THE OHIO STATE UNIVERSITY
OARDC

CENTER CarbOn sequeStration

Winter 2008/2009
Newsletter

Participants from left to right: Physician to Pres. of Bangladesh; Deputy Press Secretary to Pres. of Bangladesh; Deputy Secretary to Pres. Bangladesh; Dr. Ahkter Hossain; Dr. Tajmeri SA Islam; Dr. David Hansen; Dr. Ray Weil; Dr. Mustafizur Rahman; Dr. Bill Ravlin; Dr. Rattan Lal, President of Bangladesh Iajuddin Ahmed; Dr. Anowara Begum (President's wife); Dr. Rafiq Islam; Dr. Shivkumar; Dr. Iqbal Choudhury; Julie Chen; Dr. S.M.A. Faiz; Press Secretary to Pres. of Bangladesh.

INTERNATIONAL SYMPOSIUM ON CLIMATE CHANGE AND FOOD SECURITY IN SOUTH ASIA (CWC-TIE)

Dhaka, Bangladesh, 25-40 August 2008

An international conference on Climate Change and Food Security in South Asia, was held in Dhaka, Bangladesh 25 to 30 August 2008. This conference was sponsored by the Ohio State University (CWC-TIE), World Meteorological Organization (WMO), Food and Agricultural Organization of the United Nations (FAO),, Economic and Social Commission of Asia and Pacific (ESCAP), University of Dhaka and the government of Bangladesh. The meeting was attended by 75 participants from 13 countries.

The objective of this symposium was to deliberate the impact of current and projected climate change on (i) natural resource degradation (e.g., vegetation, soil, water, sea level rise), (ii) food security, (iii) economic and social issues, (iv) mitigation strategies, and (v) policy considerations.

The symposium had 4 specific outcomes as follows:

(i) Dhaka Symposium Declaration,
(ii) Dhaka Symposium Recommendations,
(iii) Proceedings of the Symposium, and
(iv) Research, Development, and Training Program.

Inside:

1. Dhaka Symposium Declaration

Climate change has multi-dimensional impacts on agro-ecosystems in South Asia, including increases in temperature, decline in fresh water availability, sea level rise, glacial melting in the Himalayas, increased frequency and intensity of extreme events, and shifting of cropping zones. They all impact agriculture and the related food sector as well as the general economies, societies and environment in South Asia. Continued on page 2…

Agriculture is a bearer, a contributor as well as a mitigator of climate change. Small landholders (<2 ha) and resource poor, subsistence farmers predominate in the region and contribute to CO_2 emissions. The per capita land area is <0.1 ha in many countries in South Asia and is rapidly decreasing because of conversion of land to non-agricultural uses, soil degradation and continued population growth. The serious problems of soil degradation and desertification are likely to be exacerbated by climate change through accelerated erosion, fertility depletion salinization and acidification. Subsistence agriculture, characterized by low productivity and extractive farming, is extremely vulnerable to climate change. The latter may constrain attainment of food production targets in the South Asian countries.

The symposium identified several key recommendations, knowledge gaps, and opportunities for policy makers, researchers and extension systems, international organizations, and NGOs to implement programs designed to minimize short-term and long-term vulnerability of the South Asian region to climate change. Principal recommendations are to:

- Create a Climate Change and Food Security in South Asia Network (CCFSSANet) and establish a South Asia Climate Outlook Forum (SACOF).
- Stimulate multi-disciplinary research on climate change and food security in South Asia and identify effective mitigation and adaptation options, including carbon sequestration in different ecosystems.
- Initiate and strengthen cooperation among academic and research institutions, international organizations, and NGOs to provide opportunities for strengthening institutions, human resource development and capacity building.
- Develop innovative financial mechanisms to scale up technical and financial support for the adaptation efforts of the South Asian countries.
- Promote adoption of mitigation and adaptation options through payments for ecosystem services such as carbon trading.
- Strengthen regional institutional and policy mechanisms to promote and facilitate implementation of location-specific adaptation and mitigation practices.

2. Dhaka Symposium Recommendations

The international symposium on Climate Change and Food Security in South Asia was convened at the University of Dhaka from 25 to 30 August, 2008. It identified the following recommendations based on keynote presentations, poster papers and working group deliberations.

1. Create a Climate Change and Food Security in South Asia Network (CCFSSANet) and establish a South Asia Climate Outlook Forum (SACOF), both to be maintained by WMO. They will:

    - Share information on management of climate change and related science, data, tools and methodologies in South Asia.

    - Generate data on solar heating as it relates to the effects of soot, aerosols and particulate material emissions on radiation balance, rainfall patterns, and regional climate change.

    - Develop seasonal climate predictions to assist farmers to optimally adjust their planting dates, crop varieties, and management practices to reduce agricultural vulnerability to hydro-meteorological hazards.

    - Promote adoption of proven sustainable technologies related to better soil, crop, livestock and fishery and water management in order to increase food productivity by enhancing use efficiency of inputs such as fertilizer, water, energy and labor. Examples of such win-win options include conservation agriculture, integrated nutrient and pest management, aerobic rice, sustainable fishery, crop and livestock production, biodiversity conservation and agricultural diversification, composting, integrated river basin water resources management and irrigation modernization, sustainable forest management, and plant/crop management to improve soil quality.

    - Create mechanisms to pay farmers for ecosystem services such as carbon sequestration in soils and reductions of gaseous emissions related to deforestation, degradation of agricultural soils, grasslands, and water quality improvement, and reduced emissions of methane and nitrous oxide from agricultural and forestry land uses.

    - Improve collection and dissemination of weather-related information by improving weather station networks to strengthen monitoring of extreme events and their impacts on food production and availability.

    - Establish a regional early warning system of climatic risks.

    - Promote insurance for climatic risk management.

2. Stimulate multidisciplinary research on topics related to climate change and food security in South Asia including the following:

    - Bio-fuel alternatives that encourage use of crop residues and dung as soil amendments while producing energy for household consumption in rural communities. These include algae farms, energy plantations and bio-digesters.

    - Hydrologic cycles of major river systems and their deltas, emphasizing sediment transport, fate of carbon transported by fluvial processes, subsidence and inundation of deltas and changes in mangrove swamps and riparian ecosystems.
    - Infectious diseases and water quality as they relate to human health with a specific focus on arsenic poisoning, and nitrate and pesticide loadings resulting from conventional agricultural practices.

    - Improved germplasm for tolerance to biotic and abiotic stresses exacerbated by climate change, such as increasing risks of salinization, temperature extremes, flooding, drought, pests and diseases.

3. Proceedings of the Symposium

Book:

Proceedings of the symposium will be published as a book. All invited speakers have been invited to contribute a chapter. The book will be published by Springer, the Netherlands. Reviews and revised manuscripts will be published bas a book entitled "Climate Change and Food Security in South Asia", by September 2009.

4. Follow up Research, Development and Training Program

WMO, in collaboration with OSU and FAO, is preparing a follow up research and development program. The program can be implemented only with availability of funds from World Bank (GEF) and other sponsors. Strong participation of South Asian institutions is extremely important to such activities.

Food and Agriculture Organization of the United Nations

for a world without hunger

THE OHIO STATE UNIVERSITY OARDC

World Meteorological Organization

Working together in weather, climate and water

Climate Change and Food Security in South Asia Conference Dhaka, Bangladesh
Distinguished Presenters

- *Leena Srivastava,* The Energy and Resources Institute, New Delhi, **Climate Change in South Asia.**
- *Ad Spijkers* FAO, **Implications of Climate Change for Agriculture and Food Security in South Asia.**
- *Atique Rahman,* Bangladesh Centre for Advanced Studies, **North South Dynamics in Climate Negotiation.**
- *Rattan Lal,* Ohio State University, **Climate Change and Soil Quality**
- *Dagfinnur Sveinbjornsson and H. Bjornsson,* University of Iceland, **Glacier Dynamics and Flooding.**
- *Faisal Hossain and Doug Alsdorf,* Tennessee Tech Univ. & Ohio State Univ., **Understanding Surface Water Flow and Storage Changes using Satellites.**
- *C.K. Shum and Chung-Yen Kuo,* Ohio State University, **Global Sea Level Rise**.
- *Harunur Rashid and Bryce Rodgers,* Ohio State University, **Global Temperature Change: Potential Impact in the Intensity of the Indian Ocean Monsoon, Flooding and Soil Erosion.**
- *Christian France Lanord,* CRPG-CNRS, **Suspended sediment variability and erosion geochemical budget of the Brahmaputra-Ganga basin**.
- *C.K. Shum, H. Lee, D. Alsdorf and F. Hossain, Ohio State Univ., Tennessee Tech. Univ.,* **Terrestrial Hydrology from Satellite Gravity**.
- *Ainun Nishat,* IUCN, Dhaka, **Climate Change and Water Security in Bangladesh: Concerns Options**
- *Sveinn Runolfsson,* Soil Conservation Service, Iceland, **Restoration of degraded and desertified lands: experience from Iceland.**
- *Song Liang***,** Ohio State University, **Climate Change and Infectious Diseases.**
- *Amanat Ullah*, University of Dhaka, **Emerging Health Issue and Climate Changes in Bangladesh.**
- *A. Momin,* Dhaka Medical College, **Arsenicosis in Bangladesh.**
- *Richard Dick,* Ohio State University, **Soil Microorganisms the Final Arbitrators: Can they be Managed to Optimize Carbon Sequestration in Semi-Stable Soil Pools.**
- *Anil Kumar Singh,* Indian Council of Agricultural Research (ICAR), **Options on Crop Production for Coping with Climate Change in South Asia.**
- *Samsul Huda,* University of Western Sydney, Australia, **Mitigation Adaptation Strategies in Coping with Climate Change Impacts for Improved Crop Health & Sustainable Food Production in S. Asia.**
- *Carolyn Imede Opio,* FAO, **Options on Livestock Production for Coping with Climate Change in S. Asia**.
- *N.H. Ravindranath,* Indian Institute of Science, **Options on Forestry Management for Coping with Climate Change in South Asia.**
- *Francesco Nicola Tubiello,* Columbia University, **Options on Irrigation and Water Management for Coping with Climate Change in South Asia.**
- *Elayaperumal Vivekanandan,* Indian Council of Agricultural Research, **Options on Fishery and Aquaculture for Coping with Climate Change in South Asia.**

Climate Change and Food Security in South Asia Conference Dhaka, Bangladesh

Distinguished Presenters Continued…

- *Jun Furuya,* (JIRCAS), **Modeling Economic Impacts of Climate Change on Agriculture and Food Supply and Demand.**
- *Harun Quder Yusuf,* University of Dhaka, **Climate Change: An Emerging Threat to Agriculture and Food security in Bangladesh.**
- *M.M. Haque,* BARI, **Impact of Climate Change on Biodiversity Food Security.**
- *W. Sultana, A. Aziz, A. Ahmed*, BARI, **Climate change: Impact on Crop Production and its Copping Strategies.**
- *Sultana Nahar,* Ohio State University, **Solar Irradiation of the Earth's Atmosphere with Special Reference to South Asia.**
- *Kamrul Islam,* University of Dhaka**, Global Climate Change and its Effects on hydrogeoenvironment of Bangladesh Coastal Belt.**
- *Sangmin Nam and Siva Thampi,* UNESCAP, **Mainstreaming Adaptation into Devel. Agenda.**
- *Pak Sum Low,* UNESCAP, **Possible Financial Innovations to enable Integrated Actions at the National Level.**
- *Selvaraju Ramasamy*, Natural Resources Management & Environment Department, FAO, **Messages from FAO High Level Conference on World Food Security: the Challenges of Climate Change and Bioenergy.**
- *Sanjay Srivastava* (SAARC) (SDMC), **A Framework for Regional Cooperation on Integrating Disaster Risk Reduction and Climate Change Adaptation in South Asia.**
- *Mikio Ishiwatari,* (JICA), **Prioritizing climate change adaptation in national development planning** .
- *Tomonori Sudo***,** (JBIC), **Donors' approach: climate change adaptation and development Cooperation.**
- *Prabhakar Sivapuram, (*IGES), **Climate Change Market Mechanisms for Asian Societies**
- *Pramod Aggarwal,* Indian Agric. Research Institute, **Presentation of Draft Regional Framework.**
- *Dr M.V.K. Sivakumar,* WMO, **Discussion on Breakout Groups and Terms of Reference**

CENTER CarbOn sequeStration

OSU-MSSRF Phase II India Visit

The OSU-MSSRF collaborative program works with village communities through out India on sustainable development issues such as the maintenance of safe drinking water. The Ohio State University is pleased to have the opportunity to collaborate with MSSRF on the community "Managed Bio-Industrial Watersheds for Sustainable Use of Natural Resources and Enhanced Livelihoods" project. Several OSU colleagues including Rattan Lal (Soil Physicist), Brian Slater (GIS/Soils), Lawrence Brown (Soil and Water Engineer), Martin Shipitalo (ARS/ Coshocton Experimental Watershed), and David Hansen (Rural Sociologist) visited the watersheds involved in this collaborative project. The objective of the visit was to design a research program that would facilitate assessing the impact of project interventions on the natural resources base of each watershed with particular attention to soil, water, carbon and nutrients. This team worked with the counterparts at MSSRF and the watershed sites over the duration of the project.

The goal of this partnership is to set in motion, a process of adoption of recommended agricultural practices that would enhance food security while improving the environmental quality with a major emphasis to extend productivity gains on a sustainable basis to the farmers of the area under Alfisol (red soil), Vertisol (black soil) and Inceptisol (alluvial soil) representing Pudukottai, Ludhiana and Jabalpur respectively and also to enhance the livelihood opportunities of the farm women.

Visiting Scholars

Keisuke Ono is a postdoctoral research fellow at University of Tsukuba, Japan. The research program involves evaluation of representativeness of a tower flux site in a rice paddy area and estimation of regional fluxes using eddy flux measurements, a SVAT model, a modified Roth C model, and high resolution remote sensing data. Theses researches focus on the fallow season as well as the growing season. Fallow fluxes are predominantly affected by processes on and in soils, which are my research topic at C-MASC, OSU. During his stay at OSU he hopes to carry out a study on dynamics of fallow carbon dioxide and water vapor fluxes and their dependence on management practices such as residue mulch and tillage, and to deepen his understanding of carbon sequestration into crop soil and sustainable agriculture. In Japan, he plays volleyball and enjoys trekking and skiing on holidays.

Won Kyo Jung is a visiting scholar from Korea. He will be doing his research, which is OSU-RDA joint research project, with Dr. Rattan Lal at the OSU for next an year. He has been an employee in Rural Development Administration in Korea, which is same functional organization as USDA-ARS, as an agricultural researcher for past 19 years. He's got BS and MS degree in agronomy at Yeoungnam and Kyunghee University in Korea. He's got Ph. D degree in soil and environmental science at the university of Missouri-Columbia. He has studied in GIS and remote sensing, statistical analysis, site-specific management technologies related soil management and practices. His recent research interests are carbon sequestration, energy and environment conservation management and its policy realization. Recently he's got an outstanding scientist award from The Korean Federation of Science and Technology Societies. He has served as an editor of the Korean Journal of Soil Science and Fertilizer since 2007. He is living with his wife and three children. He was a member of barbershop quartet and looking for singing chance.

Upcoming Conferences 2009

April 27-May 1 Princeton University:

The Princeton Environmental Institute (PEI), and the Science, Technology and Environment Policy (STEP) program of the Woodrow Wilson School are organizing a symposium entitled "Feeding at Hot and Hungry Planet: The Challenges of Making More Food and Fewer Greenhouse Gases".

International Soil Tillage Research Organization 18th Triennial Conference
June 15-19, 2009 Izmir, Turkey

Many scientists and researches from around the world get a chance to meet to exchange ideas on soil tillage issues. These meetings we will discuss soil tillage, soil compaction and soil management. Sustainable agriculture is the main subject for this congress. For move information please visit: https://www.istro2009.org/index.php

International Symposium on Soil Organic Matter Dynamics: Land Use, Management and Global Change Colorado Springs, Colorado, USA July 6-9, 2009

The symposium will cover a range of topics on the vital role of soil organic matter (SOM) in the function and sustainability of terrestrial ecosystems and the global carbon cycle. Research on SOM in all terrestrial ecosystems (e.g., cropland, grassland, forest, tundra) is included. Aim of the symposium is to present the latest research on SOM across the globe and highlight future research directions. http://www.nrel.colostate.edu/som-home.html.

International Annual Meeting ASA-CSSA-SSSA, Nov. 1-5, 2009 Pittsburgh, PA.
"Footprints in the Landscape: Sustainability through Plant and Soil Sciences,"

The purpose of this event is to: expand your knowledge with lectures, symposia, and 3,000 oral and poster papers; share ideas, successes, and challenges with your peers; connect with colleagues from around the world; learn about the best and latest products and services. For more information please visit: https://www.acsmeetings.org/

World Agriculture Forum is holding the **2009 World Congress** in St. Louis, MO from 18-20 May 2009.The focus is on food security in relation to sustainable management of water, especially for agricultural use in the context of increasing competition for industrial and urban uses.

2008 Publications

Books Written	Books Edited	Refereed Journal Articles	Chapters in Multi-authored books	Invited Keynote presentations	Contributory Papers	Miscellaneous Publications	Total
1	1	30	8	23	13	9	85

Books Written

- Blanco-Canqui, H. and R. Lal 2008. Principles of Soil Conservation. Springer Verlaag, 617 pp.

Books Edited

- R. Lal and R.F. Follett (Eds.). 2nd. Ed. "Soil Carbon Sequestration and Greenhouse Effect". SSSA Spec. Publ. 57. Madison, WI.

Refereed Journal Articles

- Ussiri, D. and R. Lal 2008. Method for determining coal carbon in the reclaimed minesoils contaminated with coal. Soil Sci. Soc. Am. J. 72:231-237.
- Jagadamma, S., R. Lal, R. G. Hoeft and E. D. Nafziger and E.A. Adee 2008. Nitrogen fertilization and cropping systems impacts on soil properties and their relationship with yield in a Central Corn Belt, USA. Soil & Tillage Res. 98:120-129.
- Lal, R. 2008. Managing soil water to improve rainfed agriculture in India. J. Sust. Agric. 32: 51-75.
- Lal, R., R. Follett, B. A. Stewart and J. M. Kimble 2008. Soil carbon sequestration to mitigate climate change and advance food security. Soil Sci. 172: 943-956.
- Mulumba, L.N. and R. Lal 2008. Mulching effects on selected soil physical properties. Soil Tillage Res. 98:106-111.
- Elder, J.W. and R. Lal 2008. Tillage effects on gaseous emissions from an intensively farmed organic soil in north central Ohio. Soil Tillage Res. 98:45-55.
- Lal, R. 2008. Crop residues as soil amendments and feedstock for bioethanol production. Waste Management 28:747-758.
- Lal, R. and D. Pimentel 2008. Soil erosion: A carbon sink or source? Science 319:1040-1042.
- Lal, R. 2008. Promise and limitations of soils to minimize climate change. J. Soil Water Cons. 63: 113-118.
- Polyakov, V.O. and R. Lal 2008. Soil organic matter and CO_2 emission as affected by water erosion on field runoff plots. Geoderma 143:216-222.
- Elder, J.W. and R. Lal 2008. Tillage effects on physical properties of agricultural organic soils of north central Ohio. Soil Tillage Res. 98: 208-210.
- Starr, G.C., R. Lal, L.B. Owens and J.M. Kimble 2008. Empirical relationship for soil organic carbon transport from agricultural watershed in Ohio. Land Degrad. Dev. 19: 57-64.

2008 Publications Continued….

- Blanco-Canqui, H. and R. Lal 2008. No-tillage and soil carbon sequestration: an on-farm assessment. Soil Sci. Soc. Am. J. 72:693-701.
- Lal, R. 2008. Carbon sequestration. Phil. Trans. Royal Soc. (B) 363 (1492): 815-830.
- Nyamadzawo, G., M.K. Shukla and R. Lal 2008. Spatial Variability of total soil carbon and nitrogen stocks for some reclaimed minesoils of southeastern Ohio. Land Degrad. & Dev. 19: 275-288.
- Lal, R. 2008. Sequestration of atmospheric CO_2 in global carbon pools. Energy & Env. Sci. 1: 86-100.
- Lal, R. 2008. Sustainable horticulture and resource management. Acta Hort. 767: 19-43.
- Lal, R. 2008. Soils and India's food security. J Ind. Soc. Soil Sci. 56 (2): 129-138.
- Girmay, G., B.R. Singh, H. Mitiku, T. Borresen and R. Lal. 2008. Carbon stock in Ethiopian soils in relation to land use and soil management. Land Degrad. & Dev. 19: 351-367.
- Lal, R. 2008. Food insecurity's dirty secret. Science 322: 673-674.
- Shrestha, R.K. and R. Lal. 2008. Land use impacts on physical properties of 28-years old reclaimed mine soils in Ohio. Plant and Soil 306: 259-260.
- Jiménez, J.J., R. Lal, H. Leblanc. 2008. The soil C pool in different agroecosystems derived from the dry tropical forest of Guanacaste, Costa Rica. Ecol. Eng. 34: 289-299.
- Jiménez, J.J., R. Lal, R. O. Russo, H.A. Leblanc. 2008. The soil organic carbon in particle-size separates under different regrowth forest stands of northeastern Costa Rica. Ecol. Eng. 34: 300-310.
- Lorenz, K., R. Lal, and M.J. Shipitalo. 2008. Chemical stabilization of organic carbon pools in particle size fractions in no-till and meadow soils. Biology & Fertility of Soils. 44: 1043-1051.
- Blanco-Canqui, H. and R. Lal 2008. Stover removal impacts on microscale soil physical properties. Geoderma. 145: 335-346.
- Blanco-Canqui, H. and R. Lal 2008. Axle load impacts on hydraulic properties and corn yield in no-till clay and silt loam. Agron. J. 100: 1673-1680.
- Abid, M. and R. Lal. 2008. Tillage and drainage impacts on soil quality. I. Aggregate stability, carbon and nitrogen dynamics. Soil Tillage Res. 100: 89-98.
- Lal, R. 2008. Black and buried carbon impacts on soil quality and ecosystem services. Soil & Tillage Res. 9: 1-3.
- Lal, R. 2008. Soil C stocks under present and future climate with specific reference to European economics. Nut. Cycl. Agroecosyst. 81: 113-127.
- Lal, R. 2008. Laws of sustainable soil management. Agron. Sustainable Soil Management. 29: 7-9.

2008 Publications Continued….

Chapters in Multi-Authored Books

- Lal, R. 2008. Soil Science: Management and Conservation. In W. Pond et al. (Eds) "Food For All: Culture, Science and Technology of Food in the 21st Century".
- Shrestha, R.K., D. Ussiri and R. Lal. 2008. Terrestrial carbon sequestration potential in reclaimed mine soils to mitigate the greenhouse effect. In 2nd. Ed. R. Lal and R.F. Follett (Eds.). "Soil Carbon Sequestration and Greenhouse Effect". SSSA Spec. Publ. 57. Madison, WI.
- Lorenz, K., R. Lal, C.M. Preston, K.G.J. Nierop. 2008. Soil organic carbon sequestration by biochemically recalcitrant biomacromolecules. In 2nd. Ed. R. Lal and R.F. Follett (Eds.). "Soil Carbon Sequestration and Greenhouse Effect". SSSA Spec. Publ. 57. Madison, WI.
- Lorenz, K., R. Lal. 2008. Carbon dynamics in urban soils. In 2nd. Ed. R. Lal and R.F. Follett (Eds.). "Soil Carbon Sequestration and Greenhouse Effect". SSSA Spec. Publ. 57. Madison, WI.
- Blanco-Canqui, H. and R. Lal 2008. Crop residue management and soil carbon dynamics. In 2nd. Ed. R. Lal and R.F. Follett (Eds.). "Soil Carbon Sequestration and Greenhouse Effect". SSSA Spec. Publ. 57. Madison, WI.
- Jacinthe, P.A., C.D. Barton, S. Maharaj, and R. Lal. 2008. An evaluation of methodologies for assessing geogenic carbon in minesoils of the eastern US. In 2nd. Ed. R. Lal and R.F. Follett (Eds.). "Soil Carbon Sequestration and Greenhouse Effect". SSSA Spec. Publ. 57. Madison, WI.
- Lal, R., and R. F. Follett. 2008. Soils and the climate change. In 2nd. Ed. R. Lal and R.F. Follett (Eds.). "Soil Carbon Sequestration and Greenhouse Effect". SSSA Spec. Publ. 57. Madison, WI.
- Lal, R., and R. F. Follett. 2008. Priorities in soil science research and extension in response to climate change. In 2nd. Ed. R. Lal and R.F. Follett (Eds.). "Soil Carbon Sequestration and Greenhouse Effect". SSSA Spec. Publ. 57. Madison, WI.
-

2008 Publications….Invited Keynote Presentations

- Lal, R. 2008. Improving productivity of rainfed farming in India. In "International Conference on Conservation Farming Systems and Watershed Management in Rainfed Areas for Rural Employment & Poverty Eradication". 12-16 February 2008, NASC/ICAR, New Delhi, India.
- Lal, R. 2008. Carbon sequestration implications for agriculture and conservation practices. 29 January, 2008, Soil Water Cons. Dist. Panel, Columbus, Ohio.
- Lal, R. 2008. Climate Change and Agriculture. 29 February, 2008, The Nature Conservancy Panel, Dublin, Ohio.
- Lal, R. 2008. Managing soils for climate change mitigation and adaptation. AGP Workshop on Climate Change, 3-4 March 2008, FAO, Rome, Italy.
- Lal, R. 2008. Soil carbon sequestration to mitigate climate change. Expert Meeting on Climate Change Adaptation and Mitigation. 5-7 March 2008, FAO, Rome, Italy.
- Lal, R. 2008. Soil organic matter dynamics and the global carbon cycle: Impact on climate change and the global food security. 3rd April, Univ. of Cordoba, Spain.
- Lal, R. 2008. Carbon sequestration and soil-climate change. Plant Sciences Institute, Iowa State Univ., Ames, IA, 25 April 2008.
- Lal, R. 2008. Sustaining soil quality in a warming planet. NAS, 18, July 2008, Washington, D.C.
- Lal. R. 2008. Climate change and agricultural sustainability. "Global Climate Change and Agriculture: Interactions, Land Use Patterns, and Educational Connections". Symposium #11, Ecological Soc. Am., Annual Meeting, 6 August, 2008. Milwaukee, WI.
- Lal, R. 2008. Climate change and soil quality. In "Climate Change and Food Security in South Asia", WMO/FAO/OSU/ESCARP/SARC, Dhaka Univ., 25-30 August, 2008.
- Lal, R. 2008. World agricultural production and climate change. Royal Swedish Academy of Sciences, 18 August 2008, Stockholm, Sweden.
- Lal, R. 2008. Improving small scale agriculture in a changing climate. In "World Water Week Seminar", 17th August 2008, Stockholm, Sweden.
- Lal, R. 2008. Restoring degraded soils for advancing food security and mitigating climate change. 11th National Soil Sci. Cong., "Sustainable Development of Soil Science and Society", 24-27 Sept., Beijing, China.
- Lal, R. 2008. Savannas and global climate change: source or sink of atmospheric CO_2. Intl. Symp. Trop. Savannas 12-17 October, 2008, Brazilia, Brazil.
- Lal, R. 2008, Role of soils and fertilizers in managing climate change. Symposium on Global Climate Change, APAARI, 21-22 October, Tsukuba, Japan.

2008 Publications….Invited Keynote Presentations Continued….

- Lal, R. Mitigation potential and opportunities. Symposium on global climate change. APAARI, 21-22 October 2008, Tsukuba, Japan.
- Lal, R. 2008. The Role of Soil Organic Matter in the Global Carbon Cycle. Symposium "Can Soils Make a Difference?". European Commission, 12 June 2008, Brussels, Belgium.
- Lal, R. 2008. Managing soils in a warming earth and rising human needs. German Soil Sci. Soc., 4 Dec. 2008, Berlin Technical University, Berlin, Germany.
- Lal, R. 2008. Carbon sequestration in drylands: Where we are? Where we might go? Second Conference on Drylands, Deserts and Desertification, 14-17 Dec. 2008, Ben Gurion University, Sede Boqer Campus, Israel.
- Lal, R. 2008. Global food crisis and soil carbon In "Soil Carbon: The Next Cash Crop". Carbon Farming Expo and Conference, Orange, NSW, Australia, 18-19 Nov, 2008.
- Lal, R. 2008. Growing soil carbon. In "Conservation Agriculture and Carbon Off-set Consultation". FAO/CTEC, West Lafayette, IN, 28-30 October, 2008.
- Gisladottir, G., E. Erlendsson, and R. Lal. 2008. The impact of soil erosion in Iceland on atmospheric CO_2 enrichment land use and land degradation: land degradation processes, dynamics of land degradation. IGU's Comland Conference. Taiwan, 8-13 June, 2008.
- Gisladottir, G., E. Erlendsson, and R. Lal. 2008. Carbon budget over the last millennium in the soils of the Reykjanes peninsula, SW-Iceland. Raunvísindaing 14.-15.mars 2008. Program/Natural Science Symposium 2008, p. 44.

Miscellaneous Publications

-
- Lal, R. 2008. "Our Changing Air", Preface to the book by R. Desjardins and J. Janzen. Agric. Canada, ON.
- Lal, R. 2008. "World Food Production and Use", (A.R. Conklin, Jr. and Th. C. Thomas), book review. CEAN AIR 36(2): 141.
- Lal, R. 2008. Black and buried carbons' impacts on soil quality and ecosystem services. Soil Tillage Res. (In Press).
- Larkins, B., S.P. Griggs, D.P. Delmer, R.P. Dick, R.B. Flavell, J. Gressel, T. Habtemarian, R. Lal, A. Pell, R.J. St. Leger and R.J. Wall. 2008. Emerging technologies to benefit farmers in Sub-Saharan Africa and South Asia. NRC/NAS, Washington, D.C, 237 pp.
- Lal, R. 2008. Mother of Necessity: The Soil. Foreword for E. Lichtfouse (Ed) "Sustainable Agric." Springer Verlaag, Germany.
- Lal, R. 2008. Foreword. In "Soil Conservation in Nigeria: Past and Present On-Station and On-Farm Initiatives" by B. Junge, R. Abaidoo, D. Chikoye and K. Stahn. Soil Water Cons. Soc., Ankeny, IA, 28 pp.
- Dumanski, J., R.L. Desjardins, R. Lal, P.L. Freitas, J.N. Landers, P. Gerber, H. Steinfekd, L. Verchot, G.E. Schuman, J.D. Derner and M. Rosegrant. 2008. Strategies for greenhouse gas mitigation in agriculture. Agric. Canada, Ottawa, Canada.
- Blanco, H. and R. Lal. 2008. What is the real potential of no-till soils for sequestering carbon? CSA News 53:10. https://www.soils.org/csa-news.
- Blanco, H. and R. Lal. 2008.Corn stover removal decreases soil carbon, impacts crop. The Ohio State Univ. Extension. http://www.ag.ohio-state.edu/~news/story.php?id=4306.
-

2008 Publications….Voluntary Contributions

- Gisladottir, G., E. Erlendsson and R. Lal 2008. Terrestrial vulnerability to volcanic hazards in Reykjanes, southwest Iceland. Geographical Res. Abstract vol. 10, EGU 2008-A-08381, EGU General Assembly, 2008.
- Gisladottir, G., E. Erlendsson, and R. Lal 2008. Carbon budget over the last millennium in the soils of Reykjones Peninsula, SW-Iceland. The Faculty of Science Conference, Univ. of Iceland, March 2008.
- Gisladottir, G., E. Erlendsson, and R. Lal 2008. The impact of land use and climate change on soil quality. IGU Conference, July 2008.
- Shrestha, R.K., R. Lal, and P.A. Jacinthe. 2008. Enhancing carbon and nitrogen sequestration of reclaimed mine soils in Ohio by using organic amendments and deep ripping. SSSA/ASA/CSSA annual meeting. 5-9 October, Houston, TX.
- Shrestha, R.K., R. Lal, and B. Rimal. 2008. Impacts of organic fertilizers on nitrogen dynamics and green house gas emissions in no-till corn. SSSA/ASA/CSSA annual meeting. 5-9 October, Houston, TX.
- Mishra, U., R. Lal, D. Liu, and B. Slater. 2008. Evaluation of the predictors of soil organic carbon stock at a regional scale. SSSA annual meeting. 5-9 October, Houston, TX.
- Gisladottir, G., E. Erlendsson, and R. Lal. 2008. The impact of land use and climate change on soil quality. The IGU Congress, Tunisia August 12-15.
- Gisladottir, G., E. Erlendsson, and R. Lal. 2008. Terrestrial vulnerability to volcanic hazards in Reykjanes, southwest Iceland. Geophysical Research Abstracts, Vol. 10, EGU2008-A-08381, 2008. EGU General Assembly, April 13-18, Vienna, Austria.
- Gisladottir, G., E. Erlendsson, and R. Lal, and J. Bigham. The Icelandic Institute of Natural History seminar series, Abstract published at http://www.ni.is/midlun-og-thjonusta/hrafnathing/greinar/nrr/733.
- Jagadamma, S., R. Lal, D.A.N. Ussiri, S.E. Trumbore, and S. Mestalan. 2008. Efficiency of wet oxidation methods for isolating stable soil organic carbon. Poster presentation. SSSA annual meeting. 5-9 October, Houston, TX.
- David. A.N. Ussiri and R. Lal. 2008. Land management effects carbon sequestration for the reclaimed prime farmland soils of eastern Ohio. 2008 Annual Joint Meeting, GSA, SSA, ASA, CSA, GCAGS, 5-9 October, Houston, TX.
- David. A.N. Ussiri and R. Lal. 2008. Compaction and tillage effects on nitrous oxide emission from corn-soybean-oat rotation in southwest Ohio. Annual Joint Meeting, GSA, SSA, ASA, CSA, GCAGS, 5-9 October, Houston, TX.
- Chatterjee, A., L. Wielopolski, R. Lal, D.A.N. Ussiri. 2008. Soil carbon pools in reclaimed mineland of Ohio under different ages and land uses. Annual Joint Meeting, GSA, SSA, ASA, CSA, GCAGS, 5-9 October, Houston, TX.