

## Soil Health

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A topic of rising concern in the agricultural industry is soil health—an issue that affects every sector of farming, from crop cultivation to livestock grazing. Agriculture, at its core, is inextricably tied to the land. Over the past several decades, farmers have faced increasing pressure to produce more food with fewer resources. This demand for efficiency has driven intensive use of agricultural land, often at the expense of long-term soil health.

Soil health, as defined by the USDA Natural Resources Conservation Service (NRCS), is "the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans." This definition underscores the importance of soil as more than just dirt—it is a dynamic, living system essential to food production and ecological balance.

Healthy soils are foundational to productive agriculture. They help regulate water, cycle nutrients, support plant growth, and resist erosion. Indicators of soil health include organic matter content, microbial diversity, aggregate stability (soil structure), infiltration rates, and nutrient cycling efficiency. When these indicators decline, the soil's ability to support sustainable production diminishes, putting both short-term yields and long-term food security at risk.

In response to growing concerns, extensive research is being conducted across the United States to reverse the decline in soil quality. Much of this research has centered on the Midwest, known for its high agricultural output but also for signs of soil degradation caused by years of conventional tillage, monocropping, and over-reliance on synthetic inputs.

Several conservation practices have shown promise in restoring soil health in the Midwest. These include no-till farming, which minimizes soil disturbance and helps preserve structure and organic matter; cover cropping, which protects soil between cash crops and adds biomass; and crop rotation with diverse plant species, which enhances microbial activity and nutrient balance. According to a 2023 USDA report, farms that implemented these practices saw a measurable increase in soil organic carbon and improved water infiltration rates within three to five years.

However, the Western U.S., particularly the arid and semi-arid regions, presents a different set of challenges. Low precipitation levels make it more difficult to implement some soil health practices, particularly those involving cover crops, which typically require reliable moisture. As a result, researchers are beginning to investigate regionally adapted strategies. Current studies at land-grant universities such as Colorado State University, Utah State University, and the University of Arizona are exploring drought-tolerant cover crops, dryland no-till systems, and biochar amendments as potential solutions.

One emerging area of interest is integrating livestock grazing with cover crops in a managed system—a practice known as "regenerative grazing." Early trials in western states suggest that this method could enhance soil biology while providing additional forage, creating a win-win for both crop and livestock producers.

The future of our food system depends on the health of our soils. Without sustained investment in soil stewardship, the land's capacity to feed a growing global population will be compromised. This is why farmers—often the first to witness the effects of soil degradation—are critical allies in this mission. Their on-the-ground knowledge, combined with evidence-based practices, holds the key to restoring and preserving soil health for future generations.

As the old saying goes, “No farms, no food.” But more accurately, no healthy soil—no sustainable farms. The path forward is not just about innovation; it's about recognizing the land as a living system and giving it the care it deserves.