

The significance of soils and soil science towards realization of the United Nations Sustainable Development Goals

Saskia Keesstra (1,2), Johan Bouma (3), Jakob Wallinga (4), Pablo Tittonell (5), Pete SMith (6), Artermi Cerda (7), Luca Montanarella (8), John Quinton (9), Yakov Pachepsky (10), Wim van der Putten (11), Richard BARDgett (12), Simon Moolenaar (13), Gerben Mol (14), Boris Janssen (15), and Louise Fresco (16)

(1) Wageningen University, Soil Physics and Land Management, Wageningen, Netherlands (saskia.keesstra@wur.nl), (2) Civil, Surveying and Environmental Engineering, The University of Newcastle, Callaghan 2308, Australia. , (3) Formerly Soils Department, Wageningen University, The Netherlands., (4) Soil Geography and Landscape Group, Wageningen University, The Netherlands, (5) Natural Resources and Environment Program, Instituto Nacional de Tecnología Agropecuaria (INTA), Argentina, (6) University of Aberdeen, Institute of Biological and Environmental Sciences, Aberdeen, United Kingdom, (7) Departament de Geografia. Universitat de València. Blasco Ibàñez, 28, 46010-Valencia. Spain, (8) European Commission, Joint Research Centre, Italy, (9) Lancaster University, Lancaster Environment Centre, Lancaster, United Kingdom, j.quinton@lancaster.ac.uk, (10) USDA-ARS, Environmental Microbial and Food Safety Laboratory, Beltsville Agricultural Research Center, Beltsville, MD, United States, (11) Department of Terrestrial Ecology, Netherlands Institute of Ecology NIOO-KNAW, Droevendaalsesteeg 10, Wageningen, NL- 6708, The Netherlands, (12) Faculty of Life Sciences, The University of Manchester, Oxford Road, Manchester, M13 9PT, United Kingdom, (13) Commonland, Department of Science & Education, www.commonland.com, Amsterdam, The Netherlands, (14) Alterra, Wageningen University and Research Centre, Wageningen, The Netherlands, (15) Institute for Biodiversity and Ecosystem Dynamics (IBED), University of Amsterdam, P.O. Box 94240, 1090GE The Netherlands, (16) Wageningen University and Research Centre, Wageningen, The Netherlands

In this research we discuss how soil scientists can help to reach the recently adopted UN Sustainable Development Goals in the most effective manner. Soil science, as a land-related discipline has important links to several of the SDGs which are demonstrated through the functions of soils and the ecosystem services that are linked to those functions. We explore and discuss how soil scientists can rise to the challenge both internally, in terms of our procedures and practices, and externally in terms of our relations with colleague scientists in other disciplines, diverse groups of stakeholders and the policy arena. To meet these goals we recommend the following steps to be taken by the soil science community as a whole: (i) Embrace the UN Sustainable Development Goals, as they provide a platform that allows soil science to demonstrate its relevance for realizing a sustainable society by 2030; (ii) Show the specific value of soil science: Research should explicitly show how using modern soil information can improve the results of inter- and trans-disciplinary studies on SDGs related to food security, water scarcity, climate change, biodiversity loss and health threats; (iii) Given the integrative nature of soils, soil scientists are in a unique position to take leadership in overarching systems-analyses of ecosystems; (iii) Raise awareness of soil organic matter as a key attribute of soils to illustrate its importance for soil functions and ecosystem services; (iv) Improve the transfer of knowledge through knowledge brokers with a soil background; (v) Start at the basis: educational programs are needed at all levels, starting in primary schools, and emphasizing practical, down-to-earth examples; (vi) Facilitate communication with the policy arena by framing research in terms that resonate with politicians in terms of the policy cycle or by considering drivers, pressures and responses affecting impacts of land use change; and finally (vii) All this is only possible if researchers, with soil scientists in the frontlines, look over the hedge towards other disciplines, to the world-at-large and to the policy arena, reaching over to listen first, as a basis for genuine collaboration.