

Preserving Our Earth's Lifeline: Exploring Soil Health for a Sustainable Future

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INTRODUCTION

By 2050, the world population is expected to have rapidly grown to 8.9 billion people, increasing the need for agricultural supplies. However, the excessive application of synthetic fertilizer and pesticides to fulfil agricultural demand has resulted in degradation of land and environmental contamination in a number of agroecosystems, which has had a detrimental impact on people, animals, and aquatic communities. This is significant because, on a human time frame, soil is a finite resource, and its loss and degradation cannot be reversed in a human lifetime. The condition of the soil on our planet has a significant impact on its overall health. We can guarantee the long-term sustainability of our ecological systems and assure an equitable existence for future generations by looking into the idea of soil health, comprehending its significance, and taking necessary rehabilitation measures.

Need for assessing soil health

Soil health has been broadly defined as the capacity of a living soil to function, within

natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and promote plant and animal health. For sustainable agricultural and environmental management, monitoring soil health is essential. It offers crucial data on soil fertility, nutrient content, microbial activity, and physical characteristics, all of which have an immediate influence on crop output and ecosystem health. Farmers and landowners may reduce the danger of erosion, avoid nutrient imbalances, and improve carbon sequestration by understanding soil health. The significance of soil health evaluation has been emphasized in scientific research, which also stress its role in enhancing agricultural practices, minimizing environmental effects, and assuring long-term food security. For a resilient and profitable future,



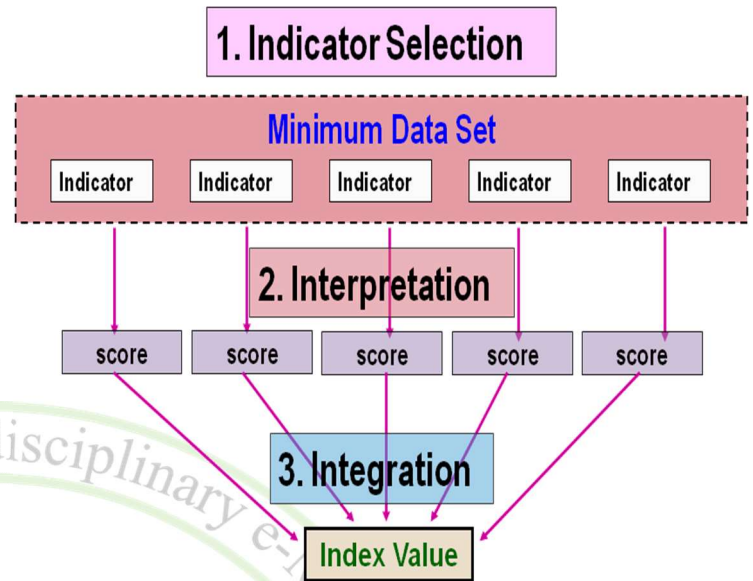
(Fig. Deterioration of soil health)

prompt and precise soil health evaluations support the implementation of sustainable

land use techniques, focused interventions, and informed decision-making.

Assessment of soil health

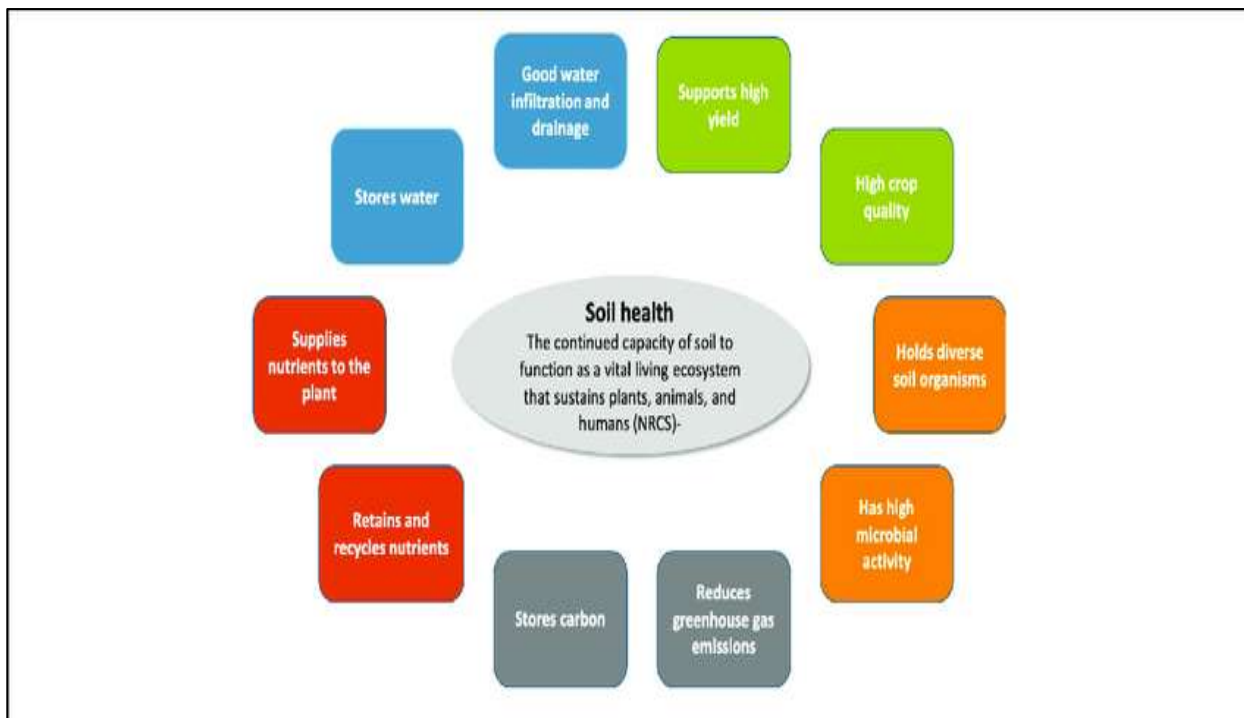
Since soil is a very sophisticated bio-matrix whose functioning is dependent on a wide variety of soil organisms, the soil architecture can change depending on the cropping system. In any event, while evaluating soil health, it's crucial to take into account its physical, chemical, and biological factors. Indicators of soil health should ideally be connected to, linked with, and/or sensitive to soil processes as well as to management and environmental changes. Indicators of soil health used to include physicochemical characteristics including texture, depth, bulk density, water-holding capacity, porosity, pH, electrical conductivity, organic matter, cation exchange capacity, and nutrient content. Due to their ecological importance, quick reaction, sensitivity, and ability to include data and responses from multiple environmental elements, soil biological characteristics, particularly microbial properties, are being employed more and more. Soil sampling, field observations and laboratory analysis are all utilized to collect data for assessments. The frameworks give a comprehensive knowledge of soil health by integrating many indicators.



(Fig. Soil health assessment framework)

Benefits of a healthy soil

Numerous advantages that come with healthy soil are essential for both ecosystem health and sustainable agriculture. In addition to encouraging biodiversity and carbon sequestration, it improves agricultural production, nitrogen cycling, and water filtering. Research has shown that good soil promotes higher yields, enhanced plant nutrient absorption, and less reliance on synthetic pesticides and fertilizers. Through carbon storage and the control of greenhouse gas emissions, it also plays a significant part to mitigate climate change. A healthy soil also has a better soil structure and water-holding capacity, which lowers the danger of erosion and increases water infiltration. These advantages underline how crucial it is to preserve and enhance soil health for effective land use.



(Fig. Benefits of healthy soil)

How to improve health of soil

1. By using techniques like cover crops, crop residue retention, and organic amendments, to increase soil organic matter content.
2. Reduce soil disruption by implementing conservation tillage techniques like no-till or reduced tillage.
3. Use of correct nutrient management strategies, such as balanced fertilization, examination of the soil, and precision farming practices.
4. Use of crop rotation and variety to disrupt pest and disease cycles, promote soil biodiversity, and improve nutrient cycling.
5. Use of cover crops to safeguard the soil's surface, stop erosion, and add more organic matter to the soil.
6. Use of appropriate irrigation techniques to prevent soil waterlogging or excessive drying
7. Effective management of crop leftovers to preserve soil cover, improve nutrient cycling, and reduce erosion.

8. Prevention of soil erosion by using terracing, contour ploughing, and other erosion

9. Use of pesticides and herbicides responsibly to reduce negative impacts on soil health and beneficial microbes.

10. Regularly tracking and evaluation of indicators of soil health through lab evaluation, field observations, and soil testing to decide management practices.

Conclusion

For the sustainability of our future and the vitality of our planet, soil health must be preserved. By appreciating the importance of soil as a resource, we may put practices in place that enhance its health and fertility. In addition to promoting agricultural production and food security, improving soil health aids biodiversity preservation, water management, and climate change mitigation. It is crucial that we continue to investigate and prioritize soil health by applying sustainable land management techniques and raising awareness of its importance on a worldwide scale. A sustainable future that balances environmental care and human



well-being can be rendered possible by protecting the soil, the lifeline of our planet.

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