

# C-MASC Newsletter

CFAES Rattan Lal Center for Carbon Management and Sequestration

Fall 2022 EDITION



*Photo from <https://humanparts.medium.com/why-do-leaves-change-color-393d86c7fade>*

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### Autumn is here!

Falling leaves, bountiful harvests,  
and class in session!

The CFAES Rattan Lal Center for Carbon Management and Sequestration would like to welcome everyone into a new season, new academic year, and wish you all a safe semester!

# From the Desk of Rattan Lal

## **Flooding in Pakistan: Mother Nature Knows No Mercy**

Pakistan is experiencing severe flood damage. The record monsoon rains, along with melting glaciers, have affected 33 million people. The death toll is estimated at 1,314 of which 458 are children. The silted-up Manchar Lake has overflowed and submerged surrounding villages. Nationally, 80 districts have declared calamity hit, with deep floods and severe damage to transport infrastructure.

Extreme climate events are exacerbating the flood/ drought syndrome. Floods are also caused by the denuded hillslopes of the lower Himalayas (Shivalik Hills). Since the 1950s, lower Himalayas have been denuded by deforestation to meet the demands of the rapidly growing population. The drought-flood tragedy, affecting five countries of South Asia (Afghanistan, Pakistan, India, Nepal, Bangladesh) is triggered by deforestation and land-use change but exacerbated and multiplied by the climate change.

The emergency aid from international organizations helped 33 million affected by the tragedy of the lower Himalayas through a coordinated effort involving five countries. There should be well-defined plan to accomplish afforestation between 2023 and 2030. International organizations should allocate \$1B/ country every year for the next 8 years provided that each country commits a match from their national resources.

Afforestation, along with development of flood control structures, should bring an end to the flood-drought problem forever. This will also put the South Asian region on track to accomplish the Sustainable Development Goals of the U.N. including 1) no poverty, 2) zero hunger, 3) good health and wellbeing, 6) clean water and sanitation, 13) climate action, 15) life on land, 16) peace, justice, and strong institutions, and 17) partnerships for the goals.

There is a strong need of cooperation and partnership among all five countries of South Asia to collectively address this serious issue. Cooperation is also essential to advance SDGs of the U.N. and promote peace and harmony.



Distinguished University Professor of Soil Science  
Director, CFAES Rattan Lal Center for Carbon  
Management and Sequestration  
Science



# Federation of Asian Indian Association- India Festival 2022



Dr. Lal attended the FIA, Federation of Indian Associations, and was honored with the Padma Shri Award of 2022. The FIA India Festival is considered the biggest Indian community program in Ohio!

The Padma Shri Award is the fourth highest civilian award given in India. Instituted in 1954, the award recognizes those of “distinguished contribution in various spheres of activity including the arts, education, industry, literature, science, acting, medicine, social service and public affairs.” Padma, meaning “lotus” in Sanskrit, and “shri” is a term that gives respect and honor, like “Mr.” or “Miss.” The award is awarded every year on India’s Republic Day.

Dr. Lal is very grateful to be given such a prestigious award. He will cherish the memories and wishes all who celebrate a Happy 75 years of Indian Independence!



From left to right: Arindam Guha, President of FIA, Mrs. Gil, Professor Gil, Dr. Lal, Mrs. Lal, Suman Singh, NY Indian Consulate Official, and Ram Kasarla, Chairperson, FIA.



# Ohio State leading new \$15 million project to study carbon farming as climate change solution



by **Sherrie Whaley** | Ohio State News contributor | [whaley.3@osu.edu](mailto:whaley.3@osu.edu)

*Work will also yield data on soil health improvements, crop productivity.*

Taking excess carbon out of the atmosphere, where it is driving climate change, and locking it into the soil, where it improves its health and agronomic productivity, is the impetus behind a new five-year, \$15 million project at The Ohio State University.

Funding for the project comes from a \$5 million grant from the Washington, D.C.-based Foundation for Food & Agriculture Research and about \$10 million in matching contributions from Ohio State, commodity groups, industry and other donors. The project will measure how much organic and inorganic carbon gets sequestered in the soil under different farming practices in key regions across the western hemispheric.

What science knows about carbon sequestration, says Rattan Lal, Ohio State Distinguished University Professor of Soil Science, has mostly come from simulation modeling carried out on computers, along with a limited number of experiments in the field.

Lal, who is a faculty member in Ohio State's College of Food, Agricultural, and Environmental Sciences (CFAES), will help to change that.

As principal investigator of the project titled "Enhanced Soil Carbon Farming as a Climate Solution," he and other researchers will take measurements directly on hundreds of farms in Ohio, other states and even other countries under real-world farming practices and conditions.

"Biologic carbon sequestration through farming is a potent tool in the battle against climate change, and this generous grant from the Foundation for Food & Agriculture Research and matching donors will fund critical work to demonstrate how to deploy this practice to its full effect," said Ohio State President Kristina M. Johnson. "The Ohio State University greatly appreciates this significant show of commitment to our land-grant tradition of service to our state and nation by identifying solutions to some of the world's most pressing problems – including preserving the food supply."

The project will generate valuable information on how carbon farming can mitigate climate change, improve soil health and make crops more productive, said Cathann A. Kress, Ohio State vice president for agricultural administration and CFAES dean. In turn, she said, it will provide that information to farmers, land managers, OSU Extension personnel, policymakers, stakeholders, the private sector, nongovernmental organizations and the public.

“Through this work, we will impact policy and agricultural practices on a national and worldwide level,” Kress said. “Under the guidance of Dr. Lal, working with other highly regarded faculty members and researchers, we’re proud to lead this vitally important initiative.”

Lal and his team will measure carbon sequestration on croplands, rangelands and grasslands, including soils used to produce a wide and representative range of crops and animals, and soils being managed through both traditional and enhanced carbon-farming methods.

“We want to generate actual primary data on productivity, on the efficiency of inputs, on the benefits of conservation agriculture and sequestering carbon, and on savings of nitrogen, water, pesticides and energy,” Lal said. He founded and directs the CFAES Rattan Lal Center for Carbon Management and Sequestration.

“We’re also going to focus on evaluating and developing technology for farming carbon, where carbon stock can be used as a farm commodity that will enable farmers to be rewarded for strengthening critical ecosystem services,” he said.

Lal said the project, among other things, will find out how much carbon dioxide produced by farming can be offset by sequestering carbon in the soil. It will determine which practices and technologies do that best for farmers. And it will provide science-based input to policymakers on matters such as standardizing carbon-credit pricing.

“The goal is to make agriculture a solution” in fighting climate change and other environment crises, Lal said.

The project will also make agriculture more resilient in the face of these crises, he noted. Soil contains more carbon than plants and the atmosphere combined. And more carbon in the soil means stronger crops and a healthier environment.

“The idea is that even as the climate is changing, agriculture will have a buffer – better soil health,” said Lal, who has received the World Food Prize, World Agriculture Prize, Glinka World Soil Prize and Japan Prize for his decades of research on how soil health impacts crop productivity.

Research for the project will take place on farms in Ohio, Michigan, Georgia, North Carolina, Kansas, Utah, Arizona and South America. Study sites will be chosen to represent a range of crops, climates, soil types, input levels of water and fertilizer, farming systems and ecological regions.

In addition to Ohio State, three other universities, three federal agencies and international collaborators are involved in the project. Within Ohio State, collaborators include Cinnamon Piñon Carlarne, associate dean of the Moritz College of Law; Marilia Chiavegato, assistant professor of agroecosystems management; M. Scott Demyan, assistant professor of soil and environmental mineralogy; Klaus Lorenz, assistant director of the Center for Carbon Management and Sequestration; Virginia Rich, associate professor of microbial ecology; Jackie Kirby Wilkins, director of OSU Extension; and Roger Williams, associate professor of forest management.

Additional project co-sponsors and collaborators include the Inter-American Institute for Cooperation on Agriculture, FONTAGRO, Bayer U.S. – Crop Science, Microsoft, Cotton Incorporated, Corteva, Ohio Corn and Wheat Growers Association, Ohio Soybean Association, Kansas Corn, United Sorghum Checkoff Program, National Sorghum Producers, Utah Department of Agriculture & Food, Kansas State University, Michigan State University and Utah State University. The project will also be supported through scientific collaborations with the USDA Agricultural Research Service, Sandia National Laboratories, the U.S. Geological Survey and the National Agricultural Research Institute of Uruguay. Further project support is provided by Ohio State’s Office of Research, Graduate School, and the CFAES Office for Research and Graduate Education.

# Carbon Farming Project



FFAR NEWS FOR IMMEDIATE RELEASE

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## **Extensive Research Study Examines Enhanced Soil Carbon Farming as a Climate Solution**

AgMission Supports The Ohio State University Study on Soil Organic Carbon-Enhancing Practices

Columbus, OH (August 25, 2022) – With a roster of Founding Partners that includes PepsiCo, McDonald’s USA and most recently, The Nature Conservancy, AgMission™, a global collaboration to develop and implement climate-smart farming solutions, announced that it will support The Ohio State University’s (OSU) study on the potential of soil management practices to mitigate climate change.

Dr. Rattan Lal, a distinguished university professor of soil science and director of OSU’s College of Food, Agricultural and Environmental Sciences Rattan Lal Center for Carbon Management and Sequestration, will chair the study, “Enhanced Soil Carbon Farming as a Climate Solution.”

“The disruption by climate change is the most urgent challenge to global food systems and agriculture,” said Allison Thomson, AgMission program director. “Enhancing soil organic carbon (SOC) stocks on croplands, grasslands and rangelands is an important strategy that can help mitigate greenhouse gas (GHG) emissions and improve land and production system resiliency at the same time.”

Carbon farming optimizes carbon capture by implementing practices that are known to improve the rate at which carbon dioxide is removed from the atmosphere and stored in plant material or soil organic matter.

Current knowledge on carbon farming is primarily based either on simulation modelling or on data from a limited number of field experiments. Furthermore, knowledge gaps exist on how projected climate extremes will impact SOC sequestration, crop productivity, agricultural GHG emissions and soil health across diverse landscapes.

The study is focusing on field research in specific geographies of the United States: the Midwest, the Plains, the West and the southeastern US. The Ohio State University researchers and collaborating institutions are collecting on-farm data from croplands, grasslands and rangelands. On-farm research offers the opportunity to study the impacts on SOC from fully implemented systems in terms of scale, adoption of management approaches and constraints faced by farm managers, growers and ranchers.

The resulting output will be anonymized on-farm data from SOC-enhancing practices using a process that calculates a unique baseline for different geographies.

# C-FARM (Carbon Farming Alliance for Research and Management)



“By increasing carbon sequestration on depleted and degraded agricultural lands, we can improve our soil and food system while restoring the environment,” said Dr. Lal, the principal investigator of this project and 2020 World Food Prize awardee for his decades of research on how soil health impacts crop productivity. “This project will provide the needed tools and data to help farms across the United States and around the world reach their full potential as a carbon sink and be part of the solution to combatting climate change and advancing the Sustainable Development Goals of the UN.”

The Foundation for Food & Agriculture Research (FFAR) and the World Farmers’ Organisation (WFO) established AgMission to unlock agriculture’s potential to reduce GHG emissions. Agricultural research and data are critical to this solution, and AgMission’s strategy envisions solutions that harness data and farmer insights to power research that accelerates adoption of climate-smart practices.

“As a core partner of AgMission, we are pleased to support such important research,” said WFO Secretary General Arianna Giuliadori. “What is needed is to ensure the results from this research are viable to the farmers’ community across different geographies, and scalable or replicable in different farming systems.”

Through FFAR, AgMission is awarding \$5 million to The Ohio State University to conduct this research, which is being matched by additional funders for a \$15 million project investment. Co-sponsors and collaborators of this study include Bayer U.S. - Crop Science, Corteva, Cotton Incorporated, FONTAGRO, Inter-American Institute for Cooperation on Agriculture, Michigan State University, Microsoft, Ohio Corn & Wheat, Ohio Soybean Council, Kansas Corn, Kansas State University, National Sorghum Producers, Sandia National Laboratories, The Ohio State University, United Sorghum Checkoff Program, Utah Department of Agriculture & Food, Utah State University, the U.S. Geological Survey and the USDA Agricultural Research Service.

This project will generate much needed knowledge on how to strengthen the adoption of SOC-enhancing practices by farmers and ranchers, and how to increase the recognition of the importance of those practices by the private sector, policy makers and the general public.

## **AgMission**

**The Foundation for Food & Agriculture Research (FFAR)** and the World Farmers’ Organisation (WFO) established AgMission, a global collaboration of farmers, ranchers and scientists mobilizing data and partnering together to accelerate collaboration, develop science-based solutions and expand innovation and research that powers adaptation and adoption of climate-smart solutions. AgMission is empowering the agriculture sector become net negative for greenhouse gas emissions. To learn more visit [agmission.org](http://agmission.org).

## A continued look at the C-Farm Project

The Soil Ecology and Management Lab is a collaboration of USDA – Agricultural Research Service and North Carolina State University. We are excited to partner with The Ohio State University and others to quantify soil organic carbon on private farms in America. Specifically, we will be sampling progressive farms throughout the southeastern region, whether those farms focus solely on grain or fiber production, pasture-based livestock systems, or mixed farming operations. Our goal is to quantify root-zone enrichment of soil organic carbon separate from that of total organic carbon. We are defining root-zone enrichment as that portion of soil organic carbon that accumulates within the surface 30 cm (i.e. the top foot of soil), in excess of a baseline concentration of soil organic carbon (see On-Farm Research Report 2022-43).



*Sampling with colleagues in Virginia*

Sampling was initiated in a series of pasture-based livestock farms in Virginia during the winter-spring of 2022. A total of 31 farms were sampled. Management history was queried of participants regarding the three separate pastures sampled on each farm, along with either no-till cropland if present, and neighboring woodland as a reference land use. Additional phases of this research will explore farms in North Carolina and other southeastern US states with emphasis in conservation cropping of grain and fiber crops.



# C-FARM (Carbon Farming Alliance for Research and Management)



## On-Farm Research Report 2022-43

### Root-zone enrichment of soil organic carbon and nitrogen

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#### Key issues

1. Soil is the foundation of agriculture; America was blessed with rich soil and other natural resources
2. Large losses of soil organic carbon (C) have occurred in US agriculture due to intensive tillage
3. Improved agricultural soil management has potential for sequestering lost soil organic C
  - a. Adhering to soil health principles is hypothesized to restore soil organic C
  - b. Although data are still limited, available evidence suggests that grassland and woodland will sequester more soil organic C than conservation cropland
4. Reliable field data to quantify soil organic C sequestration from traditional approaches are expensive and take years and decades to collect for meaningful estimation
5. Alternatively, models may not be adequately characterizing the diversity of management being deployed by private landowners, because models were developed from narrowly focused research-station experiments
6. Alternative field-based estimates of soil organic C sequestration are needed
7. Root-zone enrichment calculation from depth distribution of soil organic C is a relatively new technique that could provide low-cost, rapidly collected estimates across a diversity of management and environmental conditions
8. Urgency is needed to describe land-use and management potential for soil organic C sequestration to avoid misguided promotion of practices
9. With regionally specific data, policies would be well-grounded to encourage better soil management to protect our natural resources
10. More cost-effective policies could be developed

#### What is root-zone enrichment?

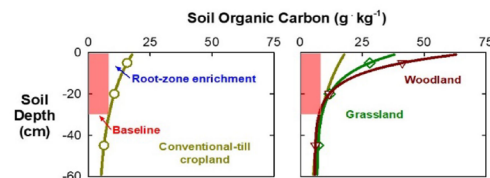
Root-zone enrichment is the calculated accumulation of soil organic matter within the surface 1-foot depth of soil, i.e. the primary root zone.

Soil organic matter may be measured as total organic C, nitrogen (N), or other organic matter fractions, such as particulate organic C and N or soil-test biological activity.

#### How is it calculated?

Root-zone enrichment conceptually separates management from pedogenic influence. This calculation is theoretical with some assumptions that are reasonable.

These calculations have been peer-reviewed and reported in several recent scientific papers - doi: 10.1002/ael2.20087, doi: 10.1002/saj2.20346, doi: 10.1002/saj2.20290



Data from 25 research station locations in North Carolina. Root-zone enrichment ( $Mg C ha^{-1}$ ) averaged 15.3 under conventional-till cropland, 24.4 under no-till cropland, 30.8 under grassland, and 44.7 under woodland.

#### Why is it important?

Root-zone enrichment could be used as a proxy for soil organic C sequestration on private lands without having to sample multiple times over long periods of time. A stock change of carbon separate from baseline condition is calculated.

High quality data could be obtained from many farms within a region at relatively low cost. Soil changes could be related to management history of fields during the past 30-50 years. A clear role of conservation management on root-zone enrichment is expected to be defined.

#### What are next steps?

Root-zone enrichment calculations will be collected throughout the southeastern US as part of on-going objectives of the Soil Ecology and Management Lab.

## Ohio State Global Lecture Series: Dr. Rajmohan Gandhi

On September 7, Dr. Lal attended a lecture series lead by Dr. Rajmohan Gandhi. Dr. Gandhi is an Indian biographer, historian, and research professor. He is also the grandson of the great political and spiritual leader, Mohandas Karamchand Gandhi . During this lecture series, Dr. Gandhi looked at the teachings of his grandfather, his impact on the world, and his major critics. The event was brought to The Ohio State University by support of the Gandhi Memorial Society, whose purpose is to “raise awareness of truth, non-violence, and love in the day-to-day social life.” At this event, Dr. Lal received the Gandhi Environmental Protection Award. On behalf of the Rattan Lal Center for Carbon Management and Sequestration, we would like to thank Dr. Rajmohan Gandhi for his visit and his dedication to the values of his grandfather and his contributions to education and activism.



Dr. Rajmohan Gandhi and Dr. Lal



Back row, from left to right:  
Jason Phillips and Rahim Merchant.  
From Row, from left to right. Mrs. Usha  
Gandhi, Dr. Rajmohan Gandhi, Dr. Lal,  
and Mrs. Lal.

## Dr. Josh Beniston



Dr. Joshua Beniston completed his PhD at CMASC in 2013 and has continued to promote soil health and conservation. Josh often draws on experiences from his time at CMASC and remains passionate and enthusiastic about soil science. In early 2022, Josh joined the Soil Health Division (SHD) of the U.S.D.A. Natural Resources Conservation Service (NRCS) as a Regional Soil Health Specialist. Soil Health Division provides leadership on the NRCS's soil health policies, tools, practice standards, assessments, programs, technology, training, and approaches used by staff, partners, and customers. Josh's work with SHD focuses on training and technical assistance. He is an instructor for the “Soil Health & Sustainability” class, which is a three-day class and field training that SHD provides to NRCS conservation program staff. Josh is also leading efforts on technical advice on soil health for urban agriculture in U.S.D.A.'s urban focus counties across the U.S. Prior to working with NRCS, Josh was a faculty member for sustainable agriculture and soil science at Santa Rosa Junior College in Sonoma County, California. He also worked as a consulting soil scientist coordinating on-farm research and doing outreach on soil health, primarily with wine grape growers. Josh and his wife have three children and live in Northern California.

## **IICA Conference-** MINISTERS OF AFRICA AND THE AMERICAS TO HOLD FIRST SUMMIT TO ENHANCE COOPERATION ON AGRIFOOD ISSUES



From left to right: IICA Chair in Agribusiness Robert Rodrigues, Special Advisor to Director General Jorge Werthein, Dr. Rattan Lal, and IICA Director General Manuel Otero

Dr. Lal attended the Ministers of Africa and the Americas Summit in San Jose, Costa Rica this year, July 27 to 29. The summit emphasized the importance of collaborating continents in an effort to strengthen food security. With so many negative impacts affecting food security today because of conflict between Russia and Ukraine and the Covid-19 pandemic still ravaging the world 2 years later. The Russian and Ukrainian conflict has made global and market trade flow increasingly difficult and has increased food prices. The summit puts into place the “quality, relevance, and appropriateness” of the impact the two continents, as well as a global effort, on agriculture and food. The summit brought together leaders in the Agricultural community to identify how both continents can increase productivity, inclusion, and sustainability of Agrifood systems.

### **The focus of the Summit was on five key areas:**

- Science, technology, and innovation, including biotechnology
- Climate change and resilience
- Digital agriculture
- Institutional innovations and policies for social inclusion, safety nets, health and nutrition and the recovery of degraded natural resources
- Fostering a more fair and transparent international food trade system.

<https://www.nepad.org/news/ministers-of-africa-and-americas-convene-summit-cooperation-counter-global-food-security>



## IICA Conference- COP 27

September 22-24, Dr. Lal attended and spoke at the COP 27 Conference held by the Inter-American Institute for Cooperation on Agriculture (IICA). The conference was to prepare various leaders and organizations throughout the Americas for the upcoming UN Climate Change Conference in Egypt. The conference explored that leaders in the region of the Americas come to a unified consensus and discuss issues that affect agriculture, such as climate change, the Covid-19 pandemic, and the Ukrainian-Russian Conflict, and how those issues contribute to malnutrition and hunger. The meeting was made up of senior officials and leaders, ministers, secretaries, and high-level officials of Agriculture of the Americas. Leaders aimed to discuss the strategic role of the region's agriculture sector in addressing climate change. A great point that was made by Dr. Lal is that "climate change is not something that will happen in the future; it is already happening." Climate change is apparent throughout the world: rising global sea levels, diminishing ice caps, rising sea surface temperatures, rising global temperatures, etc. Another great point made by Dr. Lal is that we should look to take better care of our natural resources by looking to sustainable agricultural practices to lead to sustainable development. Climate change is gravely affecting food security around the world. Efforts to make sure every human on Earth knows where their next meal is coming from is literally a life-or-death situation. Overall, the conference sought the "value of building consensus within the region's agriculture sector" as stated by IICA Director General, Manuel Otero. With the innovative ideas on how the regions can uniformly come together to discuss external issues affecting the world's agriculture, COP 27 looks forward to the UN Climate Change Conference this coming November in Egypt.



Dr. Rattan Lal is an IICA Goodwill Ambassador and Chair in Soil Sciences, and Co-Leader of the Living Soils of the Americas Initiative



# One Home, One Garden

Strengthening local food production systems is critical to minimizing disruptions in the food supply chain caused by the Covid-19 pandemic and other crises. In this regard, urban agriculture can play an important role in the era of rapid urbanization. Among diverse types of urban agriculture, home gardening is a simple but effective option. In addition to providing physical exercise and therapeutic relief, home gardening is an important source of fresh produce. Professor Lal is shown here with recently harvested bottle gourds (the photo below shows Dr. Lal holding a gourd 1 meter (40 in) long, weighing in at 6.5 lbs. (3 kg)), along with radishes, beans, and peppers. In the present era of numerous disruptions in food supply chain, the motto should be “one home, one garden.”



## Events Related to Soil Science

**September 1-16-** Annual Iowa Hunger Summit- Paths to Zero- Webinar

**October 16-** World Food Day

**October 17-21-** Des Moines, IA- World Food Prize Foundation- Feeding a Fragile World: Integrating Mitigation and Adaptation in Climate Solutions- Iowa Events Center, 3rd Street, Des Moines, IA, USA

**October 23-** The Soil-Water-Agriculture-Climate (SWAC) Nexus. Symposium. IICA, San Jose, Costa Rica

**November 6-9-** Baltimore, MD and Limited Virtual- 2022 ASA, CSSA, SSSA International Annual Meeting- Communication and Public Engagement for Healthy People and a Healthy Planet

**December 5-** World Soil Day

# New Arrivals



## Muhammad Nawaz

Muhammad Nawaz is visiting scholar at CFAES Rattan Lal Center of Carbon Management and Sequestration at The Ohio State University. He will stay at OSU from July 7, 2022 to December 31, 2022. He is pursuing his doctorate degree from department of Agronomy, University of Agriculture, Faisalabad. He is also working as Scientific Officer in Ayub Agricultural Research, Institute, Faisalabad. He was awarded a scholarship by the Higher Education Commission (HEC) of Pakistan to conduct some part of his research work of PhD degree at The Ohio State University. He is working on carbon sequestration and GHGs emission from conventional and conservation cropping system at C-MASC.

## Hafiz Waleed

Mr. Hafiz Muhammad Waleed Iqbal is a PhD Scholar in one of the Universities of Pakistan. He was awarded a scholarship by the Higher Education Commission (HEC) of Pakistan to conduct some part of his research work of PhD degree at The Ohio State University (OSU), USA. Basically, He is working on different soil parameters to improve soil health, fertility, profitability and cropping system productivity. This was the reason he got the acceptance from Dr. Rattan Lal to strengthen his research work and its quality.

He arrived at The Ohio State University on September 21, 2022. He will be staying here until February 20, 2023, to perform some analyses on soil samples. He will also participate in ongoing activities like conference, workshop, and webinar during my stay at OSU.



# Published Journal Articles

- Kan, Z. Han, S.-W., Liu, W.-Z., Zhao, X. Lal, R. 2022. Higher sequestration of wheat versus maize crop carbon in soil under rotations (vol 20, pg 101, 2022). ENVIRONMENTAL CHEMISTRY LETTERS 20, 2727–2727.
- Kaur, M., Malik, D.P., Malhi, G.S., Sardana, V., Bolan, N.S., Lal, R., et al. 2022. Rice residue management in the Indo-Gangetic Plains for Climate and food security. A review. Agronomy for Sustainable Development. 42:92. <https://doi.org/10.1007/s1359302200817-0>
- Lal, R. 2022. Sustaining soil for advancing peace: World is one family. JOURNAL OF SOIL AND WATER CONSERVATION 77, 43A-47A.
- Layek, J. Das, A. Ghosh, P.K., Rangappa, K. Lal, R., et al. 2022. Double no-till and rice straw retention in terraced sloping lands improves water content, soil health and productivity of lentil in Himalayan foothills. SOIL & TILLAGE RESEARCH 221.
- Maia, S. Medeiros, A., dos Santos, T., Lyra, G., Lal, R. et al. 2022. Potential of no-till agriculture as a nature-based solution for climate change mitigation in Brazil. SOIL & TILLAGE RESEARCH 220.
- Naorem, A., Jayaraman, S., Lal, R., Patra, A., Rao, C.S., Lal, R., 2022. Soil Inorganic Carbon as a Potential Sink in Carbon Storage in Dryland Soils—A Review. Agriculture 12.
- Lal, R. 2022. Biophysical Controls That Make Erosion-Transported Soil Carbon a Source of Greenhouse Gases. Applied Sciences 12.
- Lal, R. 2022. Agroecology. Rural 21. <https://www.rural21.com/english/search/detail/article/many-ways-one-goal-achieving-sustainable-agroecosystems.html>
- Falk, J., Attig-Bahar, F., Colwell, R.R. Behera, S.K., Beltagy, A.S., von Braun, J. Dasgupta, Lal, R. et al. 2022. Addressing our planetary crisis. Sustain Sci 17, 5–7. <https://doi.org/10.1007/s11625-021-01059-x>
- Song, X. Gang, C., Lal, R. et al. 2022. Identifying a suitable revegetation method for soil organic carbon, nitrogen, and phosphorus sequestration: A 16-year in situ experiment on abandoned farmland in a semiarid area of the Loess Plateau, China. LAND DEGRADATION & DEVELOPMENT 33, 2366–2378.

# Book Chapters

1. Lal, R. 2022. Soil Erosion and Its Impacts on Greenhouse Gases. In: Global Degradation of Soil and Water Resources. Springer, Singapore. ([https://doi.org/10.1007/978-981-16-7916-2\\_2](https://doi.org/10.1007/978-981-16-7916-2_2))
2. Lorenz, K., Lal, R. 2022. Soil Organic Carbon Stocks. In: Soil Organic Carbon Sequestration in Terrestrial Biomes of the United States. Springer, Cham. ([https://doi.org/10.1007/978-3-030-95193-1\\_2](https://doi.org/10.1007/978-3-030-95193-1_2)).
3. Lorenz, K., Lal, R. 2022. Soil Inorganic Carbon Stocks in Terrestrial Biomes. In: Soil Organic Carbon Sequestration in Terrestrial Biomes of the United States. Springer, Cham. ([https://doi.org/10.1007/978-3-030-95193-1\\_3](https://doi.org/10.1007/978-3-030-95193-1_3)).
4. Lorenz, K., Lal, R. 2022. Incentivizing Soil Organic Carbon Management in Terrestrial Biomes of the United States of America. In: Soil Organic Carbon Sequestration in Terrestrial Biomes of the United States. Springer, Cham. ([https://doi.org/10.1007/978-3-030-95193-1\\_5](https://doi.org/10.1007/978-3-030-95193-1_5)).
5. Lorenz, K., Lal, R. 2022. Soil Organic Carbon Sequestration. In: Soil Organic Carbon Sequestration in Terrestrial Biomes of the United States. Springer, Cham. ([https://doi.org/10.1007/978-3-030-95193-1\\_3](https://doi.org/10.1007/978-3-030-95193-1_3)).



# Invited Keynote Presentations

- Lal, R. 2022. Soil Carbon Sequestration for Food and Climate Security and Advancing Sustainable Development Goals of the United Nations. 30th Anniversary of the Faculty of Forestry , University of Banja Luka, 29 September 2022.
- Lal, R. 2022. Soil Health for Food and Climate Security. Westheimer Peace Symposium, Wilmington College, 28 September 2022.
- Lal, R. 2022. Soil Health for Food and Sustainability. Ernesto Illy Colloquia, Trieste, Italy. 29 September 2022.
- Lal, R. 2022. The Soil-Water-Agriculture-Climate (SWAC) Nexus. Symposium: Challenges of Americas. Agriculture in The Face of the Climate Crisis, 23 September 2022, IICA, San Jose, Costa Rica
- Lal, R. 2022. A Window of Opportunity to Adapt and Reduce Vulnerability to Abrupt Climate Change. Symposium “Challenges for America’s Agriculture in the Face of Climate Crisis” 22 September 2022, IICA, San Jose, Costa Rica
- Lal, R. 2022. Regenerative Agriculture (RA). 19 September 2022.
- Lal, R. 2022. Soil as a source or Sink of Greenhouse Gases. Colloquium, Physics Department. The Ohio State University. Columbus, OH. 13 September 2022.
- Lal, R. 2022. Regenerative Agriculture for Soil Health. Harnessing the Potential of Natural Farming (Regenerative Agriculture) as a Low-Emission Development Pathway for Improved Resilience, Soil Health, Livelihoods and Nutrition in India” ,ICRISAT, Hyderabad, 15-17 September 2022.
- Lal, R. 2022. Address Global Issues through Gandhian Philosophy. Gandhi Memorial Society, The American Legion, Westerville OH, 8 Sep 2022.
- Lal, R. 2022. Farming Carbon in Global Drylands. Impact of Climate Change on Food Production in Dry Areas. Ain Shams University, Egypt. 3-5 Sept. 2022.
- Lal, R. 2022. Functional relationship among soil, water, and climate and its role in adaptation and mitigation on of climate change. ISCARES 2022. Dublin, Ireland. 28-31 Aug 2022.
- Lal, R. 2022. Soil health and carbon sequestration. Symposium on Agriculture, Food Systems and Climate Change. North Carolina State University. Raleigh, NC, USA. 11 Aug 2022.
- Lal, R. 2022. Priming Africa’s farming through regenerative agriculture. Sasakawe/ JIRKAS Webinar on Potential of Regenerative Agriculture in Africa. 5 Aug 2022.
- Lal, R. 2022. Carbon Trading: Calculating Carbon Footprint: Payment for Ecosystem Services. Engro Fertilizer Ltd. Pakistan. 30 Aug 2022.
- Lal, R. 2022. Sustaining soil health for posterity. National Symposium of Food, Nutrition, and Environment Security, Achieving Sustainable Development Goals. NASC Complex, New Delhi, India. 29-30 Aug 2022.
- Lal, R. 2022. Soil Carbon Dynamics under changing climate. Climate Speaker Series, Sandia National Laboratory. California. 29 Aug 2022.
- Lal, R. 2022. Role of Basic Sciences. 23 Aug 2022.
- Lal, R. 2022. Soil Health. Adaptation and Mitigation of Climate Change, Academy of Sciences of Moldova.
- Lal, R. 2022. Importance of the soil for the present and future of humanity. Aaprecid Argentina, 30th Congress. 10-12 Aug 2022.
- Lal, R. 2022. SOC Stocks in Aridland Riparian Zone.
- Lal, R. 2022. Restoring Soil Health & Returning Land to Nature. 22nd World Congress of Soil Science. WCSS, Glasgow. 31 July- 5 Aug, 2022.
- Lal, R. 2022. Soil-Plant-Human Nutrition-Nexus in Africa. IICA 80th Ann. San Jose,Costa Rica. 27-29 July 2022.
- Lal, R. 2022. Soil health management and education for climate and food security. Sustainable Agriculture Education Association (SAEA). OSU, Columbus, OH. 20-22 July 2022.
- Lal, R. 2022. Managing soil as a nature-based solution to tackle climate plant biology 2022. Portland, OR. 9-13 July 2022.
- Lal, R. 2022. Impact of Covid. 15 July 2022.
- Lal, R. 2022. Managing soil for food security. OCP Cultivating Conversation, Feeding the Earth: Understanding Soil Health. 13 July 2022.
- Lal, R. 2022. No-Tillage System, Improving Soil Life, Environmental Sustainability and Social Wellbeing. 18th National Meeting on Direct Planting in Straw and First World Meeting of the Direct Planting System. Grand Carima Resort and Convention Center, Iguasu Falls, Brasil. 5 July 2022.



# Contact Information



## THE OHIO STATE UNIVERSITY

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

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*Photo from <https://www.thespruce.com/how-to-grow-pumpkins-1403469>*