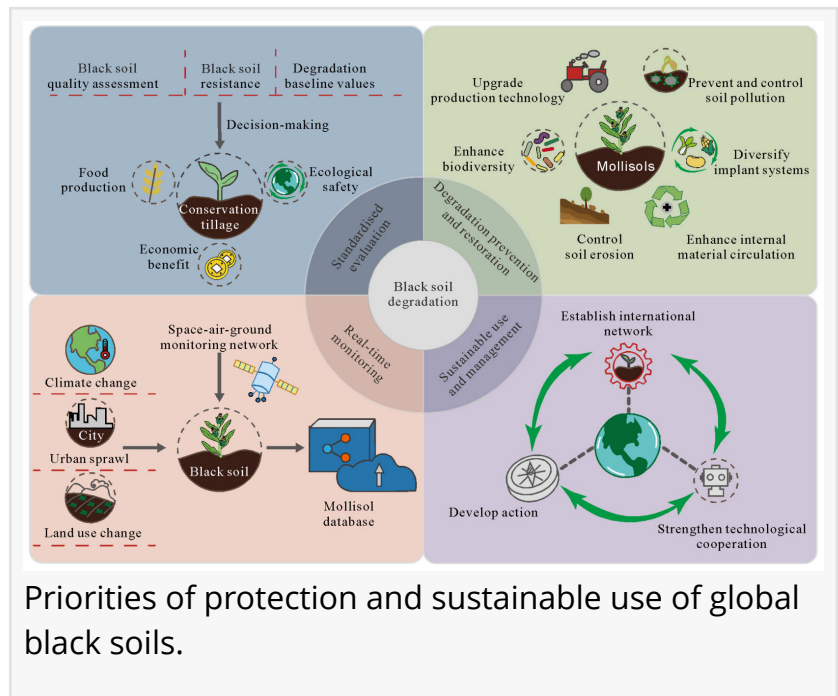


Erosion, exhaustion, and erosion: black soils face a tipping point

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/EINPresswire.com/ -- Black [soils](#),

revered as the world's agricultural powerhouses, are rapidly deteriorating under mounting environmental and human pressures. Despite their high fertility and limited global coverage, these soils are suffering from widespread erosion, nutrient depletion, and structural damage. A sweeping new review synthesizing insights from over 1,200 studies sheds light on the alarming scale of degradation across China, Eastern Europe, North America, and South America. It identifies unsustainable farming practices, chemical overuse, and climate stressors as key culprits. The findings urge a global shift toward sustainable land management to preserve these critical ecosystems that anchor the planet's food security.



Black soils—rich, dark, and highly productive—occupy only a fraction of global land, yet contribute disproportionately to global grain output. Found in key regions such as Northeast China, the Ukrainian plains, and the Pampas of South America, they support vital crops like maize, wheat, and soybeans. However, decades of intensive monoculture, chemical overapplication, and climate volatility have eroded their resilience. These pressures are degrading not only the soils themselves but also the ecosystem services they provide. Due to these converging threats, there is an urgent need for comprehensive understanding and region-specific solutions to halt further damage and secure future agricultural productivity.

In a review (DOI: [10.1016/j.pedsph.2024.06.011](https://doi.org/10.1016/j.pedsph.2024.06.011)) published in Pedosphere on January 31, 2025, researchers from the Chinese Academy of Sciences and international partners presented the first global synthesis of black soil degradation. Drawing on 1,290 scientific articles, the study provides a detailed analysis of the extent, drivers, and consequences of degradation in the four main black soil regions. From erosion and nutrient loss to contamination and biodiversity

decline, the review offers a sobering picture—and outlines urgent priorities for policy, monitoring, and management to protect these foundational soils.

The study reveals that China has emerged as a research leader, contributing over 40% of the reviewed literature on black soil degradation. Across all regions, soil erosion and fertility loss were identified as the most prevalent and pressing threats. In China's Northeast Plain alone, more than 218,000 km² of black soils are affected by erosion, with slope farming and excessive tillage being major contributors. In North America, echoes of the Dust Bowl linger, while Ukraine has lost over 80,000 km² of fertile land to erosion and organic carbon decline. Alarmingly, degradation is being accelerated by harmful farming practices: deep tillage, overuse of fertilizers and pesticides, and simplified cropping systems. Acidification and salinization are on the rise, particularly in China and Eastern Europe, and herbicide contamination—especially glyphosate—is now widespread in regions like the Pampas. In parallel, losses in microbial and fungal biodiversity are silently undermining soil function. However, the review also highlights promising management approaches, including conservation tillage, crop rotation, organic amendments, and integrated strategies like China's "Lishu model," which combine no-tillage, stubble cover, and precision agriculture to restore degraded soils.

"Black soils are the backbone of global food production, yet we're witnessing their silent collapse," said Dr. Wenyou Hu, lead author of the study. "Our review connects decades of scattered evidence into a clear message: degradation is accelerating, but it is not irreversible. With targeted policies and science-based interventions, we still have time to restore these critical soils and ensure they remain productive for generations to come."

This global review delivers a call to action for decision-makers, scientists, and land stewards. It offers a roadmap for assessing degradation, identifying vulnerable hotspots, and deploying effective conservation practices. Emphasizing data-driven strategies, the study advocates for real-time monitoring using AI and remote sensing, harmonized assessment standards, and regionally adapted interventions. It also calls for deeper international collaboration—through platforms like the FAO's Black Soil Network—to share knowledge, build capacity, and coordinate policy. By acting now, the global community can safeguard these irreplaceable soils and secure the foundation of sustainable food systems in an era of growing environmental uncertainty.

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