Soil quality: An essential component of environmental sustainability

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ABSTRACT

Soil quality assessment and management continue to be important and integral aspects of the management of natural and managed ecosystems, particularly agroecosystems. Whereas traditional soil testing focuses on nutrient management and soil reaction, soil quality embodies the integration of soil physical, soil biological, and soil chemical properties and processes. Although many definitions of soil quality have been proposed, the definition adopted by the United States Department of Agriculture Natural Resources Conservation Service and many other organizations is, 'the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation.'

Key words: soil quality, sustainability

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INTRODUCTION

The concept of soil quality has continued to expand throughout the past few decades. Evidence of this is observed in the many activities and publications in the area of soil quality:

- Various books have been published on soil quality including: Soil Quality and Agricultural Sustainability (Lal, 1998a), Methods for Assessing Soil Quality (Jones and Doran, 1997), Defining Soil Qaulity for a Sustainable Environment (Doran et al., 1994), Soil Quality and Soil Erosion (Lal, 1998b).
- Numerous research studies have been reported in various soil-related journals.
- A Soil Science Society of America, division S-3 working group on soil quality is active and meets regularly to discuss soil quality research (Soil Quality Working Group).
- Special workshops on soil quality have been organized at major soil science conferences (Soil and Water Conservation Society 2007).
- Various websites have been established specifically on the topic of soil quality, such as www.soilquality.org (verified 20 November 2008) and soils.usda.gov/sqi (verified 20 November 2008).

Soil quality stems from both inherent soil properties (i.e., the result of natural soil forming processes) and dynamic soil properties (i.e., those that change due to human management). Inherent soil properties are not easily influenced by soil management practices, but soil quality assessments can be used to affect the decisions regarding the best use of the soil resource. Dynamic soil properties can be affected by soil management practices and soil quality assessments can guide the decisions in order to manage the soil resource wisely.

Soil quality assessment is both important and challenging. The challenge of assessing soil quality is that soil quality is not a single soil property, but an integration of many soil properties that can be objectively quantified coupled with a somewhat subjective element of a soil's best use. The soil properties measured relate to specific functions of the soil. When making soil quality assessments, one must first determine the use for that soil and then determine what measurements will best define that soil use. Once these measurements are performed, interpretations are made and management practices are designed in order to enhance the quality of the soil for that particular use. Soil quality measurements can then continue to be made in order to monitor how well the management system is affecting the soil quality.

Soil quality management is based on the soil quality assessment and is the plan put in place to enhance or maintain soil quality. Although there are many practices that can enhance soil quality, there are a few basic practices that are usually adhered to most commonly including: increase soil organic matter, reduce soil disturbance, manage nutrients, keep the soil covered, and increase plant diversity. Soil organic matter is a key component of soil quality due to its many influences on soil biological dynamics, soil physical stability, and soil chemical

reactions. By reducing soil disturbance, soil structure is maintained and can enhance water infiltration and aeration. Proper management of nutrients allows for enhanced plant growth, which in turn increases biomass and organic matter. Keeping the soil covered is a very effective way to reduce erosion. Plant diversity creates a better habitat for the animals and plants sharing the ecosystem. By taking a holistic approach, soil quality management aims to maintain the soil system, not just one particular soil property. Soil quality management is essential for a sustainable agricultural system.

This special issue on soil quality for a sustainable environment contains both review articles that provide some history and conceptual ideas relating to soil quality as well as research articles that present assessments of soil management effects on soil quality. As the global demand for food, fiber, feed, and fuel production increases and as that demand must be fulfilled on less land, it is essential that a focus is placed on the impact management strategies have on the quality of the soil resource. Management based on soil quality is essential in order to have sustainable and secure agricultural enterprises and healthy natural ecosystems for decades to come.

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