

Understanding and enhancing soil biological health: The solution for reversing soil degradation

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One of the most unexplored frontiers associated with understanding the dynamics of soil resources and their subsequent health or quality is that of soil biology. We suggest this reflects the challenges associated with understanding biological properties and processes when compared to soil physical and chemical manipulations that can be used to influence soil quality/health. As a result, multiple post-World War II developments leading to agriculture as we know it today placed a greater emphasis on physical and chemical manipulation than on soil biology. These developments included: (i) increased availability and use of synthetic fertilizers, herbicides, and pesticides; (ii) an improved understanding of plant nutrition and an infrastructure for delivering fertilizers to farmers; (iii) improved tillage, planting, harvesting equipment; (iv) cost-effective subsurface drainage; (v) increased efficiencies for both animal and crop production systems; and (vi) development of global markets. Unfortunately, soil biological responses to these developments were often overlooked or not recognized, so the rapid changes also resulted in unintended consequences, especially with regard to soil health and long-term agricultural sustainability.

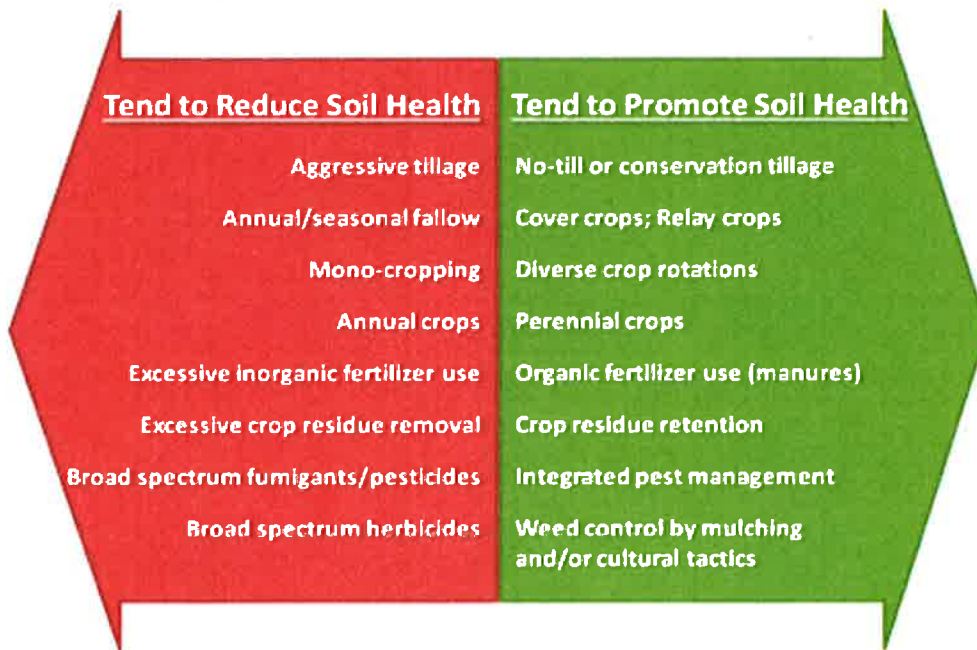


Figure 1. Generalized Effects of Agricultural Management Practices on Soil Health compiled from several sources. See more at: <http://www.mdpi.com/2071-1050/7/1/988/htm#sthash.8lu785V8.dpuf>

Our objective is to provide an optimistic strategy for reversing soil degradation by increasing public and private research efforts to understand the role of soil biology, particularly microbiology, on the health of our world's soils.

We begin by defining soil quality/soil health (which we consider to be interchangeable terms), characterizing healthy soil resources, and relating the significance of soil health to agroecosystems and their functions. We examine how soil biology influences soil health and how biological properties and processes contribute to sustainability of agriculture and ecosystem services.