



Carbon Management and Sequestration Center

Issue 4 | 2015

Soil Carbon Sequestration and COP-21

COP-21 (30 November – 12 December 2015) in Paris is a historical landmark for highlighting the importance of sequestering atmospheric CO₂ as soil organic carbon (SOC) in agricultural lands. The "4 Per Thousand" initiative has created numerous opportunities of making agriculture, especially agricultural soils, as solution to global warming while also advancing food and nutritional security and improving water quality. The focus of this proposal is more on the concept rather than the numbers per se nor the magnitude of specific off-set of the anthropogenic emissions. Indeed, it blazes a new path in the in the history of U.N. Framework Convention to Combat Climate Change (UNFCCC) and recognizes the fact that **"soil matters"** in addressing global issues. This increase in awareness about the importance of soil to mitigating climate change is a befitting tribute to "2015- International Year of Soil" and "2015-2024 International Decade of Soil." Soil restoration and judicious management are also important to achieving several key Sustainable Development Goals of the U.N.

A Convention of Hope

Presentations at ISWC	Page 2
C-MASC Thanksgiving	Page 3
Visiting Scholars 2015	Page 4
Visiting Fulbright Scholar	Page 5
New Visiting Scholars	Page 6
Graduate Students	Page 7
Awards and Alumni	Page 8
2015 List of Publications	Page 10

*Best Wishes
and Happy
Holidays from
C-MASC*





Presentation at the Institute of Soil and Water Conservation

Yangling, China
14 October 2015

Prof. Lal presented a lecture "Evolution of Conservation Agriculture in China" at the Institute of Soil and Water Conservation (CAS & MWR) on 14th October 2015 in Yangling, Shaanxi. The ISWC was established in 1956, and has been operating under the auspices of the Chinese Academy of Sciences (CAS) and Ministry of Water (MWR) since 1987. The ISWC became a part of the National Knowledge Innovation Project of CAS in 1998, and ISWC participated in establishing the Northwest A&F University in 1999. The ISWC is mainly focused on soil and water conservation, and erosion control and restoration in the Loess Plateau.

C-MASC has hosted two Visiting Scholars from the Northwest A&F University:



Yanru Liang
Visiting Scholar from:
October 2011 - October 2013



Mengyun Liu
Visiting Scholar from:
January 2009- December 2009



October 2015, Nanchang Institute of Technology, Nanchang, China
2015年10月 中国南昌 南昌工程学院

The Youth Forum on Soil & Water Conservation was organized by the World Association of Soil and Water Conservation. Students from China and overseas were invited to participate in this educational forum. The title of Prof. Lal's presentation was "Soil Science in the 21st Century".



2015 C-MASC

Photographed above (left to right): Eduane Padua, Chris Eidson, Sajid Hussain, Laura Hughes, Reed Johnson, Ellen Maas, Nall Moonilall, Raj Shrestha, Pat Bell, Audrey Konda, Klaus Lorenz, Basant Rimal, Eric Stein, Xin Zhao, Xiangbin Kong, David Ussirii, Richard Liu, Rattan Lal

Visiting Scholars at C-MASC in 2015

1.	Xiangbin Kong	China Agricultural University	China	2014-2016
2.	Antonio Pereira Filho	State University of Campinas	Brazil	2014-2015
3.	Surrender Singh Yadev	Maharshi Dayaband University	India	2015
4.	Arun Joyti Nath	Assam Univeristy	India	2015
5.	Clever Briedis	Ponta Grossa State University	Brazil	2014-2015
6.	Tangyuan Ning	Shandong Agricultural University	China	2014-2015
7.	Meiling Zhang	Gansu Agricultural University	China	2014-2015
8.	Joao Carlos Sa	Ponta Grossa State University	Brazil	2015
9.	Ahmed Nawaz	University of Agriculture, Faisalabad	Pakistan	2015
10.	Maria Munoz Garcia	Technical University of Cartagena	Spain	2015
11.	Eduane Padua	Federal University of Lavras	Brazil	2015-2016
12.	Daniela Schatzel	University of Koblenz-Landau	Germany	2015
13.	Huying Zhang	Hechi University	China	2014-2015
14.	Simi Mehta	Jawaharlal Nehru University	India	2015-2016
15.	Audrey Konda	São Paulo State University	Brazil	2015
16.	Xin Zhao	China Agricultural University	China	2015-2016
17.	Sajid Hussain	University of Agriculture, Faisalabad	Pakistan	2015-2016

Visiting Fulbright Scholar

Simi Mehta

Fulbright Nehru Doctoral Research Fellow
Jawaharlal Nehru University

Simi Mehta is a Fulbright Nehru Doctoral Research Fellow from Jawaharlal Nehru University, New Delhi, India. She is working on the bilateral cooperation between United States and India in the field of agriculture and their partnership from Green to Evergreen Revolution. With an emphasis on global food security, her study focuses on strengthening agricultural livelihoods and improving nutrition outcomes for all people. Her research interests include Foreign Policy of US and India, Political Economy of South Asia, United Nations and World Trade Organization. She has written newspaper editorials and blogs on Indian politics and PM Narendra Modi's visit to the US. Very recently she was invited by the Martin Institute and the Sustainability Center of University of Idaho to speak on Globalization and Food Security and Water, i.e.

Life at the Oxfam America Hunger Banquet. In November and December 2015, she was a part of the Fulbright Enrichment Seminars at Moscow and McCall (Idaho) and at Austin (Texas) where she was the Vice-Presidential candidate of the simulation on "Democracy in Action- US Politics and Elections". As part of her research she met with Senator Richard Lugar (State of Illinois) and Senator Sherrod Brown (State of Ohio) in Washington, DC.



Simi has written articles for several news sites during her time at Ohio State:

- "[Modi's Visit to US, Commitment to Strengthen US-India Relation](#)" The Capital Post, 24 September 2015
- "[Hon'le Prime Minister, Your Silence Is Killing This Nation](#)" Huffington Post, 14 October 2015



Far left: Simi is photographed with nominees of the US Elections: Democracy in Action

Left: Simi speaking at the Oxfam America Hunger Banquet



New Visiting Scholars

Sajid Hussain

Ph.D Student
University Agriculture, Faisalabad, Pakistan

I am a PHD final Semester student of Agronomy from the University of Agriculture, Faisalabad, Punjab, Pakistan. After being selected to receive support from the International Research Support Initiative Program (IRSIP) funded by the Higher Education Commission (HEC) of Pakistan.

My PHD Thesis Title is "Mitigation of drought stress in maize hybrid through different nutrient management strategies". My other Research interests are on soil fertility and plant nutrition.

Doing Hard Work and Increase the performance is my ambition/slogan. I am confident upon my skills, educational background and ambition which would allow me to blend with the organizational culture, and propel the team to new height of success.



Graduate Students

Eric Stein

MENR Graduate Student

Eric Stein spent Autumn semester at Sokoine University of Agriculture in Morogoro, Tanzania.

My main objective during my three month stay in Tanzania was to compare the carbon (C) pool in soils under two types of farming ecosystems: agro-forest and volcanic fluvial plains in the Kilimanjaro region of Tanzania. Within the agroforest farming ecosystem I analyzed and measured the C stock of the following four zones: old Kihamba, young Kihamba, grass fallow and short range maize. Within the volcanic fluvial plain ecosystem I analyzed the C content of the cropland zone. I collected soil samples from a depth of 0-10, 10-20, and 20-40 cm in each zone of each of the two kinds of farming ecosystems. In addition to taking soil samples I also documented the estimated age, the composition and the natural features of the landscape. I also assessed the types of tree species and the topography of each sampling area of the farming ecosystems. After analyzing the data in the lab I will relate different land uses to the rate of carbon sequestration. This will help me generate recommendations on the land management appropriate for carbon sequestration in farming ecosystems of the Kilimanjaro (... continued on page 7)



Eric (lower, left) and crew is photographed on a field site in Tanzania.



Graduate Students (continued)

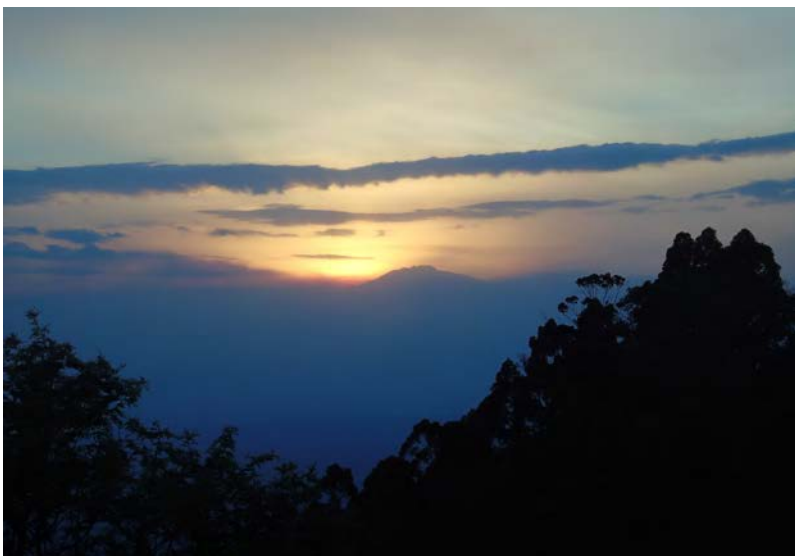


Graduate student, Nall Moonilall's photograph "Mango Mania" received 1st place in the 2nd Annual Photo Contest for the Annual Meeting of ASA-CSSA-SSSA.

The theme that this photograph placed in was "Agronomy Feeds The World, and this was published in Crops, Soils and Agronomy News (December 2015), which can be found [HERE](#).

Chris Eidson (left), a Ph.D student, discussed his research on "Soil quality as affected by rye under no-till corn-soybean rotation" with Bill Hohenstein (center; Director of the USDA Climate Change Program Office) and Dr. Richard Moore (right) at the CS-CAP Next Generation Scientist Workshop in Washington, DC in October 2015.

A link to his this presentation, which also won him an award at the CS-CAP Annual Conference in July 2015, can be found [HERE](#)



Photographed above is a scene of Mount Meru during sunset.

(From page 6)

region. I also enjoyed hiking in the highlands of the Uluguru mountains and observing rural village life and different agricultural systems.

My experience abroad in Tanzania during the Autumn 2015 semester was an unforgettable and valuable experience on a professional, academic, cultural, ecological, social and personal level. In addition to gaining new knowledge I have also established new connections to professors, professional staff and friends. I plan to return to Tanzania in the near future.

- Eric Stein



Awards and Alumni



Dr. Kalikinkar Bandyopadhyay, Principal Scientist, Division of Agricultural Physics has been awarded with 12th International Congress Commemoration Award of the Indian Society of Soil Science for significant contribution in **“improving water use efficiency of different crops and cropping systems in different soils and agroclimatic regions of India”**. The award was conferred on him by Sh. Ananth Kumar, Hon’ble Union Minister for Chemicals and Fertilizers during 80th Annual Convention of the Indian Society of Soil Science at Bangalore, India. Dr. Bandyopadhyay has also been elected as Fellow of National Academy of Agricultural Sciences for the year 2016 under Natural Resource Management section, as well as as the Asst. Secretary, Indian Society of Soil Science for the years 2016 and 2017.



Congratulations to Dr. O.P. Aishwath (right), who won the election for Councilor of Indian Society of Soil Science with the highest voting majority last year. Dr. Aishwath was a visiting Scholar at C-MASC in 2010.



Former Visiting Scholar, Arun Joyti Nath, was awarded for the best oral presentation in the Soil Science Seminar on “Issues, Challenges and Strategies in Sustaining Soil Health” held in Kerala Forest Research Institute, Kerala. The award is presented by Dr. Mike Stocking.



Awards and Alumni

Dr. Veerasamy Sejian

CMASC Visiting Scientist is currently at The University of Queensland, Australia

Dr.V.Sejian was a visiting scientist at cMASC. Currently he is at The University of Queensland, Australia under prestigious Endeavour Research Fellowship by the Australian Government. Dr.Sejian is working there on “Modeling of GHG in dairy farms” and “Impact of heat stress on metabolic profile in feedlot cattle”. With his unstinted hard work, Dr.Sejian is all set to bring out his third **International Springer book** on “**Sheep Production Adapting to Climate Change**”. Dr.Sejian is associating with Dr.Raghavendra



Bhatta, Dr.P.K.Malik and Dr.S.M.K.Naqvi from India and his mentors from both Australia and United States Dr.John Gaughan and Dr.Rattan Lal respectively in this all important volume. The book contains 21 chapters covered under four sections. The editorial board is planning to associate many reputed researchers as contributors for this all important volume and expected to complete the volume by the end of 2016. Dr.Lal and C-MASC congratulates Dr.Sejian for his dedication and commitments to excellence and lauded his efforts to be outstanding and highly commendable.

Congratulations to C-MASC Alumni who defended their Ph.D Theses:



Ahmed Nawaz
University of Agriculture
Faisalabad, Pakistan



Clever Briedis
Universidade Estadual de Ponta Grossa
Ponta Grossa , PR Brazil



2015 C-MASC Publications

Books Edited

1. Lal, R., B.R. Singh, D.L. Mwaseba, D. Kraybill, D.O. Hansen, L.O. Eik (Eds). 2015. Sustainable Intensification to Advance Food Security and Enhance Climate Resilience in Africa. Springer, Dordrecht, Holland, 665 pp.
2. Lal, R. and B.A. Stewart. 2015. Soil-Specific Farming: Precision Agriculture, Taylor and Francis, Boca Raton, FL, 431 pp.

Referred Journal Articles

3. Antille, D.L., W.C.T. Chamen, J.N. Tullberg, R. Lal. 2015. The Potential of controlled traffic farming to mitigate greenhouse gas emissions and enhance carbon sequestration in arable land: a critical review. *Am. Soc. Ag. Biol. Engin.* **58(3):707-731**.
4. Bandyopadhyay, K.K. and R. Lal. 2015. Effect of land use management practices on distribution of C and N pools in water stable aggregates. *J. Indian Soc. Soil. Sci.* **63(1):53-63**
5. Beniston JW, Shipitalo M, Lal R, Dayton EA, Hopkins DW, Jones FS, Joynes A, Dungait JAJ.(2015) Carbon and macronutrient loss during accelerated erosion from different tillage and residue management systems. *European Journal of Soil Science* **66: 218-225** DOI: 10.1111/ejss.12205.
6. Beniston, J., Lal, R., Mercer, K. 2015. Assessing and managing soil quality for urban agriculture in a degraded vacant lot soil. *Land Degradation & Development*. DOI: [10.1002/ldr.2342](https://doi.org/10.1002/ldr.2342)
7. Bordonal, R., R. Lal. 2015 Greenhouse gas balance from cultivation and direct land use change of recently established sugarcane (*Saccharum officinarum*)plantation in south-central Brazil. *Renewable and Sustainable Energy Reviews*. **52: 547-556**
8. Brar, B.S., G.S. Dheri, R. Lal, K. Singh, S. Walia.2015. Cropping system impacts on carbon fractions and accretion in typic ustochrept soil of Punjab, India. *Journal of Crop Improvement*, ID101625. **29(3): 281-300**.
9. Chacón, P., K. Lorenz, R. Lal, F.G. Calhoun, N.R. Fausey. 2015. Association of soil organic carbon with physically separated soil fractions in different land uses of Costa Rica. *Acta Agriculturae Scandinavica, Section B — Soil & Plant Science* **65: 448-459**.
10. Gautam, S., E.G. Mbonimpa, S. Kumar, J.V. Bonta, R. Lal. 2015. Agricultural policy environmental eXtender model simulation of climate change impacts on runoff from a small no-till watershed. *Journal of Soil and Water Conservation* **70: 101-109**.
11. Gelaw AM, Lal R, Singh B R. 2015. Carbon Footprint and Sustainability of Smallholder Agricultural Production Systems in Ethiopia. *Journal of Crop Improvement* **28(5): 700-714**
12. Gelaw AM, Singh B R, Lal R. 2015. Soil quality indices for evaluation of smallholder Agricultural land uses in Northern Ethiopia. *Sustainability* **7:2322-2337**.
13. Gour, S.P., S.K. Singh, R. Lal, R.P. Singh, J.S. Bohra, J.P. Srivastava, S.P. Singh, M. Kumar, O. Kumar, A.M. Latore. 2015. Effect of organic sources of plant nutrients on growth and yield of rice (*oryza sativa*) and soil fertility. *Indian Journal of Agronomy* **60(2):328-331**.
14. Hartemink, A.E., R. Lal, , M.H. Gerzabek, B. Jama, A.B. McBratney, J. Six , C. Gustavo Tornquist. 2015. Soil carbon research and global environmental challenges. *PeerJ PrePrints*. <http://dx.doi.org/10.7287/peerj.preprints.366v1>
15. Hassan, Asma, R. Lal. 2015. Active soil organic carbon fractions and aggregate stability as influenced by minimum tillage and crop rotations on a marginal dryland soil in Punjab, Pakistan. *International Journal of Plant & Soil Science* **4(4):326-337**
16. Hassan, Asma, R. Lal. 2015. Depth distribution of soil organic carbon fractions in relation to tillage and cropping sequences in some drylands of Punjab, Pakistan. *Land Degradation and Development* DOI: [10.1002/ldr.2345](https://doi.org/10.1002/ldr.2345)
17. Hassan, Asma, R. Lal. 2015. Tillage effect on partial budget analysis of cropping intensification under dryland farming in Punjab, Pakistan. *Archives of Agronomy and Soil Science*. **62(2):151-162**.
18. Khanal, S., Anex, R.P., Anderson, C.J., Herzmann, D.E. 2015. Streamflow Impacts of Biofuel Policy-Driven Landscape Change. *PLoS One* DOI: 10.1371/journal.pone.0109129 **9(10)**
19. Kladivko, F., M. Helmers, L.J. Abendroth, D. Herzman, R. Lal, M. Castellano et al. 2015. Standardized research protocols enable trans-disciplinary research of climate variation impacts in corn production systems. *J. Soil Water Conserv.* **69(6): 532-542**.
20. Kumar, S., T. Nakajima, E.G. Mbonimpa, S. Gautam, U. R. Somireddy, A. Kadono, R. Lal, R. Chintala, R. Rafique, and N. Fausey. 2015. Long-term Tillage and Drainage Influences on Soil Organic Carbon Dynamics, Aggregate Stability, and Corn Yield. *Soil Science and Plant Nutrition*. **60: 108-118**.
21. Lal, R. 2015. A System Approach to Conservation Agriculture. *Journal of Soil and Water Conservation* **70(4):82A-88A**
22. Lal, R. 2015. Cover cropping and the “4 per thousand proposal” *J. Soil Water Conserv.* **70:141A**
23. Lal, R. 2015. Managing soil carbon through sustainable intensification of agro-ecosystem. *Tropical Agriculture Association*, Spring 2015, 24:13-18.
24. Lal, R. 2015. Research and Development Priorities in Water Security. *Agronomy Journal* **107(4):1567-1572**



2015 C-MASC Publications (Continued)

25. Lal, R. 2015. World Water Resources and Achieving Water Security. [Agronomy Journal 107\(4\):1526-1532](#)
26. Lal, R. 2015. Restoring Soil Quality to Mitigate Soil Degradation. [Sustainability 7\(5\): 5875-5895.](#)
27. Lal, R. 2015. Sequestering carbon and increasing productivity by conservation agriculture. [J. Soil Water Conserv. 70\(3\): 55A-62A](#)
28. Lal, R. 2015. Soil carbon sequestration and aggregation by cover cropping. [J. Soil Water Conserv. 70:329-339.](#)
29. Lal, R. 2015. Soil Carbon Sequestration in Agro Ecosystems of India. [J. Indian Soil Sci. Soc. 63\(2\):125-143.](#)
30. Lal, R. 2015. The soil-peace nexus: our common future. [Soil Science and Plant Nutrition 61:566-578.](#)
31. Lal, R., W. Negassa, K. Lorenz. 2015. Carbon Sequestration in Soil. [Current Opinion in Environmental Sustainability. 15: 79-86.](#)
32. Li, N., T. Ning, Z. Cui, S. Tian, Z. Li, R. Lal. 2015. N₂O emissions and yield in maize field fertilized with polymer-coated urea under subsoiling or rotary tillage. [Nutr. Cycl. Agroecosyst. DOI 10.1007/s10705-015-9713-6](#)
33. Liao, Y., W.L. Wu, F.Q. Meng and R. Lal. 2015. Increase in soil organic carbon by agricultural intensification in northern China. [Biogeoscience 12:1403-1413.](#)
34. Liu, Richard and R. Lal. 2015. Effects of Low Level Aqueous Hydrogen Sulfide and Other Sulfur Species on Lettuce (*Lactuca sativa*) Seed Germination. [Communications in Soil Science and Plant Analysis. 46\(5\): 576-587.](#)
35. Mandal, S., R. Somnath, A. Das, G.I. Ramkrushna, R. Lal, B.C. Verma, A. Kumar, R.K. Singh, J. Layek. 2015. Energy efficiency and economics of rice cultivation systems under sub-tropical Eastern Himalaya. [Energy for Sustainable Development 28:115-121](#)
36. Mengistu, D., R. Lal. 2015. Conservation effects on soil quality and climate change adaptability of Ethiopian watersheds. [Land Degradation and Development, DOI: 10.1002/ldr.2376](#)
37. Mukherjee, A., R. Lal. 2015. Tillage effects on quality of organic and mineral soils under on-farm conditions in Ohio. [Environmental Earth Sciences, doi: 10.1007/s12665-015-4189-x](#)
38. Nakajima, T. and R. Lal. 2015. Comparison of greenhouse gas emissions monitored with a photoacoustic infrared spectroscopy multi-gas monitor and a gas chromatograph from a Crosby silt loam. [Carbon Management: 1-8.](#) doi: 10.1080/17583004.2015.1080473.
39. Nath, A. R. Lal, A.K. Das. 2015. Grains for ecosystem management in North East India. [Current Science 109\(8\):1387-1389.](#)
40. Nath, A.J., R. Lal, A.K. Das. 2015. Ethnopedology and soil properties in bamboo (*Bambus* sp.) based agroforestry system in North East India. [Catena 135:92-99](#)
41. Nath, A.J., R. Lal, A.K. Das. 2015. Ethnopedology and soil quality of bamboo (*Bambusa* sp.) based agroforestry system. [Science of the Total Environment 521:372-379.](#)
42. Nath, A.J., R. Lal, A.K. Das. 2015. Managing woody bamboos for carbon farming and carbon trading. [Global Ecology and Conservation 3:654-663.](#)
43. Nath, S., A. Nath, R. Lal, A.K. Das. 2015. Ecosystem-based Adaptation to Climate Change: Experience from Smallholder Floodplain Forest Management. [Advances in Forestry Letters 4:6-12.](#)
44. Obade, V. and R.Lal. 2015. Toward a standard technique for soil quality assessment. [Geoderma 265:96-102.](#)
45. Ortas, I. and R. Lal. 2015. Long-Term Fertilization Effect on Agronomic Yield and Soil Organic Carbon Under Semi-Arid Mediterranean Region. [Am. J. Expl. Agric. 4\(9\):1086-1102](#)
46. Velmurugan, A., T.P. Swarnam, R. Lal. 2015. Effect of land shaping on soil properties and crop yield in tsunami inundated coastal soils of Southern Andaman Island. [Agriculture, Ecosystems and Environment 206:1-9.](#)
47. Vilmundardóttir, O.K., Gísladóttir, G., Lal, R. 2015. Soil carbon accretion along an age chronosequence formed by the retreat of the Skafafellsjökull glacier, SE-Iceland. [Geomorphology 228:124-133](#)
48. Vilmundardóttir, O.K., R. Lal. 2015. Between ice and ocean; soil development along an age chronosequence formed by the retreating Breiðamerkurjökull glacier, SE-Iceland. [Geoderma 259-260:310-320](#)
49. Xue, J., C. Pu, S. Liu, Z. Chen, F. Chen, X. Xiao, R. Lal, H. Zhang. 2015. Effects of tillage systems on soil organic carbon and total nitrogen in a double paddy cropping system in Southern China. [Soil & Tillage Research 153:161-168.](#)
50. Zhang, H., X. Zhao, X. Yin, S. Liu, J. Xue, C. Pu, R. Lal, F. Chen. 2015. Challenges and adaptations of farming to climate change in the North China Plain. [Climatic Change 129:213-224.](#)

Chapters in Multi-Authored Books

51. Bhattacharyya, R., S.S. Kukal, S. Kundu, J.K. Saha, M. Shrivastava, R. Lal. 2015. Management of urban soils. In H. Pathak, S.K. Sanyal, P.N., Takkar (Eds) "State of Indian Agriculture: Soil" National Academy of Agricultural Sciences, New Delhi, 215-233.
52. Das, A, G.I. Ramkrushna, B. Makdoh, D. Sarkar, J. Layek, S. Mandal, R. Lal. Managing Soils of the Lower Himalayas. [Encyclopedia of Soil Science, Third Edition DOI: 10.1081/E-ESS3-120053284](#)



2015 C-MASC Publications (Continued)

53. Demessie , A, Singh, BR, Lal, R. 2015. Land Degradation and Soil Carbon Pool in Different Land Uses and Their Implication for Food Security in Southern Ethiopia. In Lal, R. et al. (Eds) Sustainable Intensification To Advance Food Security And Enhance Climate Resilience In Africa. Springer, Dordrecht, Holland: 45-62.
54. Gelaw AM, Singh B R, Lal R.2015. Land use Impacts on Soil Organic Carbon and Total Nitrogen Storage in a typical dry land district in Tigray, Northern Ethiopia. In: R. Lal, B.R. Singh, D.L. Mwaseba, D. Kraybill, D. Hansen, L.O. Eik (Eds.) Sustainable Intensification to Advance Food Security and Enhance Climate Resilience in Africa. Springer, Dordrecht, Holland, 63-74.
55. Lal, R, Singh, BR, Mwaseba, DL, Karybill, D, Hansen, D, Eik, LO. 2015. Forgotten Facts: Research and Development Priorities. In Lal, R. et al. Sustainable Intensification To Advance Food Security And Enhance Climate Resilience In Africa. Springer , Dordrecht, Holland, 603-616.
56. Lal, R. 2015. Assessment and Management of Soil Carbon Sequestration. In R.K. Rattan et al. (Eds) Soil Science: An Interdisciplinary Indian Soc. Soil Sci., New elhi, India, pp.405-424.
57. Lal, R. 2015. Biochar and soil carbon sequestration. In M. Guo, Z. He, M. Uchimiya (Eds) Agricultural and Environmental Applications of Biochar: Advances and Barriers. SSSA Special Publications 63, Madison, WI, pp. 1-23.
58. Lal, R. 2015. Tenets of soil and landscape restoration. In I. Chabay, M. Frick, J. Helgesen "Landscape Restoration: Reclaiming Landscapes for Sustainable Future. Elsevier, Waltham, MA, pp.79-96
59. Lal, R. 2015. Climate change and agriculture. In T.M. Letcher (Ed) "Climate Change", 2nd Edition. Elsevier, New York, ISBN: 978-0-444-63524-2.
60. Lal, R. 2015. Climate: The give and take of air and earth. In C. Chemnitz and J. Weigelt (Eds) "The Soil Atlas 2015". Heinrich Boll Foundation, Berlin, IASS, Postdam Germany, pp. 28-29
61. Lal, R. 2015. Interactions between agroecosystems and climatic variables. In: Seastedt, TR and Suding KN (Eds.) "Climate Vulnerability: Understanding and addressing threats to essential resources. Volume 4. Vulnerability of Ecosystems to Climate". Elsevier Press, NY 109-116
62. Lal, R. 2015. International year of soil and the sustainable developemnt goals of the United Nation. Proceedings from National Seminar on Sustaining Hill Agriculture in Changing Climate, 5-7 December 2015, Pragna Bhawan, Agartala, Tripura pp. 6-10.
63. Lal, R. 2015. Preface. In T.J. Goreau, R.W. Larson, J. Campe (Eds.) "Geotherapy: Innovative Methods of Soil Fertility Restoration. Carbon Sequestration, and Reversing CO₂ Increase" pp. xv-xvi
64. Lal, R. 2015. Soil and Society. In V. Siva et al. "Vision of the Living Soil", Shumei International, New York
65. Lal, R. 2015. Soil Carbon. In S. Nortcliff (Ed) "Task Force: Soil Matters" Catena Verlag, 64-69.
66. Lal, R. 2015. Soil Erosion. In S. Nortcliff (Ed) "Task Force: Soil Matters" Catena Verlag, 39-48.
67. Lal, R. 2015. Sustainable Intensification for Adaptation and Mitigation of Climate Change and Advancement of Food Security in Africa. In Lal, R. et al. Sustainable Intensification To Advance Food Security And Enhance Climate Resilience In Africa. Springer, Dordrecht, Holland, 3-20.
68. Lal, R. 2015. The nexus approach to managing water,soil and waste under changing climate and growing demands on natural resources. In M. Kurian and R. Ardakanian (Eds) Governing the Nexus, Springer International Publishing, Switzerland, pp. 39-60.
69. Lal, R., S.M. Virmani. 2015. Soil for food and nutritional security. In H. Pathak, S.K. Sanyal, P.N., Takkar (Eds) "State of Indian Agriculture: Soil"National Academy of Agricultural Sciences, New Delhi, 1-5.
70. Mandal, B., R. Lal. 2015. Way forward and recommendation. In H. Pathak, S.K. Sanyal, P.N., Takkar (Eds) "State of Indian Agriculture: Soil"National Academy of Agricultural Sciences, New Delhi, 361-370.
71. Mengistu, D., W. Bewketm R. Lal. 2015. Soil erosion hazard under the current and potential climate chante induced loss of soil organic matter in the Upper Blue Nile (Abay) river Basin, Ethiopia. In Lal, R. et al. Sustainable Intensification To Advance Food Security And Enhance Climate Resilience In Africa. Springer, Dordrecht, Holland, 137-164
72. Sejian, V., Bhatta, R., Gaughan, J.B., Baumgard, L.H., Prasad, C.S., Lal, R. 2015. Conclusions and Researchable Priorities. In: Climate change impact on livestock: adaptation and mitigation. Sejian, V., Gaughan, J., Baumgard, L., Prasad, C.S (Eds), Springer-Verlag GmbH Publisher, New Delhi, India, pp 491-510.
73. Sejian, V., Bhatta, R., Soren, N. M., Malik, P.K., Ravindra, J.P., Prasad C.S., Lal, R. 2015. Introduction to concepts of climate change impact on livestock and its adaptation and mitigation. In: Climate change Impact on livestock: adaptation and mitigation. Sejian, V., Gaughan, J., Baumgard, L., Prasad, C.S (Eds), Springer-Verlag GmbH Publisher, New Delhi, India, pp 1-26.
74. Sejian, V., Hyder, I., Ezeji, T., Lakritz, J., Bhatta R., Ravindra, J.P., Prasad C.S., Lal, R. 2015. Global Warming: Role of Livestock. In: Climate change impact on livestock: adaptation and mitigation. Sejian, V., Gaughan, J., Baumgard, L., Prasad, C.S (Eds), Springer-Verlag GmbH Publisher, New Delhi, India, pp 141-170.



2015 C-MASC Publications (Continued)

75. Sejian, V., Samal, L., Haque, N., Bagath M., Hyder, I., Maurya, V.P, Bhatta, R., Ravindra, J.P., Prasad, C.S., Lal, R. 2015. Overview on adaptation, mitigation and amelioration strategies to improve livestock production under the changing climatic scenario. In: Climate change impact on livestock: adaptation and mitigation. Sejian, V., Gaughan, J., Baumgard, L., Prasad, C.S (Eds), Springer-Verlag GmbH Publisher, New Delhi, India, pp 359-398.
76. Srinivasarao, Ch., R. Lal, D.L.N., Rao, K.L. Sahrawat, R.K. Gupta, S.S. Balloli, K. Srinivas. 2015. Technology frontiers for soil management. In H. Pathak, S.K. Sanyal, P.N., Takkar (Eds) "State of Indian Agriculture: Soil" National Academy of Agricultural Sciences, New Delhi, 294-309.
77. Srinivasarao, C.H., R. Lal, J.V.N.S. Prasad, K.A. Gopinath, R. Singh, V.S. Jakkula, K.L. Sahrawat, B. Venkateswarlu, A.K. Sikka, S.M. Virmani. 2015. Potential and Challenges of Rainfed Farming in India. In D.L. Sparks "Advances in Agronomy." Elsevier, Volume, 133, 115-172
78. Srinivasarao, C.H., R. Lal, S. Kumar, and P.B. Thankur. 2015. Conservation agriculture and soil carbon sequestration. In M. Farooq and K.H.M. Siddique (Eds) "Conservation Agriculture." Springer International, Switzerland, 479-523.
79. Zhao, X., R. Zhang, J. Xue, C. Pu, X. Zhang, S. Liu, F. Chen., R. Lal, H. Zhang. 2015. Management-induced Changes to soil organic carbon in China. *Advances in Agronomy, Elsevier*, 134: 1-50.

Invited Keynote Presentations

80. Lal, R. 2015. Soil and Society. Alberta Soil Science Workshop, Edmonton, Canada, February 17-19, 2015.
81. Lal, R. 2015. Soil and Global Peace. 39th annual conference of the Soil Science Society of Nigeria, Owerri, Nigeria, 9-13 March 2015.
82. Lal, R. 2015. Soil Carbon Sequestration and Climate Change. VIII Costa Rican Soil Science Congress, San Jose, Cost Rica, 18-20 March 2015.
83. Lal, R. 2015. Beyond DNC-2015. Dresden Nexus Conference, Dreseden, Germany, 25-27 March 2015.
84. Lal, R. 2015. Soil Security and Carbon Sequestration. Malaysian Society of Soil Science, Soil Security for Increasing Crop Production, Kuala Lumpur, Malaysia, 7-8 April 2015
85. Lal, R. 2015. Challenges of Measuring and Managing Soil C Sink for Mitigating Climate Change. Global Soil Week 2015, Berlin, Germany, 20-23 April 2015 .
86. Lal, R. 2015. Soil as a Sink of Atmospheric CO₂ and CH₄. Global Soil Week 2015, Berlin, 20-23 April 2015
87. Lal, R. 2015. Global Issues and IUSS. U.S. National Committee for Soil Science, Washington D.C., 7-8 May, 2015.
88. Lal, R. 2015. Environmental Sustainability. International Conference on Climate Change and Multi-dimensional Sustainability in African Agriculture, Morogorro, Tanzania, 3-5 June, 2015
89. Lal, R. 2015. Synthesis. International Conference on Climate Change and Multi-dimensional Sustainability in African Agriculture, Morogorro, Tanzania, 3-5 June, 2015
90. Lal, R. 2015. Managing Landscape for Environmental Sustainability. International Conference on Climate Change and Multi-dimensional Sustainability in African Agriculture, Morogorro, Tanzania, 3-5 June, 2015
91. Lal, R. 2015. Global Issues and IUSS. International Conference on Climate Change and Multi-dimensional Sustainability in African Agriculture, Morogorro, Tanzania, 3-5 June, 2015
92. Lal, R. 2015. Achieving Emission Neutrality in Australia by Managing Terrestrial Carbon Pool and Using Nuclear Energy. National Workshop on Nuclear Energy for Australia, Cooperative Research Center for Contamination Assessment and Remediation of the Environment (CRC-CARE) National Workshop on Nuclear Energy for Australia, Adelaide, Australia, 16 June, 2015.
93. Lal, R. 2015. Carbon Sequestration in Soils: A Challenge for Food Security and Climate Action. INRA, Paris, France, 7th July 2015
94. Lal, R. 2015. Soil Quality. Annual CS-CAP Meeting, Lied Lodge, Nebraska 3-5 August 2015.
95. Lal, R. 2015. Soil Carbon Pool as an Environmental Indicator. International Conference on Environmental Indicators (ICEI), Windsor, Canada, 2-5 August 2015.
96. Lal, R. 2015. Integrated Resource Management for Efficient Food Production. International Soil Conference on "Sustainable Uses of Soil in Harmony with Food Security (ISC2015), Phetchaburi Province, Thailand, 18-21 August 2015.
97. Lal, R. 2015. Soil Science and Societal Challenges in the FACCE Remit. Thematic Annual Programming on Improving Soil Quality Workshop. FACCE-JPI Wageningen, Netherlands 24th August 2015.
98. Lal, R. 2015. Saving Oil by Managing Soil. Soil Not Oil International Conference, Richmond, California, 4-5 September 2015.
99. Lal, R. 2015. Soil and Sustainability. Annual Meeting of the Japanese Society of Soil Science, Kyoto, Japan, 9-11 September 2015
100. Lal, R. 2015. Future Priorities in Soil Science. Annual Meeting of the Japanese Society of Soil Science, Kyoto, Japan, 9-11 September 2015
101. Lal, R. 2015. Soil Restoration for Ecosystem Services. IUSS Sustain 2015 Conference, University of Kiel, Germany, 21-24 September 2015.
102. Lal, R. 2015. The Societal Value of Soil Organic Matter and Ecosystem Services. 5th International Symposium on Soil Organic Matter, Göttingen, Germany 20-24 September 2015.
103. Lal, R. 2015. Land Use Effects on Coupled Cycling of Carbon and Water in a Changing Climate. Honorary Doctorate Award Ceremony, Technical University, Dresden Germany 23rd September 2015.
104. Lal, R. 2015. Evolution of Conservation Agriculture. Institute of Soil and Water Conservation, CAS&MWR, Yangling, Xian, China, 14 October 2015.
105. Lal, R. 2015. Soil science in the 21st century. International Youth Forum on Soil and Water Conservation, Nanchang, Jianxi, China 16-18 October 2015.



2015 C-MASC Publications (Continued)

106.Lal, R. 2015. Solutions Underfoot: The Power of Soils. Austrian Academy of Science, Vienna, 2 November 2015.

107.Lal, R. 2015. Carbon Storage and Dynamics in Urban Soils. SSSA Annual Meeting, Minneapolis, MN, 16 November 2015

108.Lal, R. 2015. International Context of SOC Sequestration. FACCE-JPI Meeting. Dublin, Ireland, 16-17 November 2015.

109.Lal, R. 2015. Inter-Connectivity and Sustainability TAMUS-Resource Nexus: Water Forum. San Antonio, Texas, 17-18 November 2015.

110.Lal, R. 2015. Land Degradation. IFPRI Policy Seminar, Washington, DC, 3 December 2015

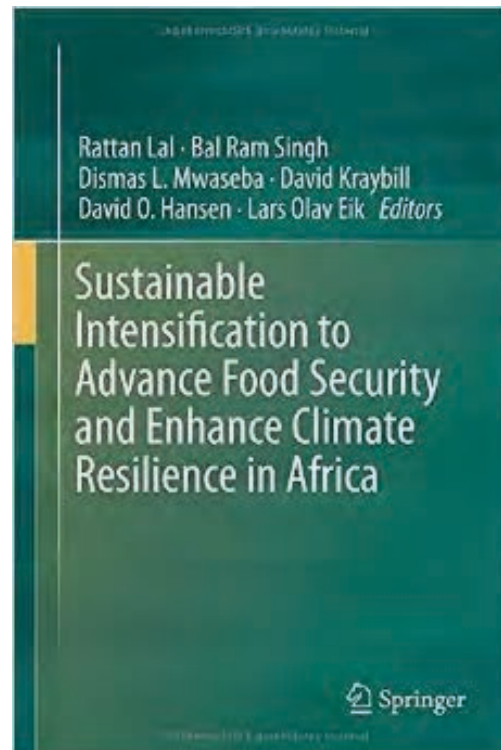
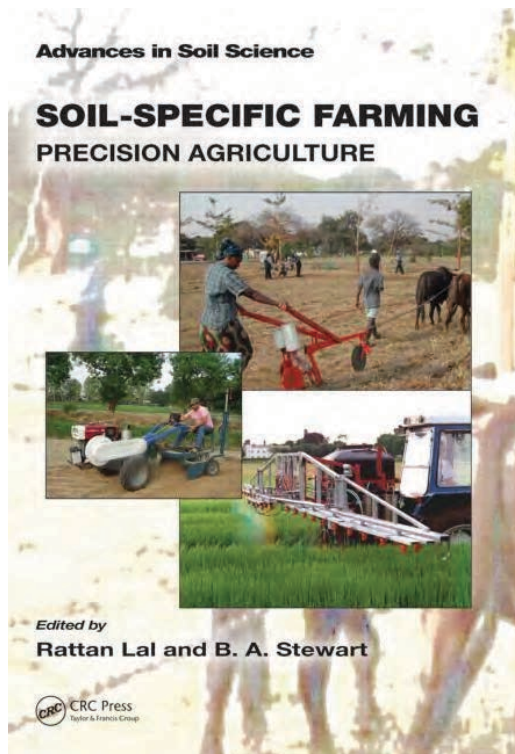
111.Lal, R. 2015. Sustainable Management of Agricultural Soils. KFRI, Peechi, Thrissur, India, 10-11 December 2015

112.Lal, R. 2015. Soil carbon sequestration and management to mitigate climate change. 1st International Conference “Afro-Mediterranean Soils: Constraints and Potentialities for Durable Management”. Marraketch, Morocco, 18-19 December 2015.

Voluntary Contributions

113.Alvarez, J.M., C. Pasian, R. Lal, R. Lopez, M. Fernandez. 2015. Biochar and vermicompost as peat replacement for ornamental-plant production. Poster

114.Stout, B., R. Lal, C. Monger. 2015. Carbon capture and sequestration (CCS): The role of agriculture in soils. ASABE 1st Climate Change Symposium: Adaptation and Mitigation. Chicago, IL, 3-5 May 2015.



Do you have contributions for our next newsletter?
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