



From Strategy to Reality:

Using Soil Analytics and Digital Maps to
Drive Food Security Policy in Ghana

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Executive Summary

Ghana's agricultural transformation is being constrained by a persistent disconnect between soil diagnostics and the planning systems that guide public investment, input delivery, and productivity support. Although the country has valuable foundational soil data from multiple initiatives, these remain fragmented and are not yet translated into sufficiently integrated, policy- and investment-ready intelligence. As a result, major agricultural interventions continue to rely on broad planning assumptions that do not adequately reflect localized nutrient constraints, climate risks, or crop-specific requirements. This weakens the efficiency of fertilizer policy, limits the targeting of production support, and reduces the capacity of the sector to respond proactively to emerging shocks.

Addressing these gaps will require more coordinated, decision-oriented approaches that integrate soil data into planning, investment, and delivery systems. Frameworks such as the Soil Nutrient Roadmap (SNR) demonstrate how spatial nutrient requirements, yield targets, environmental considerations, and economic returns can be brought together to support more informed decision-making. Scaling such approaches, alongside interoperable digital platforms, stronger institutional coordination, and wider uptake across government, extension, research, and the private sector will be critical to improving the effectiveness of public expenditure, strengthening food system resilience, and positioning soil intelligence as a core pillar of long-term agricultural transformation.

The Context: The State of Ghana's Soil

Agriculture is vital to Ghana, contributing 21% of the country's gross domestic product and employing 38.3% of its population.¹ However, the sector is hampered by low productivity, high post-harvest losses, and an over-reliance on food imports. Two major contributors to these challenges are declining soil health and the absence of integrated, quality-assured soil information systems, which limit the translation of soil diagnostics into productivity-enhancing agronomic and policy interventions.

¹ [Feed Ghana Programme](#)

Ghana's agricultural potential is currently limited by a fragmented soil data landscape. Critical, localized, and regularly updated soil nutrient data is inconsistent, siloed, and often inaccessible to decision-makers, hindering the implementation of targeted nutrient solutions and precision agriculture. While existing initiatives such as the International Soil Reference and Information Centre's (ISRIC) SoilGrids, Innovative Solutions for Decision Agriculture (iSDA) soil maps, and the GhaSIS framework provide important foundational data, policy- and investment-ready interpretations are often limited. For example, soil nutrient decision support tools with digital accessibility required for effective high-level decision-making are nonexistent, limiting the ability to translate diagnostics into targeted agronomic and policy interventions.

A harmonized soil data system which integrates, standardizes, and makes accessible soil information from various sources is imperative for enhancing flagship programs such as the Feed Ghana Programme (FGP), while ensuring alignment with the Economic Community of West African States Agricultural Policy (ECOWAP)² and the Comprehensive Africa Agriculture Development Programme (CAADP)³ commitments.

Crucially, a centralized, data-driven soil intelligence system is essential if Ghana is to meet its obligations under the African Union's Nairobi Declaration on Fertilizer and Soil Health, which aims to restore soil health and secure long-term food resilience by delivering crop-specific fertilizer recommendations to at least 70% of smallholder farmers.⁴

Where Soil Health and Agriculture Policy are Disconnected

Ghana's agricultural transformation is fundamentally constrained by a disconnect between effective soil diagnostics and the scale at which public financing and input deployments are planned. The critical issue is the lack of spatially explicit, aggregated planning that remains sensitive to localized, farm-level soil constraints. This misalignment exacerbates the deterioration of soil health – driven by chronic fertility decline and degradation – and directly links coarse planning scales to systematic underperformance in farm-level outcomes. A transition to improved spatial planning is therefore essential to bridge this gap, ensuring that policy intent translates into effective, targeted results in the field.

This vulnerability was starkly evidenced by the mid-2024 dry spell, which contributed to crop production challenges and necessitated emergency procurement and distribution of fertilizers for approximately 800,000 farmers.⁵ The scale and cost of this crisis underscored a systemic policy weakness: national planning lacks the predictive capacity to model how localized soil nutrient constraints interact with climate stress. This gap forces reactive, crisis-driven interventions, diverting resources from timely, preventive allocation.

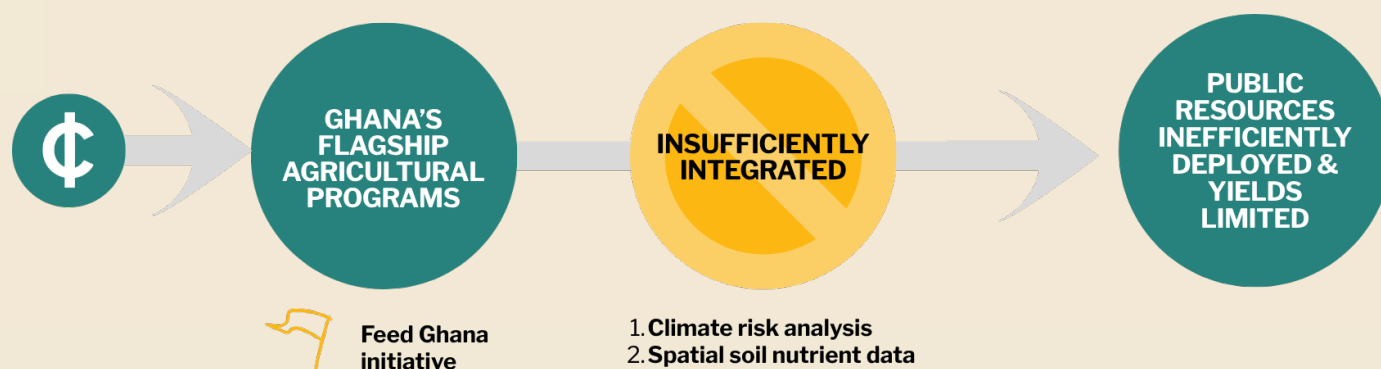
² [Economic Community of West African States Agricultural Policy \(ECOWAP\)](#)

³ [Comprehensive Africa Agriculture Development Programme \(CAADP\)](#)

⁴ [Nairobi Declaration on Fertilizer and Soil Health](#), pp. 4, 6

⁵ [Dry Spell Update: Government Unveils Measures to Mitigate Effects on Food System and Farmers](#)

These systemic shortcomings are further reflected in the design and execution of Ghana's flagship agricultural programs, including the former Planting for Food and Jobs and the current Feed Ghana initiative. Despite their substantial fiscal footprint, support for crop production remains insufficiently integrated with spatial soil nutrient data and climate risk analysis. As a result, public resources are often deployed without clear evidence of where nutrient constraints are most yield-limiting.



Concurrently, a critical “last-mile” policy gap hinders the translation of national fertilizer strategies into location-specific guidance. The absence of sufficiently granular, soil-based nutrient recommendation systems limits the ability to tailor fertilizer use to local conditions and cropping patterns peculiar to Ghana, thereby constraining the efficiency of adoption and undermining commitments to site-specific recommendations under continental agricultural frameworks. For example, the fertilizer needs of soils in the southern coastal areas around Takoradi are often vastly different from the needs in the northern savanna regions near Tamale. Collectively, these gaps impede the effectiveness of public investment, diminish resilience to climatic shocks, and slow progress toward long-term food security and sustainable agricultural transformation.

How Predictive Analytics Can Help: The Soil Nutrient Roadmap (SNR) Response

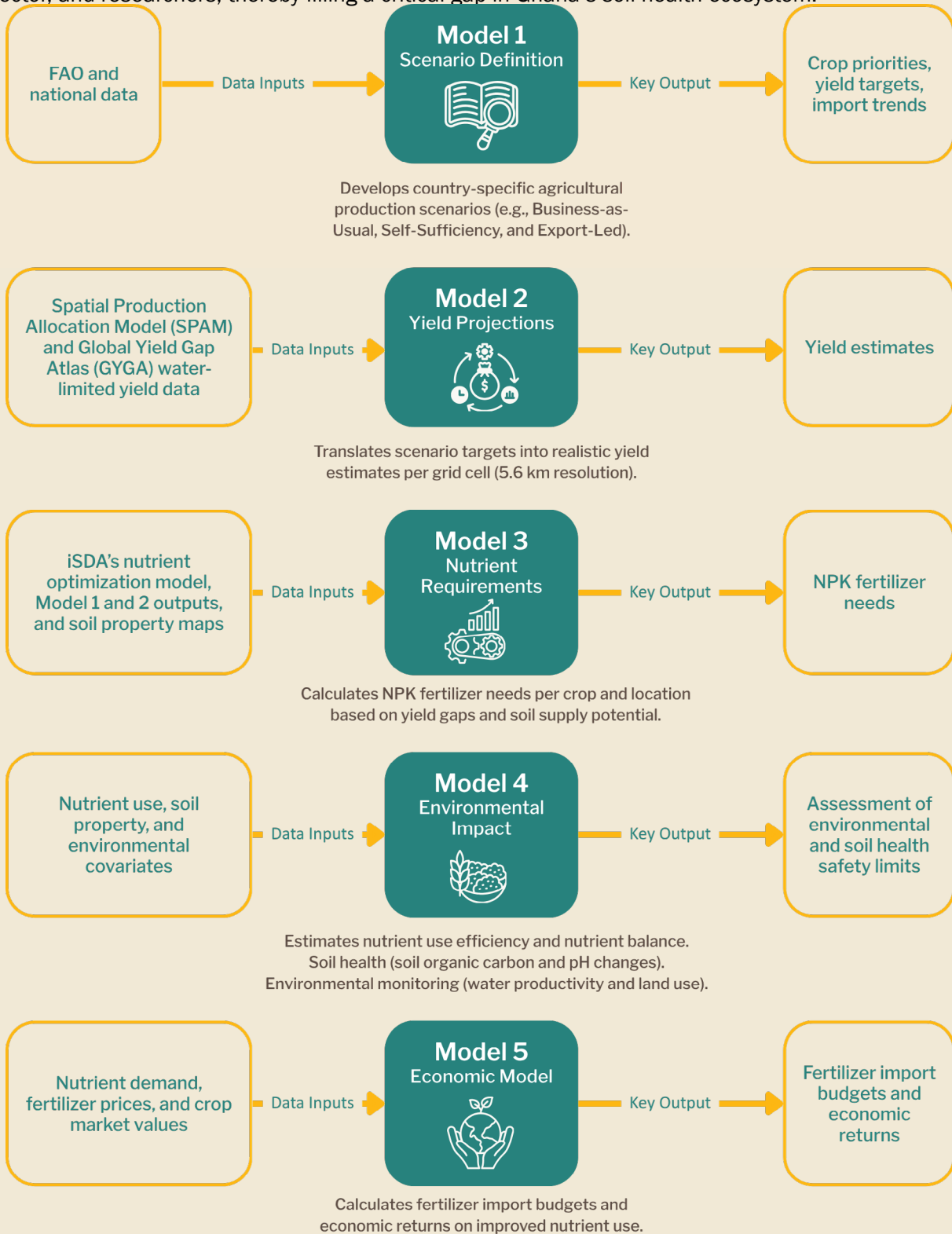
The SNR⁶ is a diagnostic and planning tool that directly addresses the need for dynamic, decision-oriented soil intelligence. It offers a harmonized, scalable framework for African countries, integrating predictive soil diagnostics, climate risk analysis, and economic assessment.

The SNR's five-model framework links scenario-based yield projections with spatial nutrient demands and cost-benefit analyses. This system strengthens the efficiency and targeting of public investments and policy formulations by grounding decisions in predictive analytics and ensuring alignment with local soil constraints and climate conditions. By translating soil constraints into actionable nutrient requirements, the SNR supports a critical shift from reactive, blanket input provision to evidence-driven public investment. This maximizes productivity gains, improves value for money, and reinforces Ghana's food security objectives while ensuring consistency with continental commitments such as CAADP 2035 and the Nairobi Declaration.

⁶ <https://developmentgateway.org/casestudy/the-soil-nutrient-roadmap/>

The Five SNR Models

The SNR is crucial because it moves beyond mere diagnosis to link soil nutrient gaps with clear, actionable recommendations and decision pathways for policymakers, extension services, the private sector, and researchers, thereby filling a critical gap in Ghana's soil health ecosystem.



How the SNR Connects to Key Food Security Initiatives

The SNR framework and its soon-to-be-launched interactive dashboard provide data-driven insights that directly strengthen Ghana's major development and policy commitments:

 Initiative	 SNR Support	 Key Model Contributions
Feed Ghana Program	Complements FGP's vision for a centralized digital platform by translating soil and yield data into actionable insights for production targets and investment.	Models 1 and 2 enable modeling production required to reduce imports . Model 5 guides investment in Agro-Production Enclaves by showing ROI.
National Medium-Term Development Policy Framework (2022-2025) and Successor Framework (2026-2029)/ President's Coordinated Programme of Economic and Social Development Policies	Supports economic transformation, sustainable production, and resilience by equipping planners with tools to project yields, calculate nutrient needs, and assess economic viability.	Objective II (Agri-business) is supported by the 5-model framework. Objective III (Sustainable Food Production) is supported by Model 4.
Nairobi Declaration	Operationalizes the Declaration's call for context-specific recommendations, standardized tools, and digital decision-support systems.	Models 2 and 3 generate tailored nutrient requirement calculations (Objective 2a). The dashboard and framework fulfill the need for a digital information system (Objective 2c).
2025 ECOWAP Strategic Policy Framework	Supports ECOWAP domestication by transforming soil and agronomic data into standardized, spatially explicit insights for productivity, resilience, and value chain competitiveness.	S02 (Competitive Value Chains) is supported by Models 2, 3, and 5 through alignment of nutrient needs with market demand. S03 (Food Access/Resilience) uses Models 2 and 3 for yield gap closure and scenario planning.
CAADP Strategy (2026-2035)	Links soil health, yield potential, environmental sustainability, and economic returns to design, prioritize, and finance CAADP-aligned interventions.	Strategic Objective 1 (Intensifying Production) uses SNR to align fertilizer requirements with realistic yield targets. Strategic Objective 2 (Boosting Investment) improves investment quality by linking data to economic returns.
UN Sustainable Development Goals	Enables data-driven nutrient strategies that increase food production while safeguarding natural resources.	Goal 2 (End Hunger) is supported by Models 2, 3, and 5 for enhanced productivity and planning. Goal 12 (Sustainable Consumption and Production) is supported by Model 4's focus on efficiency and environmental health Goal 15 (Life on Land) is contributed to by Model 4's insights into soil health and environmental impacts.
West Africa Food System Resilience Program Phase II	Strengthens digital advisory services, crisis prevention, and the sustainability of agricultural production in priority landscapes.	Component 1 (Digital Advisory) uses SNR as a foundation for a centralized, data-driven tool. Component 2 (Productive Base) bolsters sustainability by linking soil health and nutrient management.

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Key Recommendations

The Government and the Ministry of Food and Agriculture should:

- Consider strengthening a national, integrated soil intelligence system to support evidence-based agricultural policy planning, investment prioritization, and implementation
- Supporting interoperable platforms for harmonized soil intelligence, drawing on advanced analytical tools such as the Soil Nutrient Roadmap (SNR) to strengthen public planning and enhance the effectiveness of major agricultural initiatives, including Agro-Production Enclaves

Private sector actors, particularly fertilizer manufacturers and distributors, should:

- Leverage crop-specific and spatially aggregated nutrient requirement data generated through tools such as SNR to improve product differentiation and regional supply planning
- Strengthen agricultural extension services by making better use of the digital advisory tools informed by integrated soil and agronomic data, including insights generated through SNR in communicating more relevant recommendations to farmers

Researchers and academic institutions should:

- Draw on the harmonized data to deepen analysis of soil health, nutrient dynamics, environmental outcomes, and the effectiveness of agricultural policy interventions

Conclusion

Ghana's agricultural transformation hinges on an integrated data foundation that connects soil nutrients to production, investment, and sustainability. The existing fragmentation in soil data has limited the effectiveness of soil health and nutrition strategies and weakened the evidence base for investment.

Addressing this, however, requires a sustained, collaborative, and multistakeholder effort across the food systems ecosystem. The SNR is working with relevant stakeholders to close this gap by providing a practical, transparent, and scalable framework that translates soil and agronomic data into actionable insights. By linking yield targets, nutrient requirements, environmental safeguards, and economic returns, the SNR supports the implementation of national and continental commitments. Embedding it within decision-making offers Ghana a pathway toward smarter fertilizer policies, more resilient food systems, stronger value chains, and better-targeted, evidence-based investments, ensuring that soil health remains central to long-term food security and economic resilience.