

Soil Day Celebration: Nurturing the Earth beneath Our Feet

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Introduction

World Soil Day, celebrated every year on December 5, is viewed as a testament to fundamental role played by soil for sustaining life on Earth. The day was formally assigned by the Food and Agriculture Organization of the United Nations (FAO) and was celebrated in 2014 for the first time. The decision of selecting December 5 has its own significance, as it befalls on the birthday of King Bhumibol Adulyadej of Thailand, who was an admired figure acknowledged for his devotion to sustainable development, counting initiatives related to agriculture and soil conservation.

King Bhumibol Adulyadej's Legacy:

King Bhumibol Adulyadej passed away in 2016, leaving behind an estate of sustainable development actions, posing a strong emphasis on environmental conservation and agricultural practices. One of his illustrious projects was the "Sufficiency Economy Philosophy," which endorsed moderation, self-reliance, and resilience at community and individual levels. This philosophy

affixed a strong focus on sustainable agricultural practices and environmental conservation, rhyming with the broader goals of World Soil Day.

Historical Perspectives on Soil Knowledge:

The evolution of our perception about soil and its elementary role in sustaining life has deep roots in the chronicles of human history. From ancient civilizations to the modern era, numerous thinkers and scholars have volunteered significantly to the development of soil science.

HISTORICAL PERIODS	KEY CONTRIBUTORS	CONTRIBUTIONS & CONCEPTS
Ancient Civilizations	Mesopotamia, Egypt	Recognition of soil importance for agriculture in river valleys
Greek Contributions	Xenophon, Theophrastus	Acknowledgment of the link between soil quality and crop productivity; Study of plant-soil interactions
Middle Ages	Albertus Magnus, Hugh Plat	Insights into soil management practices; Agricultural perspectives
Scientific Revolution - 17th-18th C.	Johann G. Agricola	Considered "father of soil science"; Significant contributions to understanding minerals, rocks, and soil formation
19th Century	Vasily Dokuchaev, Justus von Liebig	Dokuchaev: Introduced soil horizons and classification; Liebig: Pioneered understanding of soil chemical composition and plant nutrition
20th Century	Interdisciplinary Growth	Integration of knowledge from geology, chemistry, and biology into soil science; Holistic understanding of soil-plant-environment interactions
International Collaboration	International Society of Soil Science (ISSS)	Establishment in 1924; Facilitation of global collaboration in soil science research

SOIL SCIENCE IN INDIA:

Soil science in India has a rich historical background which spans ancient agricultural practices to contemporary scientific research. The

perception of soil and its management has developed over the centuries, pounded by diverse influences, incorporating traditional knowledge, colonial agricultural policies, and modern scientific advancements. Here is an overview of the history of soil science in India:

PERIOD	KEY EVENTS & CONTRIBUTORS	SIGNIFICANT DEVELOPMENT
Ancient Period	Arthashastra and Manusmriti	Guidelines for agriculture and sustainable land use practices
Medieval Period	Krishni-Parashara	Addressed soil fertility and provided insights into agriculture
British Colonial Period	Introduction of Surveys authored by Sir Albert Howard	Surveys for revenue collection; Emphasis on organic farming
Post-Independence Era	Establishment of ICAR, Agricultural Universities	ICAR's role in advancing agricultural research; Focus on education
Recent Developments	National Bureau of Soil Survey and Land Use Planning	Soil classification, mapping, and research; Contribution to sustainability
Ongoing Challenges	Soil erosion, Nutrient management, Water management	Addressing challenges for sustainable agriculture
Future Directions	Climate change adaptation, Technological integration	Strategies for adaptation, Integration of advanced technologies

CHALLENGES IN SOIL SCIENCE:

Challenges in soil science encircles a wide range of concerns associated with soil health, sustainable land management, and global food security. These challenges are diverse, interdependent, and often require multidisciplinary approaches for productive solutions.

Some key challenges in soil science are given below:

CHALLENGE	DESCRIPTION
Soil Degradation	It's a worldwide challenge mentioning factors such as erosion, nutrient depletion, salinization, and contamination, jeopardizing agriculture and ecosystem health (Montgomery, 2007; Lal, 2015).
Loss of Arable Land	Altering arable land for urbanization contributes to the depletion of valuable soil resources, posing a threat to food security (Foley et al., 2005; Tilman et al., 2011).
Climate Change Impact	Climate change influences soil conditions impacting fertility, water availability, and distribution of soil organisms, enhancing agricultural productivity and ecosystem stability (Smith et al., 2008; IPCC, 2019).

Soil Health Monitoring	Adopting secured methods to evaluate soil health, having indicators for microbial activity, organic matter content, and nutrient levels, is a critical challenge (Doran & Parkin, 1994; Bell et al., 2015).
Urbanization and Land Use Change	Rapid urbanization leads to soil fragmentation, compaction, and contamination, triggering effective management of urban soils (Pickett et al., 2001; Scharenbroch et al., 2005).
Global Food Security	Assuring global food security is linked to maintaining healthy soils, emphasizing sustainable agricultural practices (FAO, 2019; Mueller et al., 2012).
Emerging Contaminants	The presence of contaminants in soils imposes environmental and health risks, demanding research and remediation strategies (Kümmerer, 2010; Nehra et al., 2018).
Technological Advancements	Assimilating new technologies, like remote sensing and precision agriculture, into soil science is an ongoing challenge (Sudduth et al., 2005; Schepers & Harper, 2001).
Education and Outreach	Developing awareness regarding fundamentals of soil health and sustainable practices is necessary for positive changes in land use and agriculture (Carter & Bennett, 2016; Duncan et al., 2011).
Policy and Governance	Effective policies and international collabs are curated to address soil-related issues and promote sustainable soil management practices globally (FAO, 2015; Bouma, 2009).

FRONTIER AREAS OF SOIL SCIENCE RESEARCH:

Frontier Area of Soil Science Research	Description
Soil Microbiome	Understanding diversity, structure, and function of microbial communities in the soil. Investigating their roles in nutrient cycling and plant health (Berg & Smalla, 2009; Philippot et al., 2013).
Soil Health Assessment	Developing comprehensive methods to assess and quantify soil health. Identifying key indicators for evaluating soil quality (Doran & Parkin, 1994; Bell et al., 2015).
Climate Change Impacts	Investigating the effects of climate change on soil properties. Assessing the role of soils in sequestering carbon (Smith et al., 2008; Lal, 2015).
Precision Agriculture	Applying advanced technologies to optimize soil management practices based on spatial and temporal variability (Sudduth et al., 2005; Schepers & Harper, 2001).
Soil-Plant Interactions	Studying molecular and physiological mechanisms of plant-soil interactions, including the rhizosphere and mycorrhizal associations (Hinsinger et al., 2009; Bulgarelli et al., 2013).
Emerging Contaminants	Investigating the presence and



	effects of emerging contaminants in soils. Developing remediation strategies (Kümmerer, 2010; Nehra et al., 2018).
Soil Erosion and Conservation	Studying erosion processes and developing effective conservation measures (Montgomery, 2007; Lal, 2015).
Urban Soils	Comprehending the challenges and opportunities confronted in managing soils in urban environments (Pickett et al., 2001 and Scharenbroch et al., 2005).
Data Integration and Modelling	Embodying various datasets through advanced modelling approaches to enhance predictions of soil behavior (Sudduth et al., 2005; Bouma, 2009).
Soil Informatics	Application of data science and informatics for large-scale analysis and translation of soil data, aiding data sharing in the soil science community (Donatelli et al., 2012; Minasny et al., 2017).

essential for ensuring a sustainable and resilient future for the planet.

As we delve into the festivities of Soil Day, it is an invitation to devote ourselves into the awe-inspiring world beneath our feet, appreciating the silent but potent contributions of soil to human well-being. This celebration act as a commitment to responsible stewardship, safeguarding the health and vitality of this precious resource for the benefit of present and future generations.

CONCLUSION:

World Soil Day celebration serves as a nexus consolidating a different stakeholder—scientists, policymakers, farmers, environmentalists, and the public to acknowledge soil's crucial role in sustaining life and enhancing sustainable development. The solidity of Soil Day lies in its capacity to disclose the hidden intricacies underneath the Earth's surface. From the convoluted dance of microscopic organisms structuring the soil microbiome to the symbiotic relationships between soil and plant life, the celebration reflects the often-overlooked wonders of nature. It serves as an opportunity to spread awareness regarding soil health, champion sustainable soil management practices, and tackle the multifaceted challenges confronting our soils. Addressing soil challenges necessitates a combination of technological advancements, policy implementation, education, and outreach. Embedded in historical significance, the day also elicit an exploration of innovative solutions,