THE OHIO STATE UNIVERSITY

Summer | 2022

CFAES RATTAN LAL CARBON MANAGEMENT AND SEQUESTRATION CENTER

# C-MASC NEWSLETTER

## Summer 2022

It is summertime at The Ohio State University!
Enjoy the sunshine, the fresh air, and the beauty on campus.
So many of us forget to take time to see the harmony that lives
all around us. Flowers, birds, trees are thriving.

Take a moment to breathe.
Take care of yourself.

*IN THIS ISSUE:*

# C-MASC From the Desk of Rattan Lal

War adversely affects several soil quality indicators and functions. War and conflicts adversely affect well-being of people and the quality and functions (i.e., ecosystem services) of soil. War-related vehicular traffic can aggravate soil compaction and sealing, incrase excavation of trenches or tunnels, and cause cratering by bombs. There are also changes in soil chemical properties such as contamination by oil, heavy metals, and herbicides. War causes loss of above and below-ground biodiversity and changes in microbial population by deliberate introduction of micro-organisms which are harmful to human and animals. Complete recovery of war-ravaged soil and landscape may take decades or even centuries. Contaminated soil may have to be removed physically and replaced by uncontaminated soil from elsewhere.

Land and people ravaged by war require healing and rehabilitation. Adverse effects on above ground and below ground biodiversity impacts critical ecosystem services essential to human well-being and nature conservancy and can also lead to numerous disservices. Notable among disservices are pollution of water, contamination of air of air, denudation and dissection of the landscape and extinction of species.

Human welfare is restored only when the war-ravaged land is healed, and its ecosystem services restored. . The abrupt disruption between the people and the land must be reestablished. War, conflicts, and civil disruptions are harmful to the planet and all of its inhabitantsd, including humans.

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

Traffic of heavy machinery destorys the land and creates ecosystem disservices (Source: bne IntelliNews)

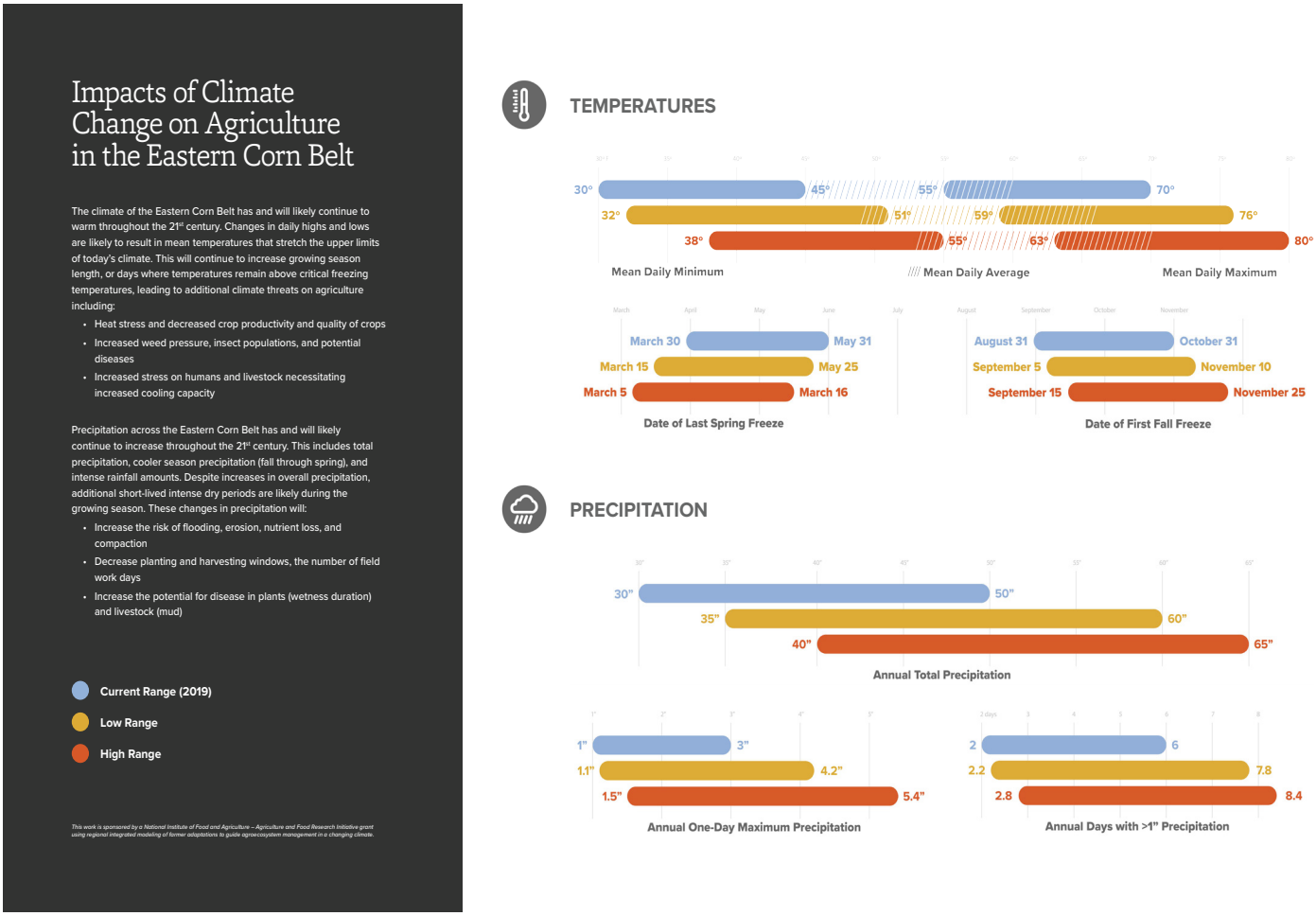
# C-MASC Dr. Robyn Wilson

**Global climate change is projected to negatively impact agriculture through increasingly severe weather.** In the eastern Corn Belt of the United States, it is projected to get warmer and wetter overall, with more variability in the seasonal timing of rainfall (see infographic Fig. 1). This will make it more difficult to get into the fields in the spring and fall due to wet conditions, while higher overall temperatures and decreased rainfall in the summer may limit crop growth. While there are multiple adaptations to reduce the vulnerability of agricultural production to a changing climate, these adaptations have varying implications for soil health, carbon sequestration and water quality. We recently conducted a survey of farmers in the eastern Corn Belt to understand how they are likely to adapt to climate change in the future, and ultimately how these adaptations may impact a suite of ecosystem services from food production to carbon sequestration to water quality (see infographic and a full survey report with link this link- https://cpb-us-w2.wpmucdn.com/u.osu.edu/dist/b/73291/files/2020/10/NIFA-Survey-Report-FINAL.pdf).

We found that ~70% of farmers are likely to adapt to expected future conditions, and this adaptation is driven in large part by self-reported past negative experiences with climate change that drive up concern about future climate change. Adaptation is also more likely among farmers that are younger, more educated, and value soil and water conservation, and who operate farms that are larger, more extensively insured, and will be passed on to a family member. However, the type of adaptation chosen is driven largely by the experienced impacts. The most common types of adaptation reflect a focus both on mitigating immediate risks posed by the weather (e.g., installing more drainage tile, changing insurance coverage), as well as diversifying and building a more resilient system as a long-term risk management strategy (e.g., retiring more land, increasing the use of conservation tillage). However, increasing tile drainage will be the most common strategy in response to concerns about heavy rainfall in the spring.

While this may help support food production, by making it easier for farmers to get in their fields in the spring and fall, there are potential negative impacts for water quality as subsurface tile drainage contributes to nutrient loading during spring rain events. Practices that promote soil health and sequestration will also be less common, despite their potential benefits to both adaptation and mitigation. When these practices occur (e.g., limited tillage), it will be done by those farmers who identify as conservationists and can implement these changes. Overall, while belief in climate change is high, motivation to act is generally low. As the extreme weather experienced in recent years becomes more frequent and severe, and as farms continue to consolidate and grow, we would expect even greater adaptation as these are the primary drivers of adaptation decisions. However, it may be possible to increase the rate at which farmers are adapting by communicating the risks associated with increasingly common climate impacts, and by providing the resources for smaller farms to adapt. In addition, policies should focus on offsetting any negative impacts of adaptation by incentivizing practices that protect local water quality (e.g., edge of field practices) and work to increase long-term resilience through improved soil health and sequestration (e.g., cover crops).

***Fig. 1- Impacts of Climate Change on Agriculture in the Eastern Corn Belt.***



# C-MASC NC1178 Annual Meeting

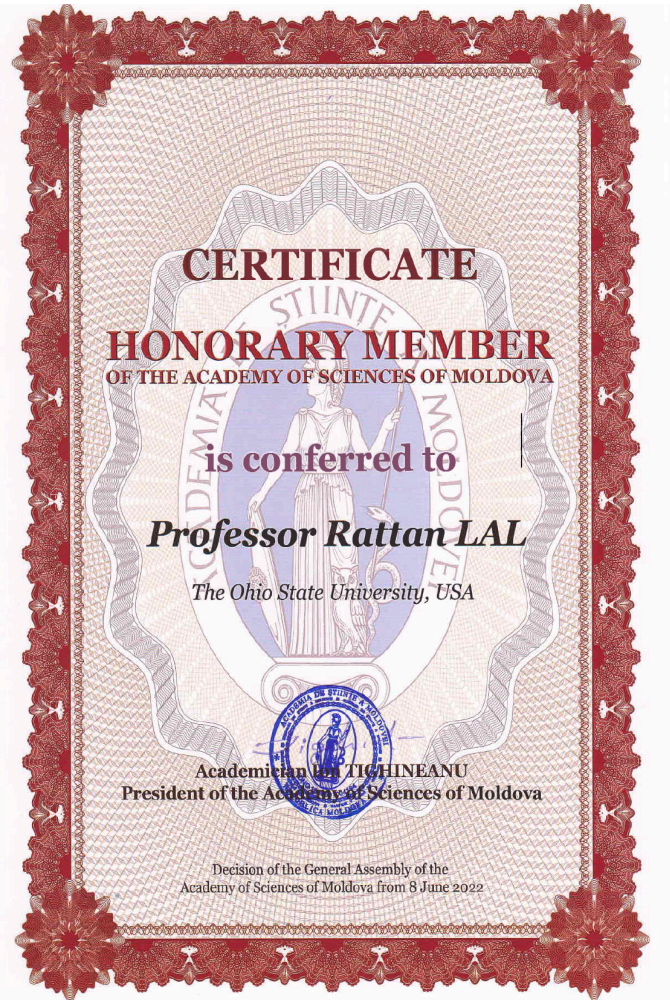
***Members of NC-1178 from L to R (front row): Ratan Lal, Mohmmad Golabi, Deann Presley, Changyoon Jeong, Xi Zhang. (Back Row): Fu-gen Dow, Rongzhong Ye, Itamar Saatai, and Asko Noormets. The meeting was hustled by Asko Noormets of Texas A+M University.***

**Dr. Lal attended the annual NC1178 on June 7th, 2022,** in College Station, Texas. NC1178 is part of The Hatch Act of 1887 whose purpose is to conduct research by institutions within a State and by the institutions in multiple states to solve problems that concern more than one state. The act provides funding to various land-grant institutions to continue agricultural research. The NC1178 Conference focused on land use and management practice and its impacts on soil carbon and associated agroecosystems services. The conference website provided a short snippet of information that was covered. It states that the "key to increasing soil's resilience against stressful climate conditions is to build or maintain soil health by improving the physical, chemical, and biological properties." Some factors that go into this is the overall health of the physical properties of soil, as well as chemical and biological. Secondly, minimizing any physical disturbances like tilling. All these things were covered during the conference as well as a tour of surrounding areas where experiments were done. Dr. Lal wants to thank all of those who were at the conference for a wonderful stay and for a great conference.

*See these sites for more information about the Hatch Act and NC1178.*

*-https://www.nifa.usda.gov/grants/programs/hatch-act-1887-multistate-research-fund*

*-https://www.nimss.org/projects/view/mrp/outline/18600*




**May 25, 2022, Dr. Lal gave a virtual lecture entitled "The Role of Scientific Research in the Promotion of Sustainable Development and Peace" for the International Scientific Conference** "European Platform for Peace" organized by the Academy of Sciences of Moldova. The Academy is the highest scientific forum of the country and represents the public institution of national interest in the sphere of science and innovation that started in 1961. Their main focus is to advance fundamental research in pure sciences, life sciences, and humanities, to conduct long-term scientific investigations closely connected with national and international science and culture,. The priority being given to ecological problems and nature conservation as well as development of national economy of Moldova (1). With this, Dr. Lal was presented was made an honorary member of the Academy of Sciences of Moldova. Alecu Russo State University of Balti is located in Balti, Moldova. It began its academic journey in 1945 and is one of five major educational institutions in the country of Moldova. Dr. Lal was awarded anhonorary degree from the University in 2010. In the presentation, he talks about how humanity is in danger of food insecurity because of many factors happening in the world: climate change, conflicts, and the covid pandemic- all of which lead to hunger and food insecurity. To tie this into the topic of soil, soil is not just an environmental or health concern, soil is also a peace and security issue. With the factors of conflict, with tanks and missiles being fired, a negative impact on soil happens where it is no longer inhabitable to soil biodiversity and can no longer generate ecosystem services. This leads to food insecurity. Dr. Lal wishes to address these issues which must stop to better the quality of soil and therefore, the quality of life. The conference was held in Moldova with "the aim of identifying common values, principles and aspirations to all nations, in order to restore and maintain peace."

1. *https://council.science/member/moldova-academy-of-sciences-of-moldova/*

## Riparian zones and wetlands created by rock dams are a carbon sink in arid lands

### A Synthesis of USGS Scientist's Research on Restoration of Dryland Streams

Over the past decade, the U.S. Geological Survey (USGS) has conducted a multi-disciplinary landscape-scale study to quantify watershed functions of Rock Detention Structures (RDS) installed in the Madrean Archipelago Ecoregion of North America (Norman, 2020). Scientists are working with land managers and restoration practitioners to establish experiments at multiple sites featuring RDS using quantitative models, remotely sensed imagery, and data collected in the field (Norman et al, 2022a). Findings of the USGS Aridland Water Harvesting Study, demonstrate thatRDS can: (i.) sequester large amounts of atmospheric C in the soil of riparian corridors and wetlands; (ii.) maintain or increase vegetation and growing seasons (iii.) extend ephemeral streams duration and volume of flow; (iv.) mitigate flooding (v.) promote lateral and soil-water storage of water; (vi.) control erosion and reduce; and reduce air temperatures (Callegary et al., 2021; Norman, 2020, 2022). The scalability, perseverance over time, and contributions to a restoration stewardship economy make RDS and easy target for land-managers looking for low-cost, low-tech options to start making a difference (Norman, 2022, 2020).

Interfacing with the CFAES Rattan Lal Center for Carbon Management and Sequestration at OSU, this research is expanding. Initially, via a cutting-edge synthesis of multidisciplinary research on RDS, beaver dams and their analogs werecollatedtogetherfor the first time to promote understanding of their similar ability to address global environmental challenges. In a soon to be published paper, authors describe a wide array of methods and tools employed to investigate the role of Natural Infrastructure in Dryland Streams (NIDS), a nature-based solution, that can reduce hydro-meteorological risk at landscape or watershed scale (Norman et al., 2022b). This is being expanded by integrating the USGS study sites in SE AZ/MX into Dr. Lal's larger project on Carbon Farming, funded by Foundation for Food & Agriculture Research (FFAR), to compare sites across the country.

# C-MASC U.S. Geological Survey

**Photographs from USGS Western Geographic Science Center, who leads the Aridland Water Harvesting Study standing above one of the rock detention structures they are studying.**

(modified from https://twitter.com/usgs_wgsc/

**Learn More**

- Watch this 10-minute field trip documentary "Re-greening a Dryland Watershed" to virtually visit the Turkey Pen Watershed, of the Chiricahua Mountains in SE Arizona, where the installation of thousands of rock detention structures in provided a 30-year case study to consider low-tech and low-cost Natural Infrastructure in dryland watersheds. The USGS systematic study, through observation and experiment, offers verifiable data that documents their efficacy as a Nature-based Solution, that can provide climate adaptation and mitigation benefits here in the Chiricahua Mountains and beyond
- Check out the USGS News Snippet describing "Ancient Methods of Preventing Desertification and Recovering from Drought".
- Explore the USGS project website, "Aridland Water Harvesting Study" for links to all the study sites, research and associated publications.

USGS
science for a changing world

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# C-MASC Middle East Studies Center (MESC)

THE OHIO STATE UNIVERSITY MIDDLE EAST STUDIES CENTER

The Middle East Studies Center (MESC) has evolved rapidly over the past year to incorporate a broader geographic area and focus its services on intercultural, immersive learning opportunities for OSU students. Professor Joy McCorriston, Anthropology, began serving as director Director on January 1. She is an archeologist who brings extensive fieldwork experience in the Middle East to her role, especially in Yemen and Oman. She led the formation of the Gulf Gateway to Indian Ocean working group as part of her new role, and established a regular forum for faculty and students from a variety of departments to share their research on the Middle East and surrounding regions. The Center's broader inclusion of languages and cultures coincides with Near Eastern Languages and Cultures becoming the Department of Near Eastern and South Asian Languages and Cultures. We expect more activities focused on Middle Eastern and South Asian countries, cultures and communities as a result of these developments. The Center is also building interdisciplinary collaborations focusing on the global water crisis, food sovereignty, and other global issues. MESC brings Middle East and South Asian cultural contexts into conversations about food, water, and equitable access to nutrition. Mark your calendar for a workshop in the fall on October 13 and 14th focused on Food Sovereignty. Follow mesc on twitter @mesc_osu or check our website for updates: mesc.osu.edu Please check out our podcast, Keys to Understanding the Middle East, to tap in to the Middle East expertise at Ohio State, ranging from archeology, to literatures of the Middle East, to media, to history, to international law. We thank Director, Dr. Alam Payind, retired on Dec. 31, for 38 years of service including 8 successfully-funded Title VI Proposals. None of these activities would have been possible without his many valuable contributions.

**Dr. Melinda McClimans**

**Dr. Alam Payind**

**Professor Joy McCorriston**

# C-MASC Jian Ding

Jian Ding is a PhD student in the Computer Science Department at Yale University. Her research interests are in wireless systems, with a focus on soil sensing using Wi-Fi signals and cloud-based massive MIMO system for 5G.

Her work has received a Best Paper Honorable Mention Award at Mobicom 2019.

Project description:

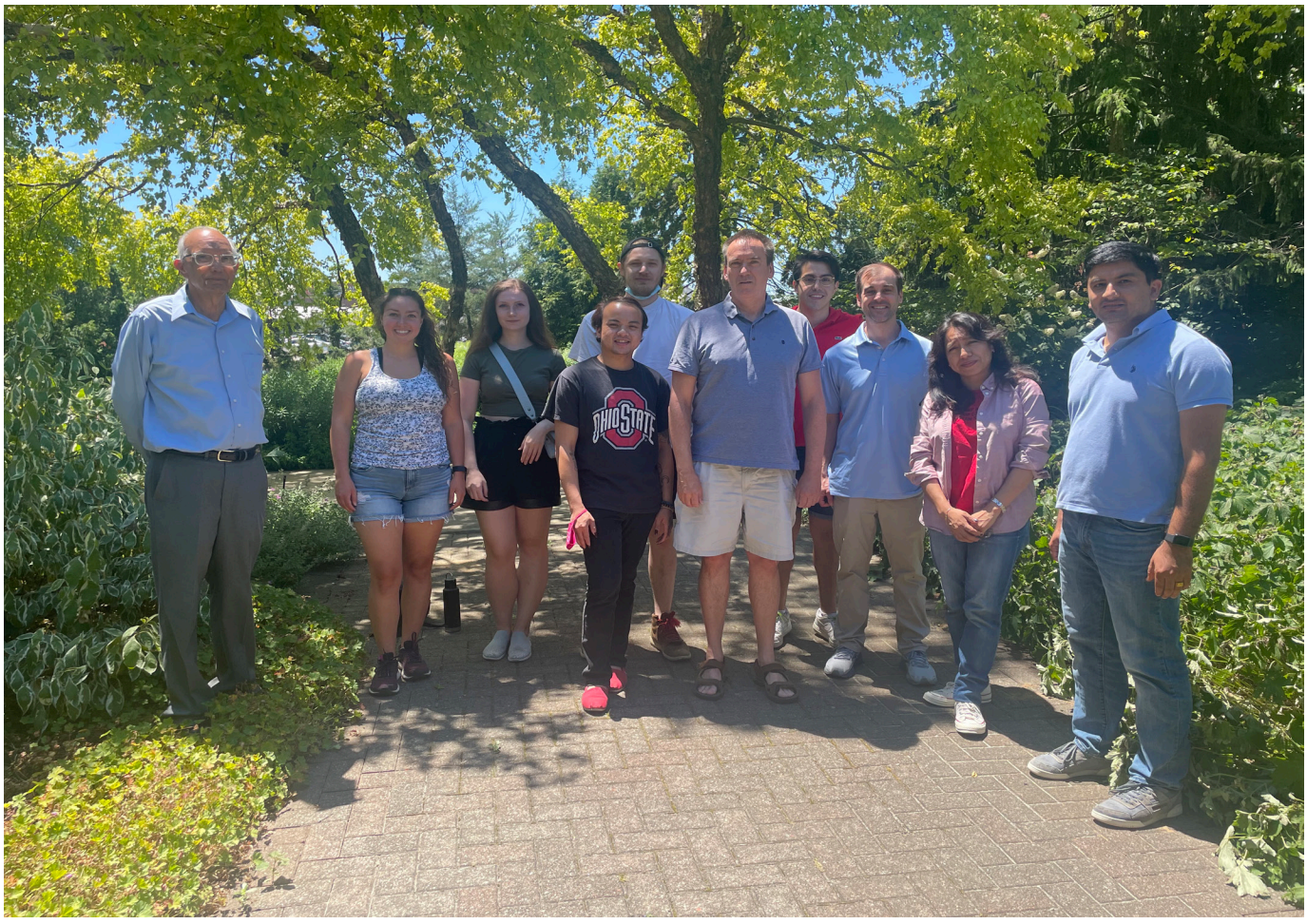
The goal of this visit is to test the possibility of using Strobe, a new Wi-Fi based soil moisture and electrical conductivity sensing technique proposed by Microsoft and published at Mobicom 2019, to detect soil carbon level. During this visit, Jian and Umesh setup Strobe in the lab to test soils from real farms. They use Strobe as well as two commodity soil sensors, TEROS 10 and Decagon GS3, to test soil moisture in 4 soil boxes which keep soils at 4 different soil carbon levels. These results are then compared to soil moisture measured by oven drying method. This work is a collaboration with Microsoft.

# C-MASC Nicholas Johnson

Nicholas (Nick) Johnson is the new Program Coordinator at CFAES Rattan Lal Center of Carbon Management and Sequestration. He has received his bachelor's degree from Ohio Wesleyan University in 2007. He is excited to be rejoining C-MASC after previously working here in 2007-2008. In between, he has worked as a Research Assistant and Lab Manager at the University of Texas in Austin and most recently at Kent State University. In addition to his Environmental Science background, he has received a Masters of Business Administration from Kent State University. He is passionate about the environment, economics and sustainability. In his free time, Nicholas enjoys exploring the outdoors and is excited to see how the Columbus Metro Parks have grown and changed over the years.

# C-MASC Dr. Martha Jimenez-Castaneda

**Dr. Martha Jimenez-Castaneda joined the C-MASC** for six months (January-June 2022). She closely collaborated with the Inter-American Institute for Cooperation on Agriculture (IICA) for the development of the Living Soils of America initiative. During her stay she wrote a book chapter on permafrost during the Anthropocene (in press) and a manuscript on carbon sequestration in soils of Latin America and the Caribbean (in review). She acknowledges friends and colleagues at C-MASC, especially Dr. Lal, for this inspiring experience. Many thanks to Francisco Mello and Kelly Witkowski (IICA) for the work developed together.



# Keynote Presentations

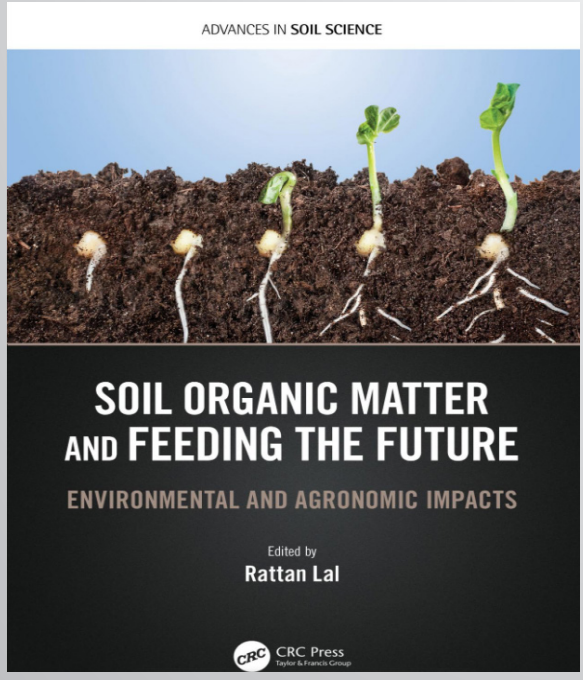
- Lal, R. 2022. Managing Physical Properties of Soils of India for Food and Climate Security. Dr. B.P.Ghildyal Memorial Lecture, ICAAR New Delhi, India. 22 February.
- Lal, R. 2022. Sustainable agriculture data: What's missing, what can be improved, and what needs validation? Strategizing to improve soil health data in agricultural surveys. 50x2030 Initiatives Methods and Tool Development. Rome, Italy.
- Lal, R. 2022. Bringing Soil-Centric Green Revolution to Sub-Saharan Africa. Climate Soil Community of Practice :4 per Thousand and GIZ Event. Bonn, Germany.24-25 March.
- Lal, R. 2022. Soil Carbon Sequestration as a Mechanism for Reducing Emissions. Bioenergy Workshop. Bioenergy Technology Office, DOE, Washington, D.C. 28-29 March.
- Lal, R. 2022. Revisiting Global Food Systems During the Era of Changing Climate and Degrading Soils. Webinar of the Dale Bumpers College of Agric. Food and Life Sciences University of Arkansas. Fayetteville, AR. 30 March.
- Lal, R. 2022. Living in Harmony With Nature. The Torch Club Seminar. Faculty Club, OSU. Columbus, OH. 7 April.
- Lal, R. 2022. Nature –Positive Agriculture: Addressing Global Issues by Innovations in Agriculture and Forestry. U.S.Farmers and Ranchers, HtH. St. Louis, MO. Spring Webinar. 21 April.
- Lal, R. 2022. Earth Day 2022: Restore Our Earth. C-MASC Earth Day. SENR-OSU. Columbus, OH. 22 April.
- Lal, R. 2022. Managing Soils for Healing the Land. State of the Planet. Earth Day Event. IUGS Earth Day. 22 April.
- Lal, R. 2022. Feeding Humanity and Healing the Land. Ohio Youth Institute. CFAES, OSU, Columbus, OH. 25 April.
- Lal, R. 2022. Negative Emission Farming: Managing Soils of Agro-Ecosystems for Sequestration of Atmospheric Carbon Dioxide. Webinar on Soils and Climate Change. National University of Science and Technology. Islamabad, Pakistan. 27 April.
- Lal, R. 2022. Regenerative Agriculture for Soil Carbon Management and Sequestration. Regenerative Society Foundation Meeting. Milan, Italy. 4 May.
- Lal, R. 2022. Making Soils of Small Landholder Farmers Input- Responsive. Research Committee of the IFDC. Muscle Shoals, AL. 10 May.
- Lal, R. 2022. Managing Soil for Food and Climate Security and Advance SDGs of the U.N. National Workshop on Innovative Agriculture, (Azadi Ka Amrut Mahotsav). ICAR, New Delhi, India. 10 May.
- Lal, R. 2022. Managing Soils for Human and the Planet. National Workshop on Innovative Agriculture, (Azadi Ka Amrut Mahotsav). Vigyan Bhawan, New Delhi. 10 May.
- Lal, R. 2022. Healthy Soil and Food for Healthy Planet. UNCCD-CA4SH Side Event. Abdijan, Ivory Coast, West Africa. 12 May.
- Lal, R. 2022. The Need for Soil Health Action. CA4SH –UNCCD COP-15 Side Event. Abdijan, Ivory Coast, West Africa. 13 May.
- Lal, R. 2022. Managing Soils for Sustainable Production of Soybean in Brazil. IX Brazilian Soybean Congress. Iguassu Falls ,Brazil. 15-17 May.
- Lal, R. 2022. Negative Emission Farming :Managing Soils of Agro-Ecosystems for Sequestration of Atmospheric Carbon Dioxide. Distinguished Scientist Seminar Series (DSSS), Lawrence Berkeley National Laboratory (LBNL). Berkeley, California. 20 May.
- Lal, R. 2022. Climate and Soil Carbon Sequestration: What are Key Questions. Making Climate Smart Agriculture Work. 24 May.
- Lal, R. 2022. The role of scientific research in the promotion of sustainable development and peace. Academy of Sciences of Moldova, Science for Peace Forum. Chisinau, Moldova. 25 May.
- Lal, R. 2022. 50th World Environmental Day 2022: only One Earth. WED. Stockholm, Sweden. 5 June.

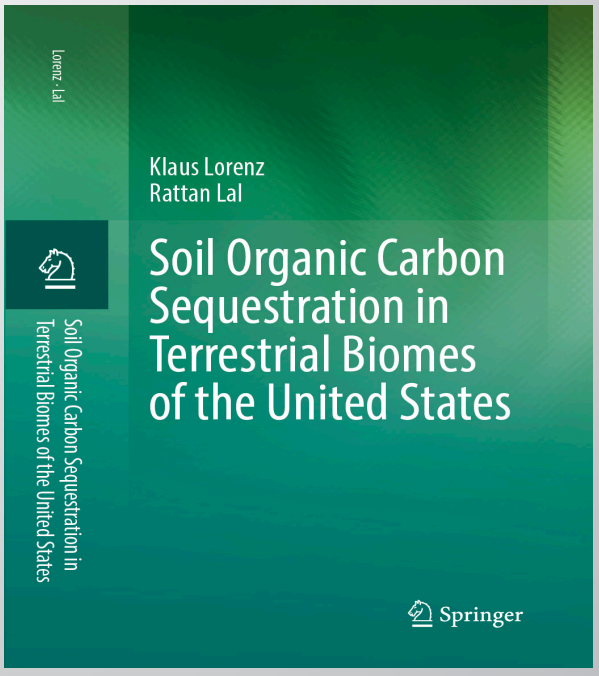
# Keynote Presentations

- Lal, R. 2022. NC 1178 Ohio 2022 Annual Report. College Station, Texas A&M University. 8 June.
- Lal, R. 2022. Managing Soil Health for Carbon Farming and Sustainability. Bayer Webinar on "Innovations for Crop Science." St. Louis, Missouri. 10 June.
- Lal, R. 2022. Nature-Positive Agriculture and Soil-Centric Farming. Corteva Webinar. Des Moines, IA. 10 June.
- Lal, R. 2022. Sustainable Soil Management For Food and Climate Security. Pepsico/IICA Webinar. 14 June.
- Lal, R. 2022. Managing Soil for Climate- Resilient Agriculture Dr. Rattan Lal. 7th International Conference on "Climate Smart Agriculture: Innovations and Adaptations. Rawalkot, Pakistan. 15-17 June.
- Lal, R. 2022. Carbon Sequestration and its benefits to the small and marginal farmers. Sustainable Food Production Systems for Self Reliant and Climate Resilient Agriculture. Dharwad, India. 16-18 June.
- 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.

# Books Published

- Lal, R. 2022. *Soil Organic Carbon and Feeding the Future.* CRC Press. ISBN: 9781000513004, 1000513009.
- Lorenz, K. Lal, R. 2022. *Soil Organic Carbon Sequestration in Terrestrial Biomes of the United States.* Springer. ISBN 978-3-030-95192-4.



# Published Articles


- Ansari, M., Choudhury, B., Layek, J., Das, A., Lal, R., & Mishra, V. (2022). Green manuring and crop residue management: Effect on soil organic carbon stock, aggregation, and system productivity in the foothills of Eastern Himalaya (India). SOIL & TILLAGE RESEARCH, 218. https://doi.org/10.1016/j.still.2022.105318
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- Song, X., Fang, 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 the abandoned farmland in the semiarid of Loess Plateau. Land Degradation & Development. https://doi.org/10.1002/ldr.4313

## CONTACT INFORMATION

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

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