-funded tick repellent fabric team (December 10).

JOSEPH P. BARSKY participated, as chair-elect, at the quarterly meeting of the New England Society of American Foresters (NESAF) Board of Directors meeting (December 10); attended 2025 Annual NESAF Winter Meeting Planning Committee meeting (December 17).

JESSICA E. BROWN, PH.D. presented invited lecture at Southern Connecticut State University titled "Making it sTick: Tick Control and Tick-Borne Disease Prevention" (18 attendees) (December 2).

GREGORY J. BUGBEE teleconferenced with the Lockwood Lake Association to provide information on nuisance aquatic plant management (December 2); discussed soil and gave a soil testing demonstration to a class from the Sound (10 attendees) (December 9); teleconferenced with Hamburg Cove stakeholders in collaboration with the United States Army Corps of Engineers (USACE) to discuss hydrilla management (December 10); teleconferenced with Salmon River stakeholders in collaboration with the USACE to discuss hydrilla management (December 16); teleconferenced with officials from the Canoe Brook Lake Association utilizing OAIS surveys to assess needs for localized dredging (December 20).

RILEY S. DOHERTY participated in the Hamburg Cove stakeholder meeting to discuss future management of hydrilla (December 10); participated in the Salmon River stakeholder meeting to discuss future management of hydrilla (December 16); participated in and recorded minutes for the CAES DEI Committee meeting (December 19); graduated from the Pennsylvania State University with a Master in Geographic Information Systems (December 22).

JEREMIAH R. FOLEY, IV, PH.D. served as an advisory council member for a planning meeting for the 2nd Annual Connecticut River Valley Environmental Summit, to be held at Wesleyan University in April (December 4); met with JLY Construction to discuss the buildout of the Tank farm at Lockwood Research Farm (December 5); met with Dr. Ben Sperry from the United States Army Corps of Engineers and his students to discuss future research projects focused on understanding the growth attributes of Connecticut River hydrilla (December 20).

SUSANNA KERIÖ, D.SC. attended the CT Urban Forest Council's (CUFC) meeting as executive board member (December 3); attended a call to plan the CUFC's conference in collaboration with Tree Warden's Association of CT, CT Tree Protective Association, and Connecticut College (December 4); attended the CT Oak Wilt Working Group meeting (December 5);

attended a call to plan the CUFC conference (December 6); administered the Arborist Examinations (December 11); attended a call to discuss re-submission of a collaborative NSF grant proposal on oak adaptation led by Dr. Tara Trammell (University of Delaware) with a team of scientists from USFS, CUNY, and John Hopkins University (December 18).

SARA L. NASON, PH.D. as Vice Chair, participated in virtual meetings for the Best Practices for Non-Targeted Analysis working group (December 2, 5, 17); met with Emily Sigman (Dartmouth) and **CHRISTIAN DIMKPA, PH.D., Craig Musante,** and **Jasmine Jones** to discuss an ongoing project on PFAS in maple syrup (December 2); met virtually with colleagues and students from the University of Minnesota (Dr. Christy Haynes, Riley Lewis, and Cheng-Hsin Huang) and CAES (**JASON WHITE, PH.D., Nubia Zuverza-Mena, Ph.D., Jingyi Zhou, Ph.D.**) to discuss an ongoing funded collaboration on nanomaterial enhancement of PFAS phytoremediation (December 3); met virtually with Bryan Berger and Michael Timko (University of Virginia), Fred Corey (Mi'kmaq Nation), Chelli Stanley (Upland Grassroots), Randy Martin (Central Aroostook Soil and Water Conservation District), and Katie Richards (Maine PFAS Labs) to discuss EPA funded collaborative work on PFAS (December 4); met virtually with high school students to discuss science fair projects (December 5, 13); began hosting weekly ROAR (regular organic analytical research) meetings to enhance cooperation, collaboration, and educational opportunities in organic chemistry at CAES with**. Carlos Tamez, Ph.D. Jasmine Jones, Nassifa Tittikpina, Ph.D. Jingyi Zhou, Ph.D., Gustavo Garcia, Ph.D.,** and **Mandeep Kumar, Ph.D.** (December 19); with **JASON WHITE, PH.D.**, led a tour of the Analytical Chemistry Department for CT Representative Brian Lanoue emphasizing PFAS analysis (December 19).

ITAMAR SHABTAI, PH.D. met with a collaborator at Virginia Tech to discuss a project funded by a BOC Award and with a colleagued from University of Idaho to discuss ongoing projects and grant proposals (December 5); attended the 2024 American Geophysical Union Meeting in Washington, D.C. (December 9-13) and gave a poster presentation on "Mapping the Spatial Distribution of Root Exudate C in the Rhizosphere in Response to Water Availability" (200 attendees) (December 12); held a Zoom meeting with collaborators from The Hebrew University of Jerusalem to discuss a collaboration carbon sequestration using enhanced rock weathering (December 16); held Zoom meetings with collaborators from the Technical University of Munich to discuss a manuscript on soil mineral identification from spectromicroscopy image and met with a collaborator from University of Minnessota to discuss a NIFA grant proposal (December 18); met with a collaborator from Cornell University to discuss a DOE grant proposal (December 31).

BLAIRE T. STEVEN, PH.D. as Branch Councilor, participated in the CT Valley Branch of the American Society of Microbiologists annual business meeting (December 2); as a graduate committee member, participated in the successful Ph.D. thesis defense of Madeline Meadows-McDonnel titled "Salt marshes in the Anthropocene: Understanding how vegetation dominance and ecosystem management affect carbon cycling" in the Department of Natural Resources and the Environment at the University of Connecticut, Storrs (December 17).

ELISABETH B. WARD, PH.D. participated in the Connecticut Oak Wilt Working Group meeting along with representatives from CAES, the USDA Forest Service, and CT DEEP Forestry Division (December 5); participated in the Forest Ecosystem Monitoring Cooperative Joint Steering Committee/State Coordinators Committee meeting in Burlington, VT (December 11); presented Connecticut Forest Health updates at the annual Forest Ecosystem Monitoring Cooperative conference in Burlington, VT (260 participants) (December 12); hosted the joint CAES-CT DEEP Forest Health meeting with Senior Staff from CT DEEP Forestry Division (December 16); was interviewed by the media outlet Heatmap News on forest carbon markets and beech leaf disease (December 16); participated in the Northeast-Midwest State Foresters Alliance Forest Health Committee quarterly meeting (December 17); met with Dr. Marlyse Duguid (The Forest School, Yale School of the Environment), Colleen Murphy-

Dunning (Urban Resources Initiative, Yale School of the Environment), and Annie Mixswell and Max Webster (City of New Haven) to plan a project on beech leaf disease management in New Haven parks (December 19).

SUMMER WEIDMAN gave a talk titled "*Hydrilla* Management in Lake Pocotopaug" to the East Hampton Rotary Club at their monthly meeting (20 attendees) (December 4); discussed publishing the OAIS invasive aquatic plant data to the EPA's WQX portal with CT DEEP virtually (December 11); co-chaired the CAES DEI committee meeting (December 19).

LEIGH J. WHITTINGHILL, PH.D. met with Vivian Feltan, NRCS Outreach Coordinator for CT, to discuss urban agriculture work (December 5); met with Judson Reid and Lori Koenick from Cornell University to discuss upcoming urban agriculture work and potential collaborations that tie in with the goals of our recently awarded MultiState Hatch grant (December 10); attended the New England Vegetable and Fruit Conference and discussed agrivoltaics research with Dr. Daniel Ward, Rutgers University, and repeat harvesting and spinach quality with Dr. Sue Scheufele, University of MA extension (December 17-19); discussed potential collaborations between CAES scientists and the University of Vermont Rubenstein School of Environmental and Natural Resources to provide for credit student projects with lecturer Dr. Kyle Whittinghill (December 24).

YINGXUE (CHARLIE) YU, PH.D. attended the "EPA-G2024-ORD-F1 Models to Predict the Removal of Emerging Micropollutants from Water by Novel Adsorbents in Fixed-Bed Column Processes" panel review from EPA (December 3–5); attended the "MONet XCT Working Groups" webinar (December 3); attended the AGU Annual Meeting in Washington DC, organized and chaired "Advancements in the Fate, Transport, Transformation, and Remediation of Contaminants in the Environment", and served as student competition judge (December 9–13); met with collaborators from EMSL in Washington DC to discuss the use of metabolomics for eco-corona characterization (December 13).

PUBLICATIONS:

1. Nieland, M. A., Lacy, P., Allison, S. D, Bhatnagar, J. B., Doroski, D. A., Frey, S. D., Greaney, K., Hobbie, S. E., Kuebbing, S. E., Lewis, D. B., McDaniel, M. D., Perakis, S. S., Raciti, S. M., Shaw, A. N., Sprunger, C. D., Strickland, M. S., Templer, P. H., Vietorisz, C., **Ward, E. B.**, Keiser, A. D. (2024). Nitrogen deposition weakens soil carbon control of nitrogen dynamics across the contiguous United States. *Global Change Biology* 30, e70016. DOI: 10.1111/gcb.70016

Abstract: Anthropogenic nitrogen (N) deposition is unequally distributed across space and time, with inputs to terrestrial ecosystems impacted by industry regulations and variations in human activity. Soil carbon (C) content normally controls the fraction of mineralized N that is nitrified (*f*nitrified), affecting N bioavailability for plants and microbes. However, it is unknown whether N deposition has modified the relationships among soil C, net N mineralization, and net nitrification. To test whether N deposition alters the relationship between soil C and net N transformations, we collected soils from coniferous and deciduous forests, grasslands, and residential yards in 14 regions across the contiguous United States that vary in N deposition rates. We quantified rates of net nitrification and N mineralization, soil chemistry (soil C, N, and pH), and microbial biomass and function (as beta-glucosidase (BG) and N-acetylglucosaminidase (NAG) activity) across these regions. Following expectations, soil C was a driver of *f*nitrified across regions, whereby increasing soil C resulted in a decline in net nitrification and *f*nitrified. The *f*nitrified value increased with lower microbial enzymatic investment in N acquisition (increasing BG:NAG ratio) and lower active microbial biomass, providing some evidence that heterotrophic microbial N demand controls the ammonium pool for nitrifiers. However, higher total N deposition increased *f*nitrified, including for high soil C sites predicted to have low *f*nitrified, which decreased the role of soil C as a predictor of *f*ni-

trified. Notably, the drop in contemporary atmospheric N deposition rates during the 2020 COVID-19 pandemic did not weaken the effect of N deposition on relationships between soil C and *f*nitrified. Our results suggest that N deposition can disrupt the relationship between soil C and net N transformations, with this change potentially explained by weaker microbial competition for N. Therefore, past N inputs and soil C should be used together to predict N dynamics across terrestrial ecosystems.

GRANTS RECEIVED:

ELISABETH WARD, PH.D is a collaborator on a project funded for **$25,000** through the Child's Family Forestry Research Fund at The Forest School (TFS) at the Yale School of the Environment (YSE) along with Marlyse Duguid, Ph.D. (TFS, YSE), Colleen Murphy-Dunning (Urban Resources Initiative, YSE), Danica Doroski, Ph.D. (Urban and Community Forestry Program Director, CT DEEP Forestry Division), and Annie Mixswell (Tree Warden, City of New Haven). This project will investigate the effects of different forest restoration treatments on stands heavily infested with beech leaf disease in New Haven parks.

PLANT PATHOLOGY AND ECOLOGY

ROBERT MARRA, PH.D. administered the arborist certification oral exam ("TPX") (December 11); participated in the CT TPX Board business meeting (December 12); was interviewed by Michael Munsell of Heatmap News, about tree disease and what that means for the near-term outlook for carbon sequestration (December 16).

FELICIA MILLETT instructed "Horse Chestnut Leaf Blotch" at the Review Night of the Connecticut Tree Protective Association Arboriculture 101 Course held in Jones Auditorium (40 adults) (December 5); and hosted the NPDN Proficiency Committee monthly meeting (5 adults) (December 17).

QUAN ZENG, PH.D. gave a lecture entitled "Fire Blight Disease Biology and Management Options" at the Connecticut Pomological Society Annual Meeting in Middletown CT (100 adults) (December 2), gave an invited presentation at the New England Vegetable & Fruit Conference entitled "Non-antibiotic control options for fire blight and climate change considerations" in Manchester New Hampshire (180 adults) (December 17t, visited Off The Wall Orchard in New Hampshire and provided disease management recommendations to the owner and other participating organic apple growers (December 21).

PUBLICATIONS:

1. Li, Y., Millett, F., and **Dugas, K.** (2024). Seed Germination and Purity Analysis 2023. *CAES Technical Bulletin.* https://portal.ct.gov/-/media/caes/publications/tb38.pdf?rev=1a772bcc64d84b7398c5af341872f833&hash=B9872C881852A6E232919716CC05F748.

2. Millett, F. Bacterial Leaf Scorch of Shade Trees. (2024). *CAES Fact Sheet*. https://portal.ct.gov/-/media/caes/pdio/fact-sheet_bacterial-leaf-scorch2024_final.pdf?rev=6deedf63a65142c0bbf8893ae0d5a90f&hash=9CE8E584C5A8ADDC286162E9961DE807

Dwarf apple trees under the protected structures grown in Concord New Hampshire by Ron Christie. Ron is one of the collaborator farmers of Quan Zeng's organic apple production grant funded by USDA-NIFA-ORG (photo by Quan Zeng).

Pipes have been laid for the Plant Pathology greenhouse (photo by Quan Zeng).

A juvenile red-tailed hawk greeted visitors outside the Jenkins-Waggoner PDIO entrance for an hour on a recent sunny morning. Just as a rescue organization was called, the hawk flew away- it was just taking a rest!

VALLEY LABORATORY

CAROLE CHEAH, PH.D., assessed hemlocks for hemlock woolly adelgid with members of the Conservation Commission, Town of Woodbury and Flanders Land Trust (3) at the Van Vleck Sanctuary, Whittemore Preserve and Nonnewaug Falls (December 4).

NATHANIEL WESTRICK, PH.D., participated in the 2024 Forest Health Cooperators Meeting (30 attendees) (November 6-7) ; presented on strawberry research and represented CAES at a booth for the CT Ag Expo (200 attendees) (November 20) ; met with the interagency CT Oak Wilt Working Group and discussed oak wilt management strategies for Connecticut (10 attendees) (December 5); presented boxwood research update at the quarterly meeting of the Boxwood Blight Insight Group (15 attendees) (December 6).

PUBLICATIONS:

1. Wan, Y., Yue, J., **Li, D. - W.**, Zhu, L. - H. (2024) Pathogenicity and biological characteristics of *Botryosphaeria dothidea* causing branch blight of *Salix babylonica*. *Journal of Phytopathology 172*, e70006. DOI: 10.1111/jph.70006

Abstract: *Salix babylonica* L. is a popular ornamental and ecological tree species. In this study, the results of pathogenicity tests showed that the *Botryosphaeria dothidea* isolates JXL1-3, JXL1-5, JXL1-11, L1-3, L2-2, NFS1, NFS2, NFS5 and WLS1 were pathogens causing branch blight on *S. babylonica*. Meanwhile, the *B. dothidea* isolates JXL1-11, L1-3, NFS1 and WLS1 were found to be pathogenic to two other willows, *S. chaenomeloides* and *S. suchowensis*. The biological characteristics of *B. dothidea* isolates JXL1-11, L1-3, NFS1 and WLS1 were investigated under different conditions, including culture media, pH, temperatures, carbon/nitrogen sources and light. It was found that potato dextrose agar (PDA) medium was the most optimal medium for the *B. dothidea* isolates JXL1-11, L1-3, NFS1 and WLS1 mycelial growth, the suitable pH was 4, and the optimal temperatures were 25°C–30°C. The optimal carbon sources were glucose and sucrose, and the optimal nitrogen sources were ammonium sulfate and peptone. The optimal light condition for inducing sporulation was dark + ultraviolet light. This study provides a fundamental basis for the prevention and control the branch blight on willows and further studies.

JOURNAL ARTICLES APPROVED NOVEMBER 2023

Aulakh, J. S. Identification and control of new invaders in Christmas tree plantations. *The Real Tree Line*.

Aulakh, J. S., Kumar, V., **Westrick, N.**, Price, A. J., Jhala, A. J. Glyphosate-resistant waterhemp (Amaranthus tuberculatus) in Connecticut: Confirmation and EPSPS gene amplification. *Weed Technology*.

Aulakh, J., Witcher, A., Kumar, V.* Ornamental Plant Safety and Weed Control with Indaziflam. *Weed Technology*.

Cowles, R. S. Stumps and wood chip mulch management. *The Real Tree Line*.

da Costa, T. E., Ferreira Borges, D., Dumas, M., Bendett, C., Santos Araújo Holanda, I., Alves Ferreira Preston, H., de Queiroz Ambrósio, M. M., **da Silva, W. L.** Detection and Genetic Variability of Grapevine Red Blotch Virus in New England vineyards. *Crop Protection*.

dos Santos Silva, J. L., Alves Bento, E., de Moura, A. P., Raianne Costa Alves, T., Vinícius Pereira da Silva, I., da Costa Fernandes, J., da Silva Filho, S. M., Gomes Souza, V. M., **da Silva, W.**, de Queiroz Ambrósio, M. M. Characterization and aggressivity of Fusarium spp. associated to root rot and stem rot in Carica papaya in Northeast Brazil. *Crop Protection*.

He, J., Li, N., **Li, D. - W.**, Huang, J. - H., Ren, J. - L., Huang, L. Alternaria yangkouensis sp. nov., a novel causal agent of shoot blight on Chinese fir in Fujian, China. *MycoKey*.

Hussain, M., Adeel, M., **White, J. C.** Nano-selenium: A novel candidate for plant microbiome engineering. *Trends in Plant Science.*

Khalil, N., Chang, A., Sandland, L., Feder, Jr., H. M., Molaei, G.* A tick-borne disease case following a bite by a male lone star tick (Amblyomma americanum Linneas) infected with Ehrlichia sp. and Rickettsia amblyommatis in Connecticut, United States. *Clinical Case Reports*.

Li, Y., Millett, F., and **Dugas, K.** Seed Germination and Purity Analysis 2023. *CAES Technical Bulletin*.

Liang, A., Hao, Y., Wu, W., Cai, Z., Xu, X., Cao, Y., Jia, W., Han, L., Pagano, L., Maestri, E., **White, J. C.**, Ma, C., Xing, B. Micro-nanoscale bone char alters Cd accumulation and rhizosphere functional genes to enhance rice yield and quality. Environmental Science and Technology.

Molaei, G.*, Mohapatra, A. R., Khalil, N., Cozens, D., Bonilla D. Ehrlichia chaffeensis DNA in Environmentally Collected Haemaphysalis longicornis Ticks, Connecticut, United States. *EID*.

Muthuramalingam Thangavelu, R., Milagres, J., **Zuverza-Mena, N.**, Panchalingam, S., El-Tanbouly, R., **White, J. C.**, and **da Silva, W.** Nanoscale Tryptophan Peptosomes for the Targeted Delivery of dsRNA to Control Plant Viral Infections. *Nature Nanotechnolgy*.

Pagano, L., Carlo, S., Lepore, G. O., Bnanni, V., Zizic, M., Pollastri, S., Margheri, S., Orsilli, J., Puri, A., Villani, M., Aquilanta, G., Gianoncelli, A., d'Acapito, F., Zappettini, A., **White, J. C.**, Marmiroli, N., Marmiroli, M. Iron oxide nanofertilization in Zea mays investigated by

synchrotron-based, physiological and molecular analyses. *ACS Nano*.

Phillips, S. G., Brake, S., Esmely-Graces Martinez, D., Eckhert, P. M., Deng, C., **White, J. C.**, Peresin, M. S., Fairbrother, D. H. Controlled release fertilizers from surface-esterified nanocellulose prills. *ACS Sustainable Chemistry and Engineering*.

Thu Le, N. N., Xue, S., Bairoliya, S., Wang, Y., Cao, B., **White, J. C.**, Xim C., Marhaba, T., Zhang, W. Unveiling the potential impacts of oxygen and nitrogen nanobubbles in water on the rhizosphere microbiome of tomato plants. *Soil Biology and Biochemistry*.

Wan, Y., Ju, Y., **Li, D. - W.**, and Zhu, L. - H. Pathogenicity and biological characteristics of *Botryosphaeria dothidea* causing branch blight of *Salix babylonica*. *Journal of Phytopathology*.

Ward, E. B., and Bradford, M. A. Plant nitrogen demand decouples net mineralization and nitrification in recently disturbed forests. *Biogeochemistry*.

Ward, J. S., Ward, E. B. and **Barsky, J. P.** Browse exposure reduces stump sprouting success and height growth following regeneration harvests. *Canadian Journal of Forest Research*.

Zhang, J., He, J., **White, J. C.**, Dong, L., Tao, S., Alvarez, P. J. J., Wang, X. Bioinspired microreactor-capsules for sustainable water purification. *Nature Sustainability*.

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