Unequal Fields: Water Use, Nutrient Gaps, and the Future of Small-Scale Agriculture

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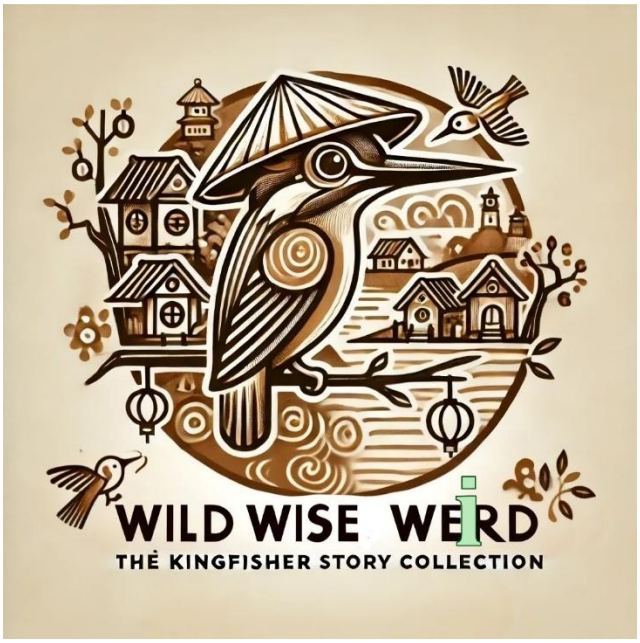

"– Wherever there is food, there is freedom!"

In "Dream"; *Wild Wise Weird* [1]

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As water scarcity intensifies globally, understanding how different agricultural systems contribute to food production and water use is crucial. A recent global study by Su et al. [3] sheds new light on this by comparing nutrient output and water consumption between small- and large-scale farms using a high-resolution, process-based crop model across 55 countries.

Despite occupying 43% of the total harvested land, small-scale farms produce only 34–50% of essential nutrients, depending on the nutrient assessed—significantly less than their proportional land share. This productivity gap stems from a combination of water scarcity and poor soil fertility. The study reveals that 68% of small-scale farms are located in water-scarce regions, yet only 18% of their area is irrigated—compared to 30% for large-scale farms. As a result, smallholders rely heavily on green water (rainfall), making them especially vulnerable to drought and climate variability.

Soil fertility stress—not just lack of irrigation—was a major barrier to production. In water-scarce regions, improving fertilization alone could increase nutrient yields from small farms by 70–90%, a greater gain than from irrigation alone. When both fertilization and irrigation were improved together, gains were even more substantial. This highlights the need for integrated investment strategies that address both biophysical and infrastructure deficits.

However, the path forward is not without trade-offs. Expanding irrigation and fertilizer use may strain water sources and ecosystems, and such investments are often out of reach for smallholders [4,5]. The authors argue for targeted, context-sensitive interventions that balance productivity goals with environmental constraints.

This study underscores the deep inequities embedded in global food systems—where smallholders, though central to food supply, face the greatest resource constraints. Addressing these disparities requires more than technical solutions. It calls for policies that promote sustainable resource use, equity in agricultural investment, and adaptive strategies tailored to regional conditions. In rethinking how we feed the world, we must consider not just what is grown but how and by whom—ensuring that both human communities and ecosystems can thrive [6,7].

References

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