THE OHIO STATE UNIVERSITY

Summer | 2021

CFAES RATTAN LAL CENTER FOR CARBON MANAGEMENT AND SEQUESTRATION

C-MASC Newsletter

Healthy soil = healthy food = healthy people = healthy ecosystem = healthy planet

C-MASC Officially Renamed

to CFAES Rattan Lal Center for Carbon Management and Sequestration

May 18th, 2021

In a surprise ceremony for Dr. Rattan Lal, Dr. Cathann A. Kress, Vice President for Agricultural Administration and Dean of the College of Food, Agricultural, and Environmental Sciences; Dr. Gary Pierzynski, Associate Dean for Research and Graduate Education; and Dr. Jeff S. Sharp, Director and Professor of Rural Sociology joined Dr. Lal outside Kottman Hall to commemorate the official recognition and renaming of the Carbon Management and Sequestration Center (C-MASC) as the CFAES Rattan Lal Center for Carbon Management and Sequestration by the Board of Trustees of The Ohio State University. The Center plans to retain its iconic acronym, C-MASC. Dr. Lal was touched by this kind gesture, and he enjoyed the company of his colleagues in the picaresque surroundings of the CFAES learning gardens.

IN THIS ISSUE:

Image courtesy Maggie Willis

Sounds of Summer

This May, the Columbus area saw the emergence of billions of Brood X cicadas after 17 years underground. They are particularly numerous in Dublin and Powell, we hope you enjoyed their symphony before it ended!

C-MASC Working Groups

Forest Carbon Working Group

Chair: Roger Williams **Co-Chair:** Sayeed Mahmood
Members: Matt Davies, Rachel S. Gabor, Matthew Hamilton, Jeff Hattey, Stephen Matthews, Brian Slater, Kathy Smith, Brent Sohngen, Eric Toman, Kaigung Zhao; (ex-officio: Rattan Lal, Klaus Lorenz)

By R. Williams

The Forest Carbon Working Group is currently evaluating possible submissions for funding to the Xprize Carbon Removal program sponsored by the Musk Foundation. XPRIZE Carbon Removal is a four-year global competition that challenges innovators from anywhere to create and demonstrate solutions that accomplish CO_2 removal – "carbon removal" – pulling CO_2 directly from the atmosphere or the oceans and locking it away in a durable and sustainable way that can scale massively to gigaton levels. More information can be found at https://www.xprize.org/prizes/elonmusk.

Agricultural Soils Working Group

Chair: Scott Demyan **Co-Chair:** Steve Lyon
Members: Mark Sulc, Steven Culman, Ajay Shah, Jeff Hattey, Dennis Heldman, Marilia Chiavegato, Matt Davies, Vinayak Shedekar, Christine Sprunger, Rachel Gabor, David Barker, and Laura Lindsey; (ex-officio: Rattan Lal, Klaus Lorenz)

By S. Demyan and S. Lyon

The Ag Soils working group has been busy! Among the various group activities and achievements, we highlight two recent items in this update to give a flavor of what's been going on over the last few months. First up, group chair Dr. Scott Demyan joined several C-MASC members and others to celebrate Earth Day 2021 during C-MASC's Restore Earth's Carbon Cycle, an Earth Day webinar. Dr. Demyan presented on the goals and achievements for the Ag Soils working group. He also overviewed examples of expertise and engagement where the group is supporting future growth and development. Of significant importance here is our dedication to teaching and engagement students across OSU. This can be seen through the recent suite of capstone projects from undergraduate students in OSU's School of Environment and Natural Resources ENR 4900.01 course which included surveys of NRCS and Extension professionals on soil carbon sequestration and a forest biomass assessment at the Waterman Farm woodlot. These projects are a clear example where C-MASC expertise has been leveraged to help train the next generation of scientists. The second major activity to highlight is the contributions of the Ag Soils working group to the development of a concept note targeting OSU's President's Research Excellence (PRE) seed funding program. The goal of this group effort is building capacity for regional validation of the technical and socio-economic potential of agricultural and forestry management as a pathway for net zero Carbon emissions. Partnering with our friends in the Forest Soils working group, this concept note outlines the need to standardize soil carbon sampling methodologies and how these can be reconciled across the land management strategies ranging from intense row-crop agriculture to forest systems. At the end of the day, this project will build the working capacity of C-MASC making OSU a leader in sustainable agriculture and land use management.

Quarterly Viewpoint

FROM THE DESK OF JACKIE WILKINS

July 2021

Farmers are taking center stage in the national discussions on environmental solutions and climate change, and the current administration sees farmers as a critical partner. In addition to the ongoing efforts to address sustainability via environmental stewardship, nutrient management, and water quality best practices, farmers are now being called on to take the lead in reducing carbon emissions. The goal is to farm in such a way as to enable crops to capture carbon dioxide from the atmosphere and store it in the soil, thus reducing the amount of greenhouse gases in the atmosphere that contribute to atmospheric warming. A variety of incentives are being introduced to encourage carbon sequestration and increase carbon markets and the participation of farmers in this new "commodity crop." In fact, storing carbon is one of the hottest topics in agriculture right now, because it can provide an income stream for farmers while addressing environmental concerns. However, many questions remain about how the carbon markets will work and how farmers can best be prepared to benefit from them when approached about selling their carbon credits.

Before signing a long-term contract, farmers will need to be able to determine their carbon footprint baselines, understand carbon credits and the carbon market, know if and when to sell and at what price, and be optimally prepared to make decisions about short- and long-term investments. Ohio State University Extension is addressing this need by hiring an Extension carbon sequestration specialist in partnership with the Rattan Lal Carbon Management and Sequestration Center at The Ohio State University, who will work closely with the Extension carbon team and the CFAES Knowledge Exchange to create a one-stop-shop for science-based information on all things carbon. Together, this team will be a resource for Ohio farmers and producers, industry leaders and professionals, and youth by: providing vital Extension education and training on soil carbon and soil health improvements as well as increasing the use of sustainable and regenerative agricultural practices; developing carbon management and sequestration programs including soil organic carbon, soil health, carbon markets, economics, payments for ecosystem services, the soil carbon cycle at farm level, and life-cycle analysis of farm production; and collaborating with other university and industry researchers, faculty, and Extension educators for on-farm research and education on soil carbon management and sequestration as well as soil health, urban soil remediation, sustainable agriculture, and community food systems. Farmers will need more questions answered about this new commodity crop before they sign on the bottom line, and our college researchers and Extension will be here to help.

Sincerely,

Jackie Wilkins
Associate Dean and Director, Ohio State University Extension
Chair, Department of Extension
College of Food, Agricultural and Environmental Sciences

In Memory of a Great Scholar and Friend

Dr. Gulab Singh Yadav

By Dr. Janta Layek

Dr. Gulab Singh Yadav, a young, rising and dynamic Scientist succumbed to novel coronavirus at the age of 39 in the early hours of 19 May 2021.

He was born to Mrs. Kamala Devi and Mr. Lala Ram as the second child on 1st July 1982 in Amlonipur, Bareilly, Uttar Pradesh, India. He completed his schooling from his native home and joined the Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, where he obtained his degree in Agriculture (2005). After a successful academic career in IARI, New Delhi, where he completed Masters and Doctorate in Agronomy, he was selected to the coveted ARS as Scientist-Agronomy in the year 2011. His first place of employment was ICAR Research Complex for NEH Region, Tripura Centre, India.

He had a commendable career at the ICAR Research Complex in the NEH Region, Tripura Centre, where he surpassed his peers, achieving accolades for himself and also for the Institute. He completed more than 20 projects, primarily in the fields of integrated farming systems, conservation agriculture, climate-resilient agriculture, and crop production. He was a pioneer in developing climate-resilient agricultural technologies for sustainable agricultural development in the Eastern Himalayan region of India. His innovative resource conservation technologies are widely adopted by the small and marginal landholders of the North-Eastern region of India. He published more than 150 research articles in highly-rated, reputable peer-reviewed journals. To date, he has more than 2000 citations with an h-index and i10-index of 24 and 48, respectively.

He was the recipient of two National Awards: Swami Sahajanand Saraswati Outstanding Extension Scientist Award and Fakhruddin Ali Ahmed Award for outstanding research in tribal areas for the year 2019. An individual receiving two national awards simultaneously in the same year is a rare feat in the scientific community in NARES system, India. He was also the recipient of the DN Borthakur Award in the year 2016 for outstanding contributions in Farming Systems Research. Additional academic honors include the DBT Overseas Fellowship 2015-16, where he got the chance to work under World Food Prize laureate Prof. Rattan Lal, C-MASC, OSU, USA from 2016-17. In Sept. 2020, he was transferred to his first choice place of posting, ICAR-IARI, New Delhi with the dream of living with family and contributing to science by working in this reputable National Institute.

Apart from his excellence in academics, research, and extension work, he will always be remembered for his service to the farming community of Tripura. During his tenure in ICAR Tripura, he touched the lives of more than 12,000 farmers, changing their views and perception towards scientific agriculture and thereby giving them the chance to improve their livelihood.

Above all, God had bestowed him with the qualities of a sincere, dedicated, amicable, and level-headed personality. His pleasant demeanour and charisma are unparalleled. His whole presence could calm down a chaotic situation, making him a favorite among his fellow colleagues. Prof. Lal, his mentor in OSU, the USA rightly coined him as an irreplaceable asset of Indian Agriculture.

He achieved many things during his brief period on this planet that many do not achieve in a lifetime. He could have achieved much more. But destiny had different plans for him. His family members, especially brother Dr. Subhash Babu (also a scientist in Agronomy at IARI, New Delhi) and his colleagues at ICAR-NEH, IARI, CMASC and NARES system are deeply shocked and saddened due to his untimely demise. We pray with all our hearts for the peace of the departed soul and pray to God to give strength to the bereaved family members to give strength to bear the irreparable loss.

You will be always remembered, Dr. Gulab, for your humbleness and contributions to science and society.....

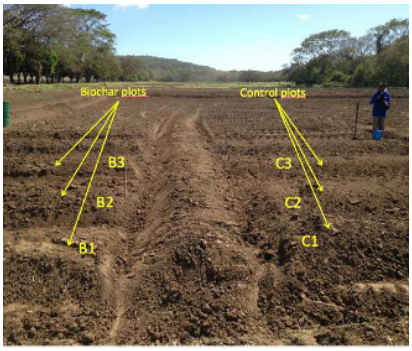
C-MASC Working Groups

Agricultural Water Innovations in the Tropics

The Agricultural Water Innovations in the Tropics (AgWIT) partnership used drone-based hyperspectral and thermal imagery to quantify upland rice productivity and water use efficiency after soil biochar application in Costa Rica. Biochar increased gross primary productivity between 20% and 40% relative to controls plots likely due to higher soil moisture and consequently significantly higher water use efficiencies.

Reference:

Jin, H.; Köppl, C.J.; Fischer, B.M.C.; Rojas-Conejo, J.; Johnson, M.S.; Morillas, L.; Lyon, S.W.; Durán-Quesada, A.M.; Suárez-Serrano, A.; Manzoni, S.; Garcia, M. Drone-Based Hyperspectral and Thermal Imagery for Quantifying Upland Rice Productivity and Water Use Efficiency after Biochar Application. Remote Sens. 2021, 13, 1866. https://doi.org/10.3390/rs13101866



Oak Versus Maple: C-Sequestration

Cole Simons, an undergraduate student majoring in Biology out of the Department of Evolution, Ecology and Organismal Biology, will be conducting a research project this upcoming school year to examine the influence of trees in sequestering carbon in forest soils. He will be looking at oak and maple species to determine if there exists an influence difference between forest species groups. He is working under the advisement of Dr. Roger Williams, associate professor of forestry in the School of Environment and Natural Resources.

Images courtesy USDA. Sugar Maple Leaves © J.S. Peterson; Pin Oak Leaves © Robert H. Mohlenbrock

C-MASC Celebrates Earth Day

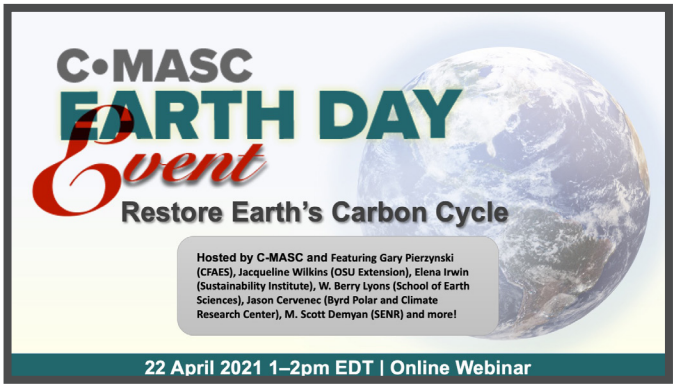
with the 2021 theme "Restore Earth's Carbon Cycle"

April 22nd, 2021

C-MASC was honored to be joined by nine esteemed guests throughout the university, who formed a multi-disciplinary panel for our inaugural Earth Day Webinar to address the urgent need to "Restore Earth's Carbon Cycle;" we were pleased to welcome 91 viewers to the webinar, from all over the globe.

After an introduction by C-MASC Director Rattan Lal and Assistant Director Klaus Lorenz, our panelists gave an overview of their visions for how their organizations can address this pressing issue. CFAES Associate Dean for Research Gary Pierzynski discussed the important role that soil and soil

science plays in modulating the carbon cycle, and Associate Dean and Director of Extension Jackie Wilkins addressed the vital way that Extension can educate and empower Ohio's growers regarding the carbon markets, while Elena Irwin, Faculty Director of OSU's Sustainability Institute, outlined the was that human behavior influences the carbon cycle directly and indirectly.



From the School of Earth Science, Professors and Distinguished University Scholars W. Berry Lyons and C.K. Shum joined the webinar. Dr. Lyons discussed the history of the carbon cycle on a geological scale and Dr. Shum gave us an overview on emerging satellite technologies to monitor the Earth's carbon cycle. Jason Cervenec, Education and Outreach Director for the Byrd Polar and Climate Research Center, celebrated the 60th anniversary of the Byrd Polar center and gave an overview of the many research projects that that center has spearheaded, including FARM, the Field Application Resource Monitor.

Finally, the leaders of both C-MASC Working Groups gave updates on their respective goals and accomplishments in the last few months. Scott Demyan, Assistant Professor in the School of Environmental Resources (SENR) and Chair of C-MASC Working Group 1: Agricultural Soils, outlined the work he, Co-Chair Steve Lyons, and the members of the group have focused on by investigating soil organic carbon processes and stocks in the soil, using both traditional wet lab analyses and emerging technologies such as rapid quantification with remote sensing technologies, and using results from these and other manipulative experiments to inform policies. Sayeed Mehmood, Associate Professor in SENR and Co-Chair of C-MASC Working Group 2: Forest Soils relayed an update on the activities that he, Chair Roger Williams, Brent Sohngen and the other working group members have studied, including the age of a forest, land use change, pests and diseases and sequestration rates and how these issues may be applied to policy - primarily the way "many countries and companies are relying on forests to meet their net-zero carbon emission goals."

The webinar recording can be found here: https://cmasc.osu.edu/events/c-masc-earth-day-event.

Update: Amitava Chatterjee

Dr. Chatterjee first joined the Dr. Lal and the CFAES Rattan Lal Center for Carbon Management and Sequestration (C-MASC) as a Post Doc and Visiting Scholar from September 2007-August 2008. In 2021, he will join the National Sedementation Lab, USDA ARS in Oxford, MS as a Research Soil Scientist. He previously served as Associate Professor of Soil Science at North Dakota State University. He was also the master advisor of Dr. Umesh Acharya who was recently appointed a Post Doctoral Scholar at C-MASC, and Dr. Acharya will join us in August to work on C-MASC's joint project on remote sensing with Microsoft.

Congratulations, Dr. Chatterjee! We look forward to hearing more about your important contributions to the field of soil science.

C-MASC Arrivals & Updates

Srabani Das

Dr. Srabani Das has joined C-MASC, at the Ohio State University as a Postdoctoral Scholar. Srabani did her PhD studying soil carbon dynamics and soil health in marginal soils under perennial grass bioenergy crops, from Cornell University, Ithaca, New York. Her work encompassed assessing the influence of long-term soil moisture on soil properties, soil organic carbon mineralization utilizing mechanistic modeling and on greenhouse gas emissions. Residing in upstate New York for more than a decade, she has followed the growth of sustainable bioenergy production sector in the US Northeast as a viable climate change mitigation option. Srabani has been the Head Teaching Assistant for undergraduate biology with the College of Agriculture and Life Sciences at Cornell University and taught Environmental Sciences at several institutions.

Srabani has a master's in Environmental Science and Engineering from the Indian Institute of Technology Bombay, India and another in Life Sciences from the Jawaharlal Nehru University, New Delhi, India. Besides her academic career, she has engaged substantially in multi-stakeholder processes focused on improving agricultural water use in India. While working for the project 'Dialogue for Water, Food and Environment (World Wildlife Fund-Consultative Group on International Agricultural Research)', she has coordinated a civil society dialogue aimed to streamline environmental focus of water resource development and agricultural water use.

At C-MASC, Srabani is conducting research on soil physical, mechanical, and hydrological properties in farmlands and pastures of Stark County, Ohio. The objective of on-farm measurements and lab analyses will be to understand processes, factors, and management practices which influence soil health, carbon sequestration, and crop yields. She will use these data to test models and measurements made by remote sensing techniques and field reflectance measurements. She is excited and thankful to work with the C-MASC team, OSU Extension, Kent State University, the Herbert W Hoover Foundation and feels blessed to get an opportunity to work with Dr. Rattan Lal.

Update: Con"grad"ulations, Hao Su!

My name is Hao Su, a former visiting scholar from China. I have just completed my doctoral dissertation on Cropland system health and protection strategies. I'm going to graduate from Zhejiang University and work at the School of International Affairs and Public Administration, Ocean University of China, as a lecturer. Thanks to Dr. Lal for his guidance on some parts of my doctoral dissertations during my stay in OSU and his recommendation. I will always miss the good time spent at OSU.

Professor Rong Tan (Deputy Dean of School of Public Affairs), Professor Wenze Yue (Subject Leader), Dr. Hao Su, Professor Cifang Wu (Supervisor), Professor Zhou (Chairman of the Defense Committee), and Director Kai Fang

C-MASC Arrivals & Updates

Sia Chitnis

Soil, so intrinsic to our life, has been severely damaged. We are steering ourselves into a cycle of drought and starvation. If I wanted to help redirect our perceptions, and offer soil a helping hand, returning it to a pristine state, I knew I would need to genetically modify the soil to retain water. Loving nature, I found a way to contribute.

My name is Sia Chitnis, and I am a rising senior at West Windsor Plainsboro High School North. I am working with genetic modification to increase water retention to save our soil, which will save us. I am conducting an experiment in my backyard greenhouse to record the effect that addition of cellulose has on soil carbon and water retention. I will be working at C-MASC in July and August of 2021, and my goal is to improve upon existing soil management practices and strategize soil water, carbon, and nutrient retention at Ohio State, while I work with Dr. Reardon and Dr. Trippe remotely to conduct my greenhouse experiment in New Jersey.

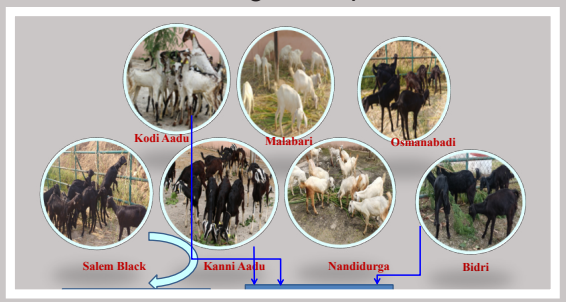
Building a bridge between genetics and soil science, we open the door to assisting soil in retaining water, eating carbon, and allowing every breathing organism on earth to return to life as we know it. This is my goal.

Update: Veerasamy Sejian

Congratulations to Dr. Veerasamy Sejian, who was listed among the world's top 2% scientists in 2019 by Stanford University as per published report in Plos Biology by Ioannidis, et al. (2019, 2020 https://doi.org/10.1371/journal). Dr. Sejian is ranked #1014 out of 48043 scientists under the category Veterinary and Physiology.

Dr. Sejian feels pride in being listed in top 2% where his mentor Prof. Rattan Lal is placed in top 0.002% globally. He feels this as his greatest achievement for sharing the honor of being among the crème de la crème of scientists with his role model Prof Lal.

Furthermore, based on a Pubmed ranking, he is above the top 1% of researchers publishing in heat stress research, among the top 0.34% and he was selected as Associate Editor for "the Stress Physiology Section in Elsevier's Smal Ruminant Research Journal.



The work at the Centre for Climate Resilience Animal Adaptation Studies, ICAR - National Institute of Animal Nutrition and Physiology, Bangalore, India continues apace. The centre was given the mandate of establishing the climate resilient potential of all indigenous breeds of small ruminants in India Few studies on the Southern Indian goat breeds clearly established the excellent climate resilient potential of Salem Black breed.

C-MASC Departures

Patricia Cordero Irizarry

There is a quote by Melchor Lim that says, *'Difficult roads often lead to beautiful destinations.'* This is how I can best describe my time at The Ohio State University, particularly here at CMASC. Adversity, sacrifice, and persistence are what are needed to prevail in graduate school. It is not about how is the smartest in the room or who has the most experience. It is about grasping onto our goals with confidence and perseverance because we are certain that we will reach them. Throughout my journey as a master's student, I have been in extremely tough situations, to the extent that I have doubted my abilities but having faith in the outcome gave me the strength to push forward and succeed. Regardless of the daily struggles, the journey has gifted me with marvelous friends, colleagues, experiences, and lessons that I will carry for the rest of my life. I am thankful to the many hands that helped me along the way because graduate school is a road that cannot be passed through alone, and so I am honored to have been a part of the CMASC team. As a legacy, I will continue to spread the message I have learned from my peers to advocate for land rights and the defense and conservation of the soil. There is always a harvest for those who work the land with devotion, passion, and respect. The soil will always be more fertile when it is treated with kindness.

Henry Anton Peller

C-MASC doctoral candidate Henry Anton Peller successfully defended a dissertation in soil science on April 23rd, 2021. His work, titled "Soil fertility, agroecology, and social change in southern Belize", examined how and why the environment in this region of central America is deteriorating, the impact of agroecological changes on soil quality and weeds, and how smallholder farming communities are adapting. Henry is currently making final edits on the manuscript, applying to job opportunities, and working on the family farm in southeast Ohio. He is considering options for what comes next but is gravitating towards working in extension or soil conservation in his hometown, advancing the farm's journey into regenerative agricultural production, and maintaining international collaborations on cover crops and soil health as part of the global struggle to respond to climate change. Henry is grateful to C-MASC for their friendship, support, and critical feedback throughout the research process, and for all that the public of Ohio and our outstanding University have provided.

C-MASC Program Coordinator Viewpoint

FROM THE DESK OF MAGGIE WILLIS

Each day seems to bring another wave of bad news about our climate crisis: the accelerating Arctic warming and disappearance of sea ice, sea levels rising faster than expected, record-breaking forest fires in Australia and heat domes in the Pacific Northwest. It often feels overwhelming. Despite the tireless work I witness at C-MASC and the School of Environmental and Natural Resources, I sometimes worry our efforts won't be enough to counteract this tide. When I feel discouraged in this way, I look for inspiration in my garden.

The first year we lived on our small plot of land, our backyard was little more than turf. I noticed, however, that soil under the western side of the lawn seemed richer, softer, and blacker. The previous owner must have tended a garden there some time ago, and so I dug it up and planted grapes, some yarrow, and blackberries.

As a novice gardener, I was disappointed when after the first year the grapes grew a grand total of 8 inches up their arbor. The following year, they were hit by the remarkably late freeze in May, and I was certain I'd lost at least one vine. But I persisted in my efforts to water, feed, and protect them from beetles as best I could.

I was just barely aware of the incredible work the grapes were performing beneath my feet, extending roots as far as 20 feet below into the clay and soil, made soft by the gardener before me. I am pleased to say that this year, I am looking forward to eating grapes for the first time, as both vines - even the one stunted by the early freeze - have exploded over the arbor and shown great resilience in the face of imperfect conditions and my clumsy care. I am certain that the good foundation laid by the healthy soil played an integral part in their survival.

And so, I have faith in the work we do every day, which sometimes may seem to be only "beneath the surface." We are gathering resources and laying the foundation fro repair and fortify the resilience of our planetary systems. One day, all of us may enjoy the fruits of these efforts which have grown out of the healthy "soil" of climate action, good policy guidance, and a well-educated population, thanks to the hard work of all people the world over committed to the health of our planet in step with those at C-MASC, SENR, and The Ohio State University.

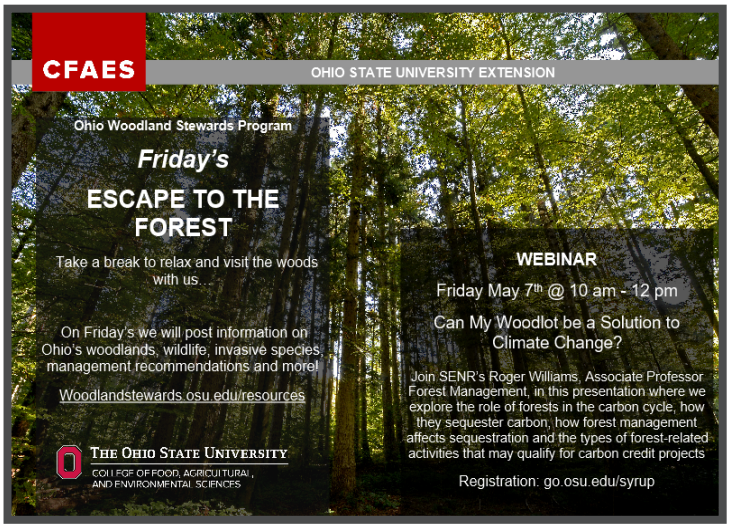
Sincerely,

Maggie Willis
Program Coordinator, CFAES Rattan Lal Center for Carbon Managment and Sequestration
School of Environment and Natural Resources
The Ohio State University

Where in the World is C-MASC

CFAES Friday's Escape to the Forest

Columbus, OH, USA *7 May*



The webinar "Can My Woodlot be a Solution to Climate Change?" presented by Dr. Roger Williams was held on May 7, 2021. The webinar was offered through the Ohio Woodland Stewards program. There were 116 participants in the webinar with 206 registered. Drs. Sayeed Mehmood and Brent Sohngen served on a question and answer panel following the presentation. The webinar covered topics that included the forest carbon cycle, pools, and fluxes; the status of Ohio's and the nation's forest carbon stocks; factors affecting forest carbon sequestration rates; concepts of forest carbon offsets and credits; voluntary vs. compliance carbon markets; and types of recognized forest carbon offset projects. The webinar lasted for 2 hours, with much good discussion.

President Johnson Meets with Dr. Lal

Columbus, OH, USA *14 May*

As The Ohio State University relaxed some restrictions for COVD-19, Dr. Lal was honored to join President Johnson for lunch in the faculty club. The Ohio State University has a very bright future ahead under the visionary leadership of President Kristina Johnson. With more than 100 national and international patents to her credit, President Johnson is the iconic role model to the faculty, staff, and students to look up to. Being a highly accompliished and world class professional, President Johnson is an inspiring personality for anyone to have the privilege and honor to meet and listen to her words of wisdom.

Climate Change Roundtable

2 June *Columbus, OH USA*

Dr. Lal was pleased to be invited to a climate change roundtable, facilitated by the Sustainability Institute at Ohio State, in preparation for the U.N. Climate Change Conference, COP26, in November. Attended by several dimplomatic leaders from the United Kingdom, he enjoyed the opportunity to discuss issues surrounding climate change with Her Majesty's Consul General for Chicago, Alan Gogbashian (left).

C-MASC Recent Publications

Refereed Journal Articles

- Amonette, J.E., H. Blanco-Canqui, C. Hassebrook, D.A. Laird, R. Lal, J. Lehmann, and D. Page-Dumroese. 2021. Integrated Biochar Research: A Roadmap. Journal of Soil and Water Conservation 76, no. 1 (January 1): 24A LP-29A. http://www.jswconline.org/content/76/1/24A.abstract.
- Anghinoni, G., F.B.G. Anghinoni, C.A. Tormena, A.L. Braccini, I. de Carvalho Mendes, L. Zancanaro, and R. Lal. 2021. Conservation Agriculture Strengthen Sustainability of Brazilian Grain Production and Food Security. Land Use Policy 108: 105591. https://www.sciencedirect.com/science/article/pii/S0264837721003148.
- Ansari MA, Saha S, Das A, Lal R, et al. 2021. Energy and carbon budgeting of traditional land use change with groundnut based cropping system for environmental quality, resilient soil health and farmers income in eastern Indian Himalayas. J Environ Manage. 2021 May 29;293:112892. doi: 10.1016/j.jenvman.2021.112892. Epub ahead of print. PMID: 34062423.
- Das, A., K. Rangappa, S. Basavaraj, U. Dey, M. Haloi, J. Layek, R. G. Idapuganti, R. Lal, N. A. Deshmukh, G. S. Yadav, S. Babu, and S. Ngachan. 2021. Conservation tillage and nutrient management practices in summer rice (Oryza sativa L.) favoured root growth and phenotypic plasticity of succeeding winter pea (Pisum sativumL.) under eastern Himalayas, India. Heliyon 7(5):e07078.
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- Kurmi, B., Nath, A. J., Lal, R., and Das, A. K. (2020). Water stable aggregates and the associated active and recalcitrant carbon in soil under rubber plantation. Sci. Total Environ. 703, 135498. doi:https://doi.org/10.1016/j.scitotenv.2019.135498.
- Lal, R. 2021. Negative Emission Farming. Journal of Soil and Water Conservation 76, no. 3 (May 1): 61A LP-64A. http://www.jswconline.org/content/76/3/61A.abstract.
- Lal, R., J. Bouma, E. Brevik, L. Dawson, D.J. Field, B. Glaser, R. Hatano, et al. 2021. Soils and Sustainable Development Goals of the United Nations: An International Union of Soil Sciences Perspective. Geoderma Regional 25, no. June 2021: e00398. https://www.sciencedirect.com/science/article/pii/S2352009421000432..
- Mishra, G., A. Sarkar, K. Giri, A.J. Nath, R. Lal, and R. Francaviglia. 2021. Changes in Soil Carbon Stocks under Plantation Systems and Natural Forests in Northeast India. Ecological Modelling 446: 109500. https://www.sciencedirect.com/science/article/pii/S0304380021000715.g
- Zolin, C.A., E. da S. Matos, C.A. de S. Magalhães, J. Paulino, R. Lal, S.T. Spera, and M. Behling. 2021. Short-Term Effect of a Crop-Livestock-Forestry System on Soil, Water and Nutrient Loss in the Cerrado-Amazon Ecotone. Acta Amazonica 51, no. 2 (June 24): 102–112. http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0044-59672021000200102&tlng=en

Book Chapters

- Lal, R. 2021. Soil Strength and Carbon Sequestration. Chapter 10B. In Hydrogeology, Chemical Weathering, and Soil Formation (eds A. Hunt, M. Egli and B. Faybishenko). https://doi.org/10.1002/9781119563952.ch10b1.

Dawn over the Oval of The Ohio State Univeristy brings hope as expanded vaccinations lead to a reopening of Ohio

Image courtesy The Ohio State Universty Signature Image Gallery

CONTACT INFORMATION

Do you have contributions for our next newsletter?
Please contact us!

Carbon Management and Sequestration Center (C-MASC)
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