Grand Challenge

Soil Science Society of America

Soils Sustain Life

Written by the Soil Science Society of America Grand Challenge Workgroup

Soil Society of America

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The Soil Science Society of America (SSSA) is a progressive, international scientific society that fosters the transfer of knowledge and practices to sustain global soils. Based in Madison, WI, and founded in 1936, SSSA is the professional home for 6,000+ members dedicated to advancing the field of soil science, providing information about soils in relation to crop production, environmental quality, ecosystem sustainability, bioremediation, waste management, recycling, and wise land use.

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Grand Challenge

Optimizing soil ecosystem services for greater food and energy security, water quality, and adaptation to and mitigation of climate change

Food and energy security, water availability and quality, and climate change adaptation and mitigation are some of the greatest challenges facing our society. Appropriate management of soils offers the potential to provide solutions for each of these challenges. The soil ecosystem provides services—carbon sequestration, nutrient cycling, water purification, waste treatment, provisioning of industrial and pharmaceutical goods, and a mitigating sink for chemical and biological agents—that enhance the resilience of managed and natural systems. Soil health, however, faces increasing human-linked threats from contamination, unplanned urban development, desertification, salinization, mismanagement and erosion. Protecting and promoting soil health will ensure food and energy security, assist in climate change adaptation and mitigation and conserve and improve water quality.

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The Soil Science Society of America, in consultation with individual members of the U.S. National Committee for Soil Science and other experts in soil science, has identified the following research priority areas and corresponding critical knowledge gaps to guide interdisciplinary soil science research for the next 20 years and beyond.

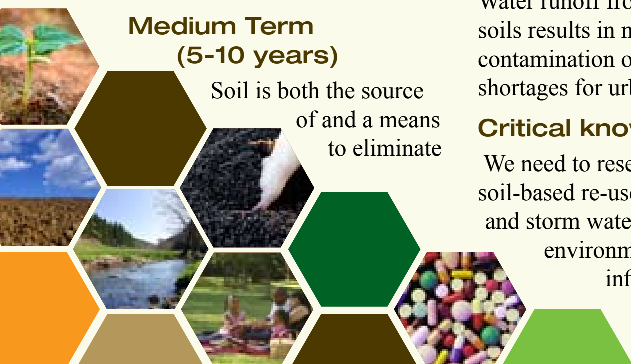
Human and Ecosystem Health

Short Term (1-5 years)

Soil microbial communities are the greatest source of biological diversity in the world, yet only a small fraction have been studied despite their proven potential as sources of medicines and health agents.

Critical knowledge gap

There is a need to harness the microbial diversity in soils for the development of new pharmaceuticals.



Medium Term (5-10 years)

Soil is both the source of and a means to eliminate disease. Exploration of the life cycle and management of soil-borne pathogens (Salmonella, E. coli) will reduce food contamination and improve human health.

Critical knowledge gap

We need to understand the soil's capacity to treat and deactivate pathogens in waste materials and contaminated waters.

Long-term (10-20 years)

Agriculture contributes nitrogen, phosphorus and pesticides to surface and groundwater.

Critical knowledge gap

There is a critical need to improve our understanding of the mechanisms controlling nutrient use efficiency to prevent impairment of watersheds as well as economic losses.

Waste Treatment and Water Quality

Short Term (1-5 years)

Water runoff from urban and rural soils results in nutrient and sediment contamination of watersheds and water shortages for urban and rural agriculture.

Critical knowledge gap

We need to research the potential for soil-based re-use of waste- industrial, and storm waters- in rural and urban environments to maximize water infiltration and storage and minimize damage to aquatic systems and reduce dependence on groundwater.

Medium Term (5-10 years)

Increasing applications of organic human and industrial waste to soils will strain soil treatment capacity.

Critical knowledge gap

We need to optimize use of these materials to maximize soil carbon sequestration and nutrient availability, while minimizing fugitive gas emissions.

Long-term (10-20 years)

Knowledge is lacking concerning long-term impacts of applications of organic human and industrial waste to soils.

Critical knowledge gap

We need to investigate the risk factors associated with soil-based treatment of land-applied human and industrial waste and identify scientific solutions to managing those risks.

Food and Energy Security

Short-term (1-5 years)

Obesity and malnutrition plague our urban population.

Critical knowledge gap

We need to develop educational tools and soil quality controls to foster the development of urban agriculture, promoting improved nutrition for urban children.

Medium-term (5-10 years)

Sustainable agricultural systems that produce food, feed, fiber, and fuel are needed to maximize nutrient uptake while minimizing environmental impacts.

Critical knowledge gap

Site-specific agronomic solutions need to be elucidated that maximize soil agroecosystem services, minimize soil disturbance, and concurrently increase soil carbon reserves and reduce the need for inputs.

Long-term (10-20 years)

Developing regions of the world lack basic agronomic tools and knowledge to sustainably produce food, feed, fiber and fuel.

Critical knowledge gap

There is a need for international education on conservation production systems to promote food security and stability for these regions.

Climate Change

Short-term (1-5 years)

Alternative manure management practices have the capacity to increase soil carbon sequestration.

Critical knowledge gap

There is a need to discover means to use manures to optimize plant yield, carbon sequestration, and soil tilth while minimizing nitrous oxide emissions

Medium-term (5-10 years)

The cryosphere is thawing due to climate change, resulting in significant emissions of greenhouse gases.

Critical knowledge gap

We need to determine the mechanisms controlling greenhouse gas emissions from organic soils, particularly tundra and permafrost soils, and identify methods to control those emissions.

Long-term (10-20 years)

U.S. agriculture contributes 6% of annual U.S. greenhouse gas emissions. Forests, cropland, and grass land have the capacity to be sinks if properly managed.

Critical knowledge gap

We need to identify biological and geochemical soil processes controlling carbon storage and emissions of greenhouse gases (CO_2, CH_4, and N_2O) from managed ecosystems in order to develop management practices to reduce emissions and increase capture.