

Station News

The Connecticut Agricultural Experiment Station

Volume 11 Issue 10 October 2021



Edge of Autumn by Jamie Cantoni,
Edgerton Park, New Haven, CT.

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CAES

The Connecticut Agricultural Experiment Station

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GRANTS RECEIVED SEPTEMBER 2021

DRS. SCOTT C. WILLIAMS and **MEGAN A. LINSKE** were awarded a competitive contract (\$315,000) from the Centers for Disease Control and Prevention “Evaluation of landscaping and vegetation management to suppress host-seeking *Ixodes scapularis* nymphs on residential properties.” The work will investigate different vegetation management strategies such as fall leaf removal, establishment of a wood chip berm on the lawn edge, and differing lawn lengths on spring tick abundances. It will also quantify and compare tick abundances in backyard habitat features such as ornamental plantings, vegetable gardens, engineered hardscapes, xeriscapes, grass/shrubs/forest ecotonal areas, as well as wood piles, stone walls, and bird feeders.

ADMINISTRATION

DR. JASON C. WHITE participated in the Center for Sustainable Nanotechnology (CSN) Strategic Planning Meeting (September 1); participated in the Proposal B Defense and annual Dissertation Committee meeting of Ms. Carolina Valdes Bracamontes of the University of Texas El Paso (remote) (September 2); participated in the Center for Sustainable Nanotechnology (CSN) weekly All-Hands call (September 8, 15, 22, 29); with **DR. YI WANG** and **DR. WADE ELMER**, hosted a meeting with collaborators at the University of Massachusetts to discuss a joint USDA research project on nanoscale sulfur (September 9); participated in the monthly CT Laboratory Preparedness Teams call with the CT Department of Public Health and others (September 13); participated in the monthly FDA LFFM Zoom call for the Human and Animal Food program (September 13); gave a guest lecture (remote) at the Institute of Science and Technology of Sorocaba, São Paulo State University entitled “Nano-Enabled Agriculture: Sustainable Approaches to Food Security” (September 15); hosted the monthly CSN Nanochemistry-Plant Zoom call (September 15); with **DR. JAYA BORGATTA**, participated in a Zoom call with collaborators at Louisiana State University to discuss a joint USDA research project (September 17); participated in Chunyang Li’s PhD proposal defense (September 21); participated in a meeting of the Experiment Station Associates and gave a Director’s Report (September 22); chaired the quarterly CAES Safety Committee meeting (September 24); held a Zoom call with collaborators at Johns Hopkins University to discuss a joint research project on nanoscale phosphorus delivery (September 27); with **DR. WADE ELMER**, participated in a Zoom call with collaborators from the University of Florida and the University of Central Florida to discuss a joint book chapter we are preparing (September 27); participated in the Northeast Regional Experiment Station Directors (NERA) meeting (September 28); participated by Zoom in the Editorial Advisory Board meeting of *Environmental Science and Technology Letters* (September 29); hosted the monthly CAES J-1 Visa recipient meeting (September 30); gave a guest lecture at the European Union Sustainable Innovation of Microbiome Applications in the Food System (SIMBA) online training course “Risk Assessment and Safety Aspects in the Application of Microbial and Nanotechnologies to Agriculture and Food Production”; the lecture was entitled “Nano-Enabled Strategies to Enhance Crop Tolerance to Biotic and Abiotic Stress” (September 30-October 1).

ANALYTICAL CHEMISTRY

DR. CHRISTINA ROBB attended the Eastern Analytical Symposium (EAS) program meeting (September 7), board meeting (September 10), and executive committee meetings (September 7, 13, 15); attended the Pittcon webinar, “Analysis of Microplastics in Water” by Damia Barcelo of the Catalan Institute for Water Research (September 7); participated in the APHL Food Chemistry Workgroup Monthly Call (September 8); attended the Food and Drug Administration (FDA) Laboratory Flexible Funding Model (LFFM) Chemistry Human and Animal Food (C-HAF) Monthly Conference Call - 2021 Series (September 13); was an analytical chemistry judge for the EAS Student Virtual Symposium (September 14); attended the Separation Science webinar, “Mass Spectrometry to Fight Food Fraud” (September 15); discussed mutual interest in microplastics detection with the Coast Guard Academy (September 20); spoke with NOAA about the 2022 Marine Debris Prevention grant (September 21); met with visiting scientist Lidija Jakobek Barron (September 21); attended the ChromSoc “Advances in Gas Chromatography” symposium (September 22); attended several homeland security talks of 908 devices Critical Mass 2021 (September 23); met with the board of the Great Scientific Exchange Conference (SciX) 2021 (September 29); met with Chemistry and Biochemistry professors at the University of Rhode Island (URI) (September 30); and presented “Career Paths of Analytical Chemists” to the URI senior seminar series of the Department of Cell and Molecular Biology, URI (30 attendees) (September 30).

DR. NUBIA ZUVERZA-MENA, with **DR. SARA NASON**, presented “Plant Uptake Mechanisms” at the monthly group meeting with **DR. JASON WHITE** and collaborators from Yale and the University of Minnesota (September 1); met one-on-one and accompanied for lunch or dinner the Department of Environmental Sciences Assistant Scientist candidates Dr. Ahmed A. Hashem (September 7), Dr. Sanjai J. Parikh (September 9), and Dr. Itamar Shabtai (September 20); with **DR. GALE RIDGE**, **MS. JAMIE CANTONI**, **MS. KATHERINE DUGAS**, **DR. JAYA BORGATTA**, and **MS. MEGHAN CAHILL**, staffed the CAES booth at the Big E in West Springfield, MA (37,600 overall attendance) (September 23); with **DR. SUSANNA KERIÖ**, hosted a “Lunch with the Director” potluck organized by **DR. REBECCA JOHNSON** for The CAES Postdoctoral Organization (September 15); attended the Department of Analytical Chemistry’s monthly quality meeting via Teams (September 16); attended the CAES J-1 Visa recipient meeting (September 30); participated in the US FDA program Human and Animal Feed (HAF) subcommittee monthly meeting (September 30); and presented a virtual seminar entitled “Nanotechnology Strategies Towards a Sustainable Agriculture” for the University of New Haven Biomedical Engineering FBMI 2021 Seminar (September 30).

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The CAES booth at the Big E. From left to right: Meghan Cahill, Dr. Gale Ridge, Jamie Cantoni, Katherine Dugas, Dr. Nubia Zuverza-Mena, and Dr. Jaya Borgatta.

ENTOMOLOGY

DR. KIRBY C. STAFFORD III presented a virtual talk on “Strategies and Challenges to the Management of Ticks and Tick-Borne Disease” for the Tick Academy organized by the IPM Institute of North America and the North Central IPM Center (September 14); presented a virtual talk on “Strategies and Challenges to the Management of Ticks and Tick-Borne Disease” for the virtual meeting of the Society for Vector Ecology (SOVE) (September 16); was interviewed about the spotted lanternfly on the Ray & Brian show, WTIC (September 21); presented a talk on the history of the Experiment Station, as part of the CAES Seminar Series, in Jones Auditorium (September 22); organized and moderated a meeting of the Changing Dynamics of Tick Ecology, Personal Protection, and Tick Control Subcommittee of the Tick-Borne Disease Working Group (September 29).

MS. JAMIE CANTONI, with **DR. GALE RIDGE**, **MS. KATHERINE DUGAS**, **DR. NUBIA ZUVERZA-MENA**, **DR. JAYA BORGATTA**, and **MS. MEGHAN CAHILL** attended and staffed the CAES booth at the Big E in West Springfield, MA (September 23).

MS. KATHERINE DUGAS with **DR. GALE RIDGE**, **MS. JAMIE CANTONI**, **DR. NUBIA ZUVERZA-MENA**, **DR. JAYA BORGATTA**, and **MS. MEGHAN CAHILL** attended and staffed the CAES booth at the Big E in West Springfield, MA (September 23).

DR. GOUDARZ MOLAEI presented an invited talk entitled “Bracing for the Worst: Invasion & Range Expansion of Tick Vectors of Human Diseases,” to the 59th Annual

Yankee Conference on Environmental Health, “The Herculean Effort of Environmental Health,” Mashantucket, CT (20 attendees) (September 23); and directed the testing for Lyme disease, babesiosis, and anaplasmosis and reported the results for 75 submissions of blood-engorged adult blacklegged ticks for The CAES Tick Testing Laboratory.

DR. GALE E. RIDGE, with **MS. KATHERINE DUGAS**, staffed an Experiment Station Exhibit at the Woodstock Fair with over 200,000 attendees (September 3-6), and with **MS. KATHERINE DUGAS**, **MEGHAN CAHILL**, **JAMIE CANTONI**, and **DRS. NUBIA ZUVERZA-MENA** and **JAYA BORGATTA**, staffed the Experiment Station exhibit at the Big E in West Springfield, MA with 37,604 attendees at the fair that day (September 23) (photo on p. 4).



DR. CLAIRE E. RUTLEDGE gave a talk on biological control of emerald ash borer to the Universalist Unitarian Church of Lafayette, IN via live stream (15 adults) (September 5); administered the oral portion of the State Arborist’s license exam at Lockwood Farm (10 adults) (September 8); staffed a table with information about southern pine beetle and spotted lanternfly at the annual picnic of the Connecticut Tree Wardens Association in Madison (40 adults) (September 18); taught a class on “Insects that Attack Trees” via live stream for the Connecticut Tree Warden School (35 adults) (September 23); was interviewed on the biological control of emerald ash borer in Connecticut by writer Mike Freeman for an article in *Northern Woodlands* magazine (September 23); and was interviewed about the biological control of emerald ash borer in Connecticut by writer Carrie Arnold for a web article for *National Geographic* (September 24).

MS. TRACY ZARRILLO visited the UConn insect collection to update the taxonomy of certain bee species in the genus *Lasioglossum* (September 9); and gave a workshop about cavity nesting bee biology and the use of bee hotels for the HuneeBee Project in New Haven (5 participants) (September 18).

ENVIRONMENTAL SCIENCES

DR. JOSEPH PIGNATELLO participated in virtual update meetings with co-investigators on grants (September 3); and gave an invited lecture entitled “Modified Biochars for Use in Environmental Remediation” at the 2021 Yankee Conference of the Connecticut Environmental Health Association, Foxwoods (approx. 30 attendees) (September 22-24).

DR. PHILIP ARMSTRONG spoke to reporters from Channel 3 News (September 13), NBC CT (September 13), and Channel 8 News (September 15) about West Nile virus activity in the State; and spoke to the Connecticut Health Investigative Team about long-term changes to mosquito populations and arbovirus risk observed during 25 years of statewide surveillance (September 23).

MS. ANGELA BRANSFIELD participated in BioRAFT’s EHS Community Connection webinar “Chemical Safety for Non-Chemical Hygiene Officers” (September 9); participated in the Federal Select Agent Program’s Responsible Official webinar series “Decontamination vs. Inactivation; Inactivation Guidance” (September 15); participated in the American Biological Safety Association’s BSAT Discussion Forum “The Impact of the Pandemic on Your Select Agent Program”; and participated in a CAES Health and Safety Committee meeting (September 24).

MR. GREGORY BUGBEE, as President of the Northeast Aquatic Plant Management Society, oversaw its annual preconference executive committee meeting in Hyannis, MA (September 13-14); with **MS. SUMMER STEBBINS**, gave a tour of Lake Quonnipaug to the Guilford Conservation Commission Lake Quonnipaug Subcommittee (September 15); toured the Croton Reservoir and River hydrilla control projects with officials from the US Army Corps of Engineers, New York City Department of Environmental Protection, and New York Department of Environmental Conservation (September 20); gave a virtual seminar entitled “Aquatic Plants” to the National Garden Club Environmental School (approx. 50 attendees) (September 22); and gave a tour of the lower Connecticut River and the Salmon River’s hydrilla infestation to officials from the US Army Corps of Engineers, Lower Connecticut River Valley Council of Governments, and SePRO Corp. (September 22).

DR. SARA NASON participated in a virtual meeting on PFAS with colleagues from the Maine Bureau of Agriculture, the University of Maine, the University of Virginia, the University of New Castle, and citizen scientists (September 2); and participated in virtual meetings for the Benchmarking and Publications for Non-Targeted Analysis working group (September 9, 28).

MS. SUMMER STEBBINS, with **MR. GREGORY BUGBEE**, gave a tour of the lower Connecticut River and the Salmon River’s hydrilla infestation to officials from the US Army Corps of Engineers, Lower Connecticut River Valley Council of Governments, and SePRO Corp. (September 22); and gave a talk entitled “Invasive Aquatic Plants in Connecticut Lakes and Ponds” to the Long Hill Garden Club (approx. 40 attendees) (September 27).



FORESTRY AND HORTICULTURE

DR. JEFFREY S. WARD administered practical and oral examinations to arborist candidates for the Connecticut Tree Protection Examining Board at Lockwood Farm (September 8); was interviewed about the fall foliage forecast by Susan Dunne, *Hartford Courant* (September 9); spoke on "Changes in Forest Carbon During 38 Years of Active Management" to a virtual Connecticut and New York Audubon Science Forum (44 attendees) (September 10); spoke on "Forest Management, the Good, the Bad, and the Ugly" at the Valley Laboratory's 100th Anniversary Celebration in Windsor (15 attendees) (September 10); participated in a Forest Ecosystem Monitoring Cooperative CT Sprint Project virtual meeting (September 15); participated in a Forest Ecosystem Monitoring Cooperative State Coordinators Meeting (September 16); spoke on forest management and resiliency at the Yankee Division-Society of American Foresters field workshop in North Madison (58 attendees) (September 21); was interviewed about hickory nut masting by Robert Miller, *News-Times* (September 28); participated in a ConnT Council on Soil and Water Conservation virtual meeting (September 30); and met with Jerry Milne (CT DEEP Forestry) to discuss forest management in Naugatuck State Forest, Hamden (September 30).

DR. SUSANNA KERIÖ assisted with administering examinations to arborist candidates for the Connecticut Tree Protection Examining Board at Lockwood Farm (September 8); participated in the annual meeting for the Multistate Research Project NE1833 - Biological Improvement of Chestnut Through Technologies that Address Management of the Species and its Pathogens and Pests (September 10); attended a seminar about citizen science research projects (September 15); and served on the Yale Biological Safety Committee (September 16).

DR. SCOTT C. WILLIAMS, with **DR. MEGAN LINSKE** and **MR. MICHAEL SHORT**, conducted a small mammal trapping demonstration to students in the Wildlife Management Techniques class in the Department of Natural Resources and the Environment at the University of Connecticut, Storrs (24 students, 1 professor) (September 13); and met with Yale Forest manager Dr. Joseph Orefice to collaborate and discuss forestry practices and prescribed fire regimes for the East Haddam Fishing and Game Club (September 20).

MR. JOSEPH P. BARSKY participated in the Annual Business Meeting of the Sleeping Giant Park Association (September 14); participated in the quarterly meeting of the New England Society of American Foresters Executive Committee (September 16); and attended the Society of American Foresters-Yankee Division Fall Field Meeting in North Madison (September 21).

PLANT PATHOLOGY AND ECOLOGY

DR. WADE ELMER, with **DR. JASON WHITE**, participated in Carolina Valdes Bracamontes' PhD Proposal B Defense (UTEP) (3 attendees) (September 2); with **DRS. JASON WHITE**, **YI WANG**, and faculty from UMass, attended the CAES-UMASS Nano S update (7 attendees) (September 9); with **DRS. JASON WHITE** and **NEIL SCHULTES**, **MR. MICHAEL LAST**, **MR. CRAIG MUSANTE**, and **MS. TERRI ARSENAULT**, attended the CAES P-4 Association council (6 attendees) (September 13); attended the CT Management Advisory Council meeting (162 attendees) (September 15); and attended the NIFA plan of work conference webinar (122 attendees) (September 23).

DR. WASHINGTON DA SILVA traveled to Minas Gerais state in Brazil and, as part of a professional development program sponsored by the local city hall to encourage the young local students to pursue higher education, he presented two seminars entitled “The Roads I Have Travelled: A Journey from Rural Brazil to the Establishment of a Modern Virology Lab in Connecticut USA” at a local college and high school in Divinolândia de Minas in Brazil (300 attendees) (September 9).



Dr. Washington da Silva lectures a classroom in Minas Gerais, Brazil.

DR. YONGHAO LI, with **DRS. ROBERT MARRA** and **CLAIRE RUTLEDGE**, staffed the CAES disease and insect tables at the Tree Warden Association of Connecticut Fall Gathering in Madison (September 18); participated in the National Plant Diagnostic Network National Meeting Poster Committee meeting via Zoom (September 20); and gave a lecture on “Tree Diseases” to the Connecticut Tree Warden School via Zoom (30 adults) (September 23).

DR. ROBERT E. MARRA met with USFS pathologist Dr. Cameron McIntire, who assisted Dr. Marra in taking annual measurements at three of Dr. Marra’s beech leaf disease long-term monitoring plots in Tunxis State Forest (Barkhamsted), Yale Myers Forest (Eastford), and Nathan Hale State Forest (Coventry) (September 20-21).

DR. QUAN ZENG gave an invited seminar via Zoom entitled “Microbiome on Apple Flowers and Its Impact to Fire Blight Disease” for the Department of Plant Pathology, University of Minnesota (40 adults) (September 13); visited the Department of Plant Science and Landscape Architecture, University of Connecticut, and gave a seminar entitled “Microbiome on Apple Flowers and Its Impact to Fire Blight Disease” (30 adults) and met with Dr. Sydney Everhart, Dr. Nick Goltz, and Dr. John Inguagiato from the same department (September 24); and served as a Panelist for the USDA NIFA Foundational Program (September 28-30).

VALLEY LABORATORY

DR. JATINDER S. AULAKH spoke about “New Herbicides for Weed Control in Christmas Trees” (45 attendees) and “Nursery Weed Management” at the 100th Anniversary Celebration of the Valley Laboratory (September 10); and participated in the annual fall meeting of the Connecticut Christmas Tree Growers Association (September 11).

DR. CAROLE CHEAH spoke about “Biological Control of Hemlock Woolly Adelgid” as part of the 100th Anniversary Celebration of the Valley Laboratory (September 10); gave an evening Zoom presentation through the Woodbury Library on resurgence of hemlock woolly adelgid (HWA) and expanding biological control of HWA for towns and homeowners (41 attendees) (September 28).

DR. RICHARD COWLES presented “Phytophthora Root Rot Management” (50 attendees) and “The Box Tree Moth” (20 attendees) at the 100th Anniversary Celebration of the Valley Laboratory (September 10); and spoke on the subjects of “Phytophthora Root Rot, Armored Scale, and Mite Management” to the Christmas Tree Growers Association meeting in East Haddam (50 attendees) (September 11).

DR. SRIKANTH KODATI spoke about “The Effect of Temperature and Rainfall on Boxwood Blight” and “Integrated Pest Management of Hop Pests and Diseases” as part of the 100th Anniversary Celebration of the Valley Laboratory (September 10); and virtually attended the annual meeting of the Northeast Regional Multistate Nematology Technical Committee (NE-1640) (September 16).

DR. JAMES LAMONDIA participated in the virtual SCRI progress update meeting for the Advisory Panel (25 attendees) (September 3); participated in the 100-Year Anniversary Celebration of the Tobacco Station/Valley Lab, speaking about “No-Till/Reduced-Till Tobacco,” “Weather, Water, Early Flowering and Disease, the Story of 2021,” “Breeding for Disease Resistance in Connecticut Broadleaf,” “Boxwood Blight Management,” and “Beech Leaf Disease” (175 people) (September 10); was interviewed about the history, research, and services at the Valley Laboratory by Brian Scott-Smith of WSHU (September 10); virtually attended the Society of Nematologists meeting and presented a poster entitled “Effects of Planting Density on Litchi Tomato (*Solanum sisymbriifolium*) Trap Crop Efficacy Against the Tobacco Cyst Nematode, *Globodera tabacum*” (September 12-15); participated in the annual meeting of the Northeast Regional Multistate Nematology Technical Committee (NE-1640) held virtually (17 attendees) (September 16); and was interviewed about the status of the Connecticut Valley tobacco crop in 2021 by Chris Bickers for the *Tobacco Farmer Newsletter* (September 22).



The Valley Laboratory 100th Anniversary Celebration - Friday, September 10, 2021.

The Connecticut Agricultural Experiment Station Valley Laboratory on Cook Hill Road in Windsor was founded as the Tobacco Experiment Station in 1921 and celebrated its 100-year anniversary on September 10. The day included grower meetings consisting of plot tours and talks and featured a mid-day program welcome by Director Dr. Jason White, a short history of the Tobacco Station/Valley Laboratory by Dr. James LaMondia, a reminiscence from Nancy Taylor, daughter of former head of the Valley Laboratory Dr. Gordon Taylor, who also presented a plaque and congratulations from the Tobacco museum, comments and congratulations from the CAES Board of Control by Terry Jones presented by Joan Nichols, of the Board and Connecticut Farm Bureau, as well as a message of congratulations from Lancaster Leaf and Imperial Tobacco by Ben Refuge, ITG and Vaughan Stevens of Universal Tobacco. Midday music and food were provided by Lancaster Leaf and Imperial Tobacco to growers, dignitaries, and friends. Nearly 200 people attended this day-long event.

Tobacco growers learned about “Worker Protection Standards” from Christina Berger of the CT DEEP; “Tobacco Insurance Program Changes” from Colleen Kisselburgh; and “No-Till/Reduced-Till Tobacco,” “Weather, Water, Early Flowering and Disease, the Story of 2021,” and “Breeding for Disease Resistance in Connecticut Broadleaf” from Dr. James LaMondia. Growers then toured plots to observe disease resistance, breeding lines, and varieties. Christmas tree growers learned about “New Herbicides for Weed Control in Christmas Trees” from Dr. Jatinder Aulakh; “Advances in Understanding Phytophthora Root Rot” by Dr. Richard Cowles; “Mulching for Weed Control and Mushroom Production” by Dr. DeWei Li, and “Insecticide Selectivity for Control of Armored Scales” from Dr. Richard Cowles. A meeting for nursery and landscape professionals featured “Effect of Temperature and Rainfall on Boxwood Blight” by Dr. Srikanth Kodati, “Boxwood Blight Management” by Dr. James LaMondia, “Box Tree Moth Management” by Dr. Richard Cowles, and “Nursery Weed Management” by Dr. Jatinder Aulakh. Arborists and

foresters learned about “Biological Control of Hemlock Woolly Adelgid” from Dr. Carole Cheah, toured plots and heard “Forest Management, the Good, the Bad, and the Ugly” by Dr. Jeffrey Ward, and learned of “Beech Leaf Disease” from Dr. James LaMondia. The day ended with a Valley Laboratory hopyard tour regarding “Integrated Pest Management of Hop Pests and Diseases” by Drs. James LaMondia and Srikanth Kodati. Pesticide certification credits were available for all grower meetings. James Preste, Ethan Paine, Diane Riddle, Michelle Salvat, and Christine Grant from the Valley Laboratory, J. P. Barsky from Forestry and Horticulture, and Richard Cecarelli and Rollin Hannan of Lockwood Farm assisted with all of the arrangements and logistics that made the day go well.



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STATION NEWS



ADMINISTRATION:

1. Meselhy, A. G., S. Sharma, Z. Guo, G. Singh, H. Yuan, R. D. Tripathi, B. Xing, C. Musante, J. C. White, and O. Parkash-Dhankher. 2021. Nanoscale sulfur improves plant growth and reduces arsenic toxicity and accumulation in rice (*Oryza sativa* L.). *Environ. Sci. Technol.* doi.org/10.1021/acs.est.1c05495.

Abstract: Rice is known to accumulate arsenic (As) in its grains, posing serious health concerns for billions of people globally. We studied the effect of nanoscale sulfur (NS) on rice seedlings and mature plants under As stress. NS application caused a 40% increase in seedling biomass and a 26% increase in seed yield of mature plants compared to untreated control plants. AsIII exposure caused severe toxicity to rice; however, co-exposure of plants to AsIII and NS alleviated As toxicity, and growth was significantly improved. Rice seedlings treated with AsIII+NS produced 159% and 248% more shoot and root biomass, respectively, compared to the plants exposed to AsIII alone. Further, AsIII+NS treated seedlings accumulated 32% and 11% less As in root and shoot tissues, respectively, than the AsIII alone treatment. Mature plants treated with AsIII+NS produced 76%, 110%, and 108% more dry shoot biomass, seed number, and seed yield, respectively, and accumulated 69%, 38%, 18%, and 54% less total As in the root, shoot, flag leaves, and grains, respectively, compared to AsIII alone treated plants. A similar trend was observed in seedlings treated with AsV and NS. The ability of sulfur to alleviate As toxicity and accumulation is clearly size dependent as NS offers superior performance compared to bulk amendments. These results have significant environmental implications as the NS application in agriculture has the potential to decrease As in the food chain and simultaneously enable the crops to grow and produce higher yields on marginal and contaminated lands.

2. Chen, S., N. Shi, M. Huang, X. Tan, X. Yan, A. Wang, Y. Huang, R. Ji, D. Zhou, Y.-G. Zhu, A. K. Keller, J. L. Gardea-Torresdey, J. C. White, and L. Zhao. 2021. MoS₂ nanosheets-cyanobacteria interaction: Reprogrammed carbon and nitrogen metabolism. *ACS Nano* DOI: 10.1021/acsnano.1c05656.

Abstract: Fully understanding the environmental implications of engineered nanomaterials is crucial for their safe and sustainable use. Cyanobacteria, as the pioneers of the planet earth, play important roles in global carbon and nitrogen cycling. Here, we evaluated the biological effects of molybdenum disulfide (MoS₂) nanosheets on a N₂-fixation cyanobacteria (*Nostoc sphaeroides*) by monitoring growth and metabolome changes. MoS₂ nanosheets did not exert overt toxicity to *Nostoc* at the tested doses (0.1 and 1 mg/L). On the contrary, the intrinsic enzyme-like activities and semiconducting properties of MoS₂ nanosheets promoted the metabolic processes of *Nostoc*, including enhancing carbon fixation via accelerating the Calvin Cycle. Meanwhile, MoS₂ boosted the production of a range of biochemicals, including sugars, fatty acids, amino acids, and other valuable end products. The altered carbon (C) metabolism subsequently drove proportional changes in nitrogen (N) metabolism in *Nostoc*. These intracellular metabolic changes could potentially alter global C and N cycles. The findings of this study shed light on the nature and underlying mechanisms of bio-nanoparticle interactions, and offer the prospect of utilization bio-nanomaterials for efficient CO₂ sequestration and sustainable biochemical production.

3. Marmioli, M., L. Pagano, R. Rossi, R. De La Torre-Roche, G. O. Lepore, R. Ruotolo, G. Gariani, V. Bonanni, S. Pollstri, A. Puri, A. Gianoncelli, G. Aquilanti, F. d'Acapito, **J. C. White**, and N. Marmioli. 2021. Copper oxide nanomaterial fate in plant tissue: Nanoscale impacts on reproductive tissues. *Environ. Sci. Technol.* 55(15):10769-10783.

Abstract: A thorough understanding of the implications of chronic low dose exposure to Engineered Nanomaterials (ENMs) through the food chain is lacking. The present study aimed to characterize such response in *Cucurbita pepo* L. (zucchini) upon exposure to a potential nanoscale fertilizer: copper oxide (CuO) nanoparticles. Zucchini was grown in soil amended with nano-CuO, bulk CuO (100 mg Kg⁻¹) and CuSO₄ (320 mg Kg⁻¹) from germination to flowering (60 days). Nano-CuO treatment had no impact on plant morphology or growth, nor pollen formation and viability. The uptake of Cu was comparable in the plant tissues under all treatments. RNA-seq analyses on vegetative and reproductive tissues highlighted common and nanoscale-specific component of the response. Mitochondrial and chloroplast functions were uniquely modulated in response to nanomaterial exposure as compared with conventional bulk and salt forms. X-ray Absorption Spectroscopy (XAS) showed that Cu local structure changed upon nano-CuO internalization, suggesting potential nanoparticles biotransformation within the plant tissues. These findings demonstrate the potential positive physiological, cellular, and molecular functions related to nano-CuO application as a plant fertilizer, highlighting the differential mechanisms involved in the exposure to nano-CuO, bulk or salt. Nano-CuO stimulates plant response minimizing environmental and health risk, through sustainable nano-enabled agricultural strategies.

4. Adeel, M., N. Shakoor, M. Shafiq, A. Pavlicek, F. Part, C. Zafiu, A. Raza, M. A. Ahmad, G. Jilani, **J. C. White**, E.-K. Ehmoser, I. Lynch, X. Ming, and Y. Rui. 2021. A critical review of the environmental impacts of manufactured nano-objects on earthworm species. *Environ. Poll.* 290: 118041.

Abstract: The use of manufactured nano-objects (MNOs) in various consumer or industrial products has increased with the rapid development of nanotechnology and therefore, concerns about possible ecotoxicological effects associated with exposure to these materials have also risen. MNOs can be unintentionally released along the product life cycle, consequently accumulating in soils and other environmental matrices, and potentially leading to adverse effects on biota or environmental processes. Earthworms, of the group of Oligochaetes, are an ecologically significant group of organisms and play an important role in soil remediation, as well as acting as a potential vector for trophic transfer of MNOs through the food chain. This review on the potential toxic effects of MNOs on earthworms was conducted to support further risk assessment, as these species are model organisms for ecotoxicity testing. The paper focuses on scientific literature between 2010-2020 and critically evaluates the potential ecotoxicity of 16 different metal-, metal oxide- or carbon-based MNO types. Various adverse effects on the different earthworm life stages of have been reported, including reduction in growth rate, changes in biochemical and molecular markers, reproduction, and survival rate. Importantly, this literature review reveals the scarcity of long-term toxicological data needed to characterize MNOs risk, as well as an understanding of mechanisms causing toxicity to earthworm species.

ENVIRONMENTAL SCIENCES:

1. Sharma, R., D. W. Cozens, P. M. Armstrong, and D. E. Brackney. 2021. Vector competence of human-biting ticks *Ixodes scapularis*, *Amblyomma americanum* and *Dermacentor variabilis* for Powassan virus. *Parasites & Vectors* 14(1):466.

Abstract: Powassan virus (POWV; genus *Flavivirus*) is the sole North American member of the tick-borne encephalitis sero-complex and an increasing public health threat in the USA. Maintained in nature by *Ixodes* spp. ticks, POWV has also been isolated from species of other hard tick genera, yet it is unclear if these species can serve as vectors. *Dermacentor variabilis* and *Amblyomma americanum* share geographic and ecologic overlap with *Ixodes* spp. ticks and POWV transmission foci, raising the possibility that POWV could become established in these tick species and leading to range expansion and increased human risk. Therefore, we assessed the competency of *Ixodes scapularis*, *D. variabilis* and *A. americanum* for POWV lineage II (POWV II). Larvae from all three species were co-infested on POWV-infected Balb/c mice. The engorged larvae were allowed to molt to nymphs and screened for the presence of POWV II RNA by reverse transcription-qPCR. Eight infected nymphs from each species were allowed to individually feed on a naïve mouse. Mice were screened for the presence of POWV II RNA to determine infection status. The results demonstrated that larvae from all three tick species were able to efficiently acquire POWV II via feeding on viremic mice, maintain infection through molting and successively transmit POWV to naïve mice at the nymphal stage at comparable rates across all three species. Our findings reveal that non-*Ixodes* tick species can serve as competent vectors for POWV and highlight the potential role of these species in the ecology and epidemiology of POWV. Future studies examining the possible implications of these findings on POWV epidemiology and the adaptability of POWV in these new vectors are warranted.

2. Yang, Y., P. Duan, K. Schmidt-Rohr, and J. J. Pignatello. 2021. Physico-chemical changes in biomass chars by thermal oxidation or ambient weathering and their impacts on sorption of a hydrophobic and a cationic compound. *Environ. Sci. Technol.* 55(19):13072-13081; <https://doi.org/10.1021/acs.est.1c04748>.

Abstract: This study examined conditions that mimic oxidative processes of biomass chars during formation and weathering in the environment. A maple char prepared at the single heat treatment temperature of 500 °C for 2 hours was exposed to different thermal oxidation conditions, or accelerated oxidative aging conditions prior to sorption of naphthalene or the dication paraquat. Strong chemical oxidation (SCO) was included for comparison. Thermal oxidation caused micropore reaming; ambient oxidation and SCO much less so. All oxidative treatments incorporated O, acidity, and cation exchange capacity (CEC). Thermal incorporation was a function of headspace O₂ concentration and reached a maximum at 350°C due to the opposing process of burn-off. The CEC was linearly correlated with O/C, but the positive intercept together with NMR data signifies that, compared O groups derived by anoxic pyrolysis, O acquired through oxidation by thermal or ambient routes is more efficiently incorporated into CEC. Thermal oxidation increased naphthalene sorption coefficient, characteristic energy of sorption, and uptake rate, due to pore reaming. By contrast, ambient oxidation (and SCO) suppressed naphthalene sorption by creating a more hydrophilic surface. Paraquat sorption

capacity was predicted by an equation that includes a CEC^2 term due to bidentate interaction with pairs of charges predominating over monodentate interaction, plus a term for the capacity of naphthalene as a reference representing non-specific driving forces.

PLANT PATHOLOGY AND ECOLOGY:

1. Li, Y., and K. Dugas. 2021. Seed germination and purity analysis 2020. *CAES Technical Bulletin* https://portal.ct.gov/-/media/CAES/DOCUMENTS/Publications/Technical_Bulletins/TB26.pdf.

JOURNAL ARTICLES APPROVED SEPTEMBER 2021

Cao, X., L. Yu, C. Wang, X. Luo, C. Zhang, X. Zhao, F. Wu, **Jason C. White**, Z. Wang, and B. Xing. Foliar applied iron oxide nanomaterials stimulate nitrogen fixation, yield and nutritional quality of soybean. *ACS Nano*.

He, J., **De-Wei Li**, Y.-N. Zhu, Y.-Z. Si, J.-Y. Bian, W.-L. Cui, and L. Huang. Diversity and pathogenicity of *Colletotrichum* species causing anthracnose on Chinese fir (*Cunninghamia lanceolata*) in China and descriptions of *Colletotrichum shangraoense* sp. nov. *Plant Disease*.

Pless, E., **Andrea Gloria-Soria**, K. R. Seger, B. Ellis, and J. Powell. Evidence for serial founder events during the colonization of North America by the yellow fever mosquito, *Aedes aegypti*. *Evolution*.

Prakash Giri, V., S. Pandeya, M. Kumaria, A. Tripathi, R. Katiyar, **Jason C. White**, and A. Mishra. Hybridization of chitosan and biosynthesized silver nanoparticles to enhance antimicrobial activity against phytopathogens in tomato. *Journal of Agricultural and Food Chemistry*.

Stoner, Kimberly A., A. Nurse, R. T. Richardson, R. Koethe, and D. M. Lehmann. Where does honey bee (*Apis mellifera* L.) pollen come from? A comparison of DNA metabarcoding methods and microscopy for pollen identification and quantification. *Frontiers in Sustainable Food Systems*.

Wang, Yi, Christian Dimkpa, C. Deng, Wade H. Elmer, J. Gardea-Torresdey, and Jason C. White. Interactions of engineered nanomaterials and rice (*Oryza sativa* L.): A review of current knowledge. *Environmental Pollution*.

White, Jason C., and J. Gardea-Torresdey. Nanoscale agrochemicals for crop health: A key line of attack in the battle for global food security. *Environmental Science and Technology*.

Xu, X., C. Zhao, K. Qian, S. Min, Y. Hoa, L. Han, C. Ma, **Jason C. White**, and B. Xing. Physiological response of pumpkin to zinc oxide quantum dots and nanoparticles. *Environmental Pollution*.



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