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Soil Initiative for Africa (SIA): Implications for Resilience of Agriculture and Food Security in Nigeria

‘Wole Fatunbi PhD
Director of Research and Innovation, FARA

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Background

Foundation of Food Security: Soil underpins the production of staple and cash crops, sustaining national food systems and reducing dependence on imports.

Renewable Economic Asset: Unlike oil and minerals, soil can be continuously productive if well managed, making it a sustainable driver of long-term growth.

Driver of Economic Diversification: Healthy soils enable expansion of agribusiness, agro-processing, exports, and value chains—key to reducing oil dependency.

Primary Source of Livelihoods: Over 70% of Nigerians depend on agriculture—soil is the base resource for employment, income, and rural stability.

Strategic National Stability Factor: Productive soils reduce food insecurity, rural poverty, and potential socio-economic instability.

Climate Resilience Engine: Fertile soils improve water retention, reduce erosion, and buffer crops against droughts and floods.

Platform for Innovation and Investment: Soil health enables adoption of modern technologies (precision agriculture, digital soil mapping, smart inputs).

Agroecological Diversity Advantage: Nigeria's varied soils across forest, savannah, and semi-arid zones enable the cultivation of a wide range of crops and livestock systems.

Environmental and Ecosystem Services: Soils contribute to carbon sequestration, biodiversity conservation, and sustainable land management.

Soil types in Nigeria and their Fertility Implications

Source
Adapted from FDALR (1990) Soil Map of Nigeria and FAO/UNESCO soil classification (FAO, 1988; WRB), synthesized for illustration

SOIL TYPE	WHERE FOUND IN NIGERIA	FERTILITY IMPLICATIONS
Arenosols (Sandy Soils)	Far North & North-West (Sokoto, Kebbi, Zamfara, Katsina, Kano, Jigawa, Yobe, Borno)	• Very low fertility • Low organic matter & nutrient holding capacity • High risk of nutrient leaching and drought • Requires organic matter, manure and fertilizer
Luvisols ("Latosolic" soils)	Northern Guinea Savannah (Niger, Kaduna, Bauchi, Gombe and adjoining areas)	• Moderate fertility • Often acidic and low in P, N • Good potential with lime, fertilizer and organic inputs
Alisols (Upland clay soils)	Jos Plateau & parts of Bauchi Plateau, Plateau State	• Moderate to high fertility • Good structure and water holding capacity • Generally respond well to fertilizer and lime
Cambisols (Mixed soils)	Middle Belt / Transitional Zone (Kwara, FCT, Nassarawa, Benue, Taraba and parts of Kogi)	• Moderately fertile but variable • Fertility depends on texture and organic matter • Responds well to good management
Acrisols (Greater part of the Southwest)	Southwestern States (Oyo, Osun, Ekiti, Ondo, Ogun, Lagos)	• Low to moderate fertility • Strongly acidic, low in bases, P and organic matter • Requires liming, fertilizer and organic matter
Nitisols (Deep red soils)	Rainforest Zone (Edo, Delta (uplands), Enugu, Anambra, Imo, Abia, Akwa Ibom, Cross River)	• Inherently fertile but strongly leached • Low in available P • High potential with fertilizer and organic matter
Fluvisols (Alluvial soils)	River valleys, floodplains and inland valleys across the country (e.g. floodplains of Niger, Benue & their tributaries)	• Generally fertile • High natural fertility, good moisture retention • Ideal for rice, vegetables and other intensive crops
Gleysols & Solonchaks (Hydromorphic/ Coastal soils)	Coastal plains, mangrove swamps and poorly drained areas (Delta, Bayelsa, Rivers, parts of Lagos, Cross River)	• Often waterlogged, acidic or saline (especially Solonchaks) • Low productivity without drainage and reclamation • Good for rice, mangrove and salt-tolerant crops after proper management

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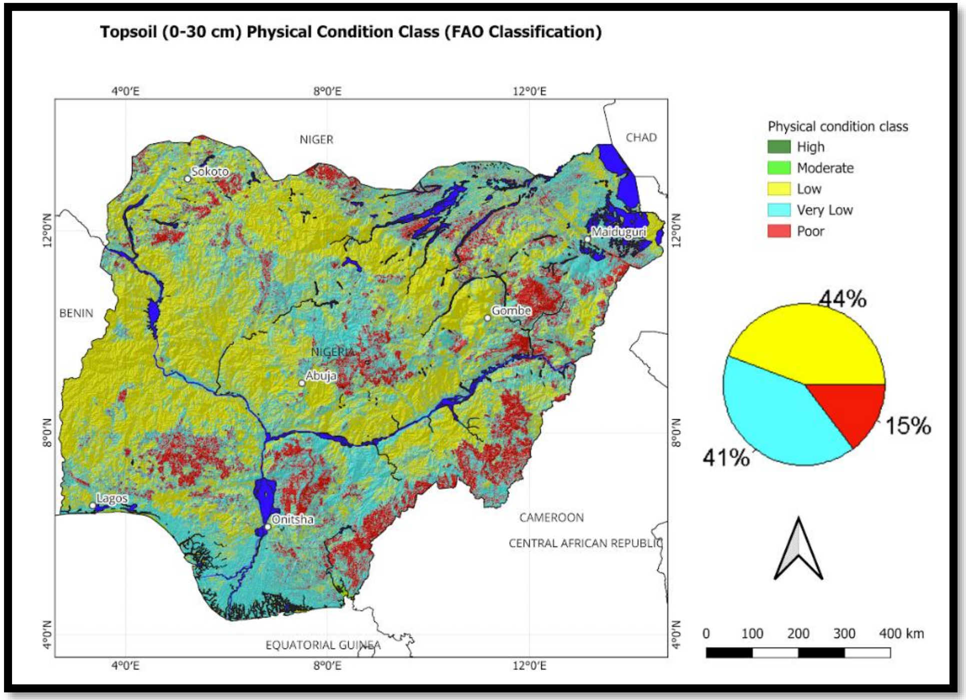
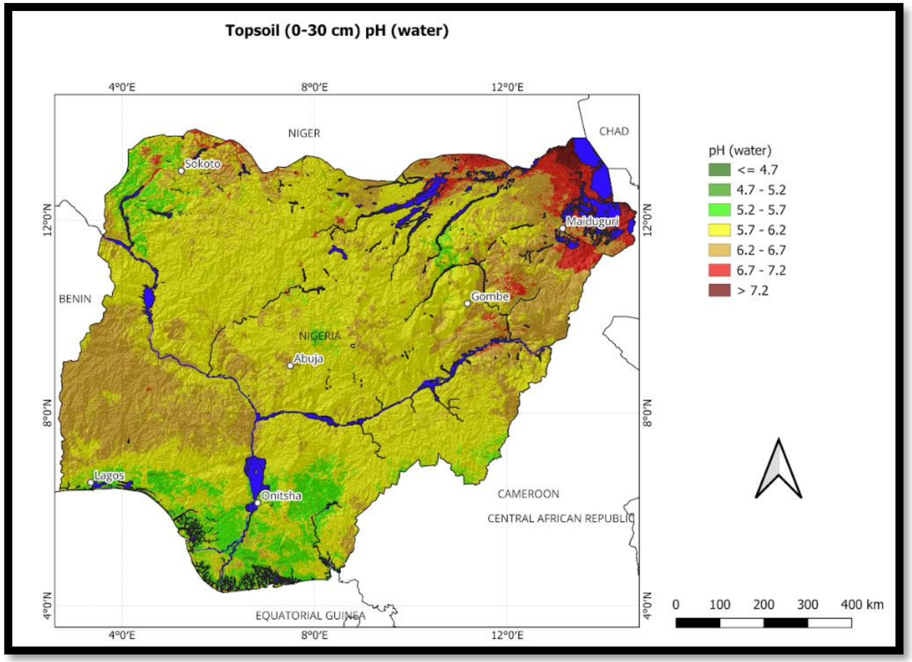


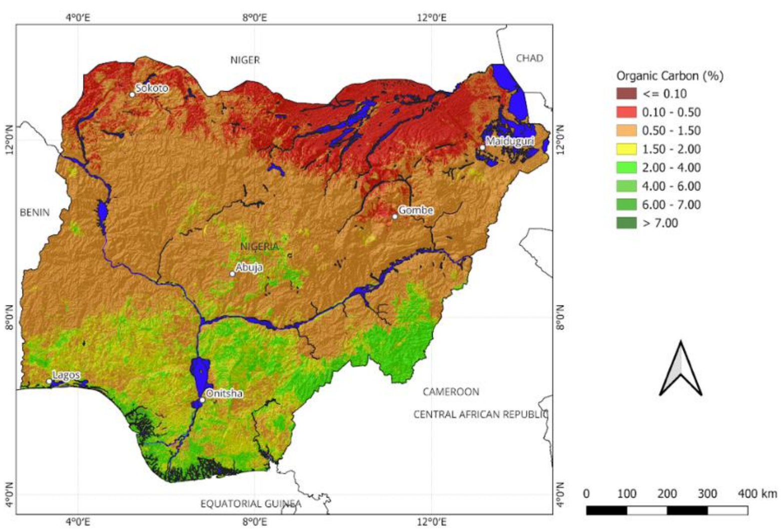
- Soil structure (aggregation, stability)
- Texture (sand, silt, clay balance)
- Bulk density/compaction
- Porosity and aeration
- Water infiltration and drainage
- Root penetrability

Soil fertility is not only about nutrients; soil must be physically "fit" to function.

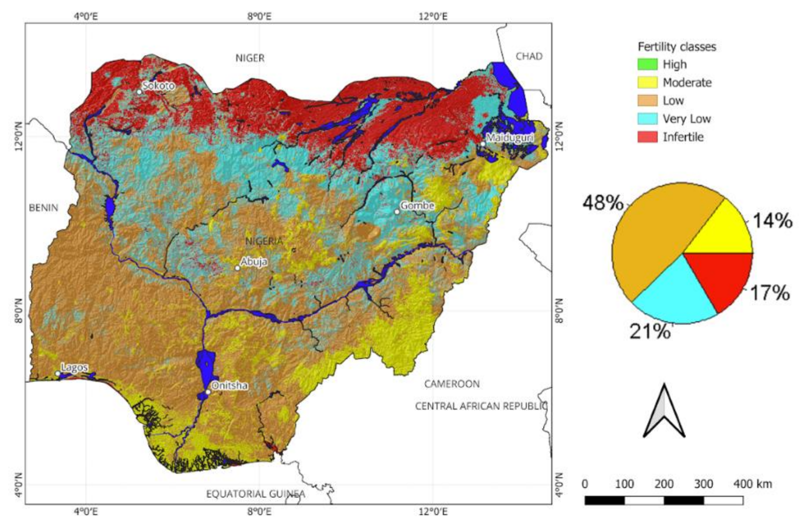
60% – 80% of land degradation in Nigeria is driven by physical soil processes. 350,000 ha/year to erosion and desertification



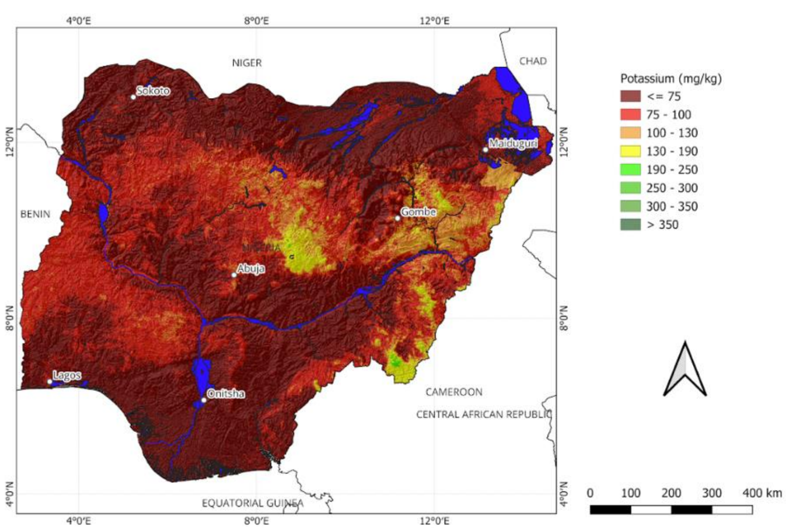
Topsoil (0-30 cm) Organic Carbon (%)



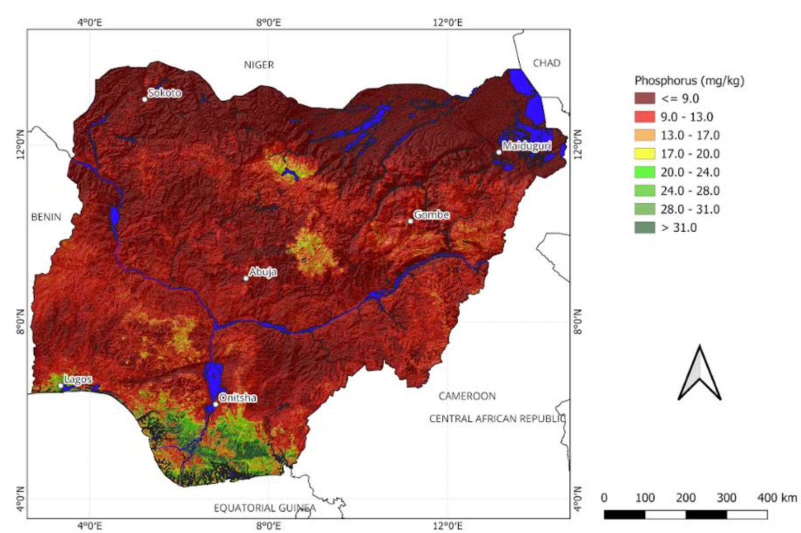
Topsoil (0-30 cm) Total Nitrogen (%)



Topsoil (0-30 cm) Extractable Potassium (mg/kg)



Topsoil (0-30 cm) Extractable Phosphorus (mg/kg)



Strategic Insight in Most Nigerian Soils Issues

General Critical Levels

Indicator	Critical Level	Meaning
Soil Organic Matter	2.0%	Below this → poor soil health
Total N	0.10–0.15%	Below → N deficiency
Available P (Bray-1)	10–15 mg/kg	Below → P limitation
Exchangeable K	0.15–0.25 cmol/kg	Below → K deficiency

- **SOM < 2% → systemic constraint**
- **N is almost always limiting**
- **P is often "locked" (not available)**
- **K varies but is declining with continuous cropping**

- **Prominent formation minerals are low-activity clay**

Kaolinite (1:1 clay) | Illite (2:1, moderate activity) | Smectite (2:1, high activity, localized)

Critical Requirement for prominent crop

Parameter	Maize	Rice	Cassava
SOM (%)	~2.0	~2.0	1.5–2.0
Total N (%)	0.12–0.15	0.10–0.12	0.08–0.12
Available P (mg/kg)	12–15	10–12	8–10
Exchangeable K (cmol/kg)	0.20–0.30	0.15–0.25	0.20–0.30

"Nigeria's soil is an asset ….but an underperforming one without restoration."

Soil Fertility Implications on Agricultural Productivity

Yield Gap in Prominent Food Commodities in Nigeria

Crop	Average Yield (t/ha)	Attainable Yield (t/ha)	Yield Gap (%)	The Drivers
Maize	2.0 – 2.5	5.0 – 7.0	**60 – 70%**	Low fertilizer use, poor seed systems
Rice (paddy)	2.0 – 3.0	5.0 – 8.0	**50 – 65%**	Water control & improved varieties critical
Cassava	10 – 15	25 – 35	**50 – 70%**	Nutrient mining, low-input systems
Yam	8 – 12	20 – 30	**55 – 65%**	Soil fertility & planting material
Sorghum	1.0 – 1.5	3.0 – 4.5	**50 – 65%**	Moisture stress, low input use
Millet	0.8 – 1.2	2.5 – 3.5	**50 – 70%**	Marginal soils, drought
Cowpea	0.5 – 0.8	1.5 – 2.5	**50 – 70%**	Pest pressure, low improved seed use
Soybean	1.0 – 1.3	2.5 – 3.5	**55 – 65%**	Poor inoculation, low inputs
Tomato	6 – 8	20 – 40	**70 – 80%**	Very low hybrid adoption

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Resilience of Agriculture in Nigeria

The use of production assets within the limit of its capacity.

Enhance the future opportunities to produce goods or income from production assets are not lost.

Agribusiness development and capacity to Innovate.

Pricing of agricultural commodities

Investment in irrigation facilities

Strategic Food Reserve System

Local Fertilizer manufacture

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Nigeria: 10-Year Agricultural Resilience Status (2015–2025)

Agricultural Resilience

Dimension (FAO-aligned)	Indicator Proxy	2015 Status	2020 Status	2025 Status	Trend	Commentary
Access to Basic Services	Irrigation, roads, extension	Low	Low–Moderate	Moderate	↑	Gradual improvement, but still inadequate
Assets (Productive Capacity)	Mechanization, inputs, and land quality	Low	Low	Low–Moderate	↑ (slow)	Soil degradation constrains asset value
Social Safety Nets	Subsidies, insurance, programs	Low	Moderate	Moderate	↑	Expansion of programs but uneven reach
Adaptive Capacity	Climate adaptation, innovation	Low	Low–Moderate	Moderate	↑	Growing awareness but limited scale
Soil Health (Critical Add-on)	SOM, erosion, fertility	Low	Low	Low	↓ / stagnant	Major unresolved constraint
Water Control	Irrigation coverage	Very Low	Very Low	Low	↑ (marginal)	<5% irrigated land remains key risk
Productivity (TFP/Yield)	Yield gap closure	Low	Low–Moderate	Moderate	↑	Gains but large gaps persist
Climate Resilience	Shock absorption	Low	Low	Low–Moderate	↑	Still highly vulnerable to shocks

Nigeria's agricultural system has transitioned from "fragile" to "moderately resilient," but remains structurally vulnerable due to unresolved soil and water constraints.

Institutional resilience is improving faster than ecological resilience—and that mismatch is the core risk."

Summary

Year	Resilience Level (0–1 scale)	Interpretation
2015	0.30	Fragile system
2020	0.35–0.38	Slight improvement
2025	0.40–0.45	Moderate but vulnerable

Note

This analysis used the FAO's RIMA (Resilience Index Measurement and Analysis)

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Nigeria Agriculture Resilience : Weighted Contribution of Core Issues

Agricultural Resilience

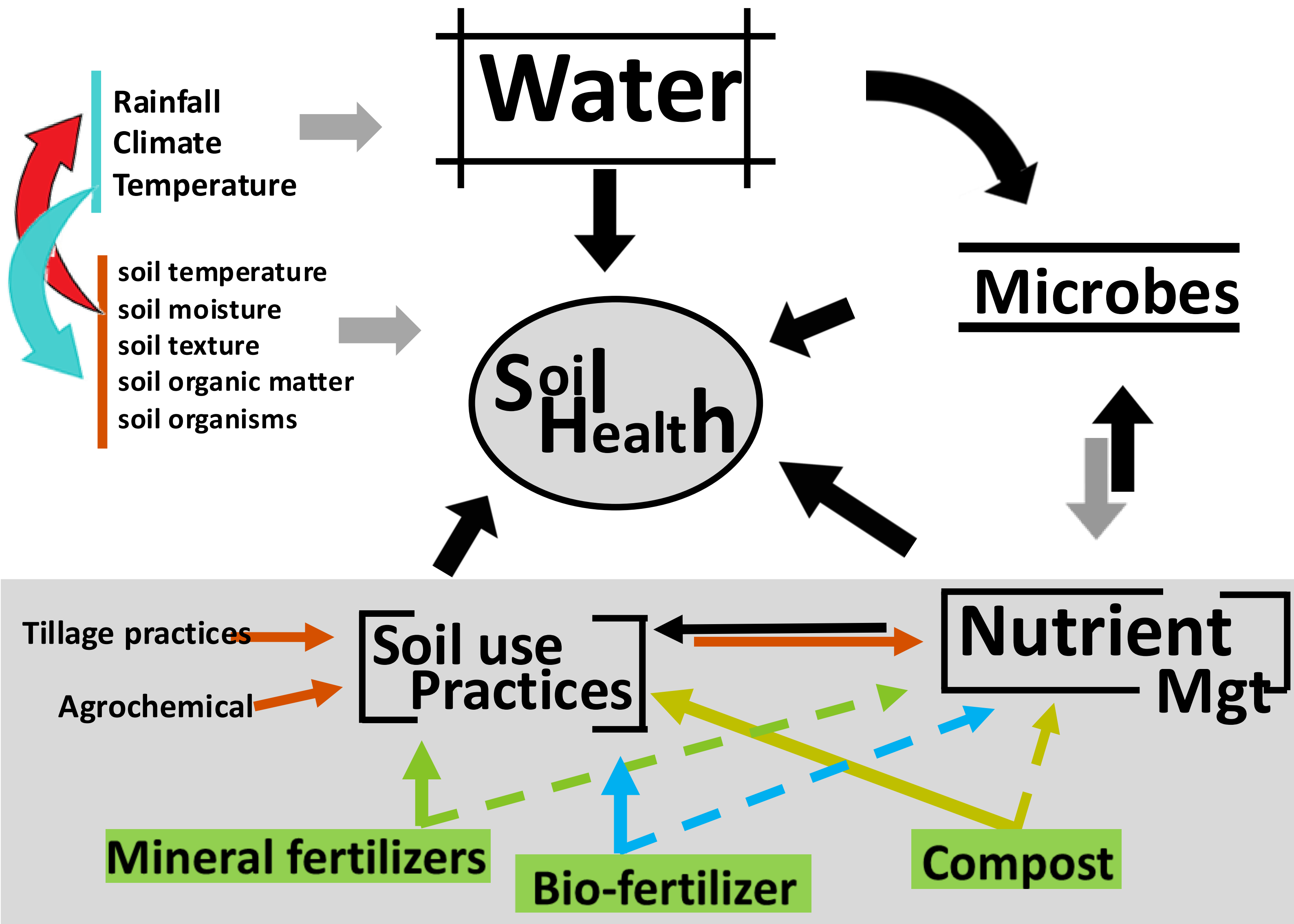
Dimension	Core Issue	Estimated Contribution (%)	Rationale
Biophysical (Soil)	Soil health & land degradation	**30%**	Foundational constraint; affects water retention, nutrient use efficiency, and productivity across all systems
Biophysical (Water/Climate)	Climate variability & water stress	**20%**	High exposure due to rainfed systems (>90%); droughts and floods directly affect output
Productivity System	Yield gaps & low input use	**15%**	Farmers operate at 30–50% of potential → limits buffer capacity
Water Infrastructure	Irrigation deficit & water management	**10%**	Low irrigation (<5%) amplifies climate risk
Technology System	Mechanization & innovation gaps	**8%**	Limits the timeliness, scale, and efficiency of response
Market/Economic	Value chains & market access	**7%**	Post-harvest losses and weak markets reduce resilience through income instability
Institutional/Policy	Policy inconsistency & investment gaps	**5%**	Weak coordination and underinvestment slow systemic transformation
Social/Human Capital	Farmer capacity, gender, and youth	**5%**	Limits adoption, adaptation, and long-term sustainability

Note

"Percentages represent synthesized estimates based on literature (FAO, World Bank, IFPRI, IITA) and expert judgment; they are indicative of relative importance rather than exact quantified shares."

"If soils are weak, resilience is impossible—no matter the policy."

Mutual Reinforcing Effects of Water, Nutrients, Soil Health and Ecological Services



Human Capital Dev

Ext services.

Knowledge mgt

Tech Gen

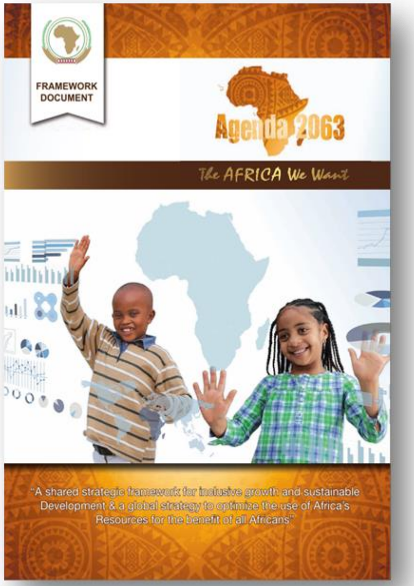
Thinking about crop suitability in alignment with Soil status

Figure 2. Suitable Crop for the Current Soil Fertility Status in Nigeria

The Genesis of Soil Initiative for Africa (SIA)

Agenda 2063:

- **Double agricultural (total factor) productivity** (PA 1.5.1)
- At least **30% of agricultural** land under **sustainable land management** practice (PA 1.7.2)



Context: Africa Soil Health Crisis

Soil Fertility Crisis

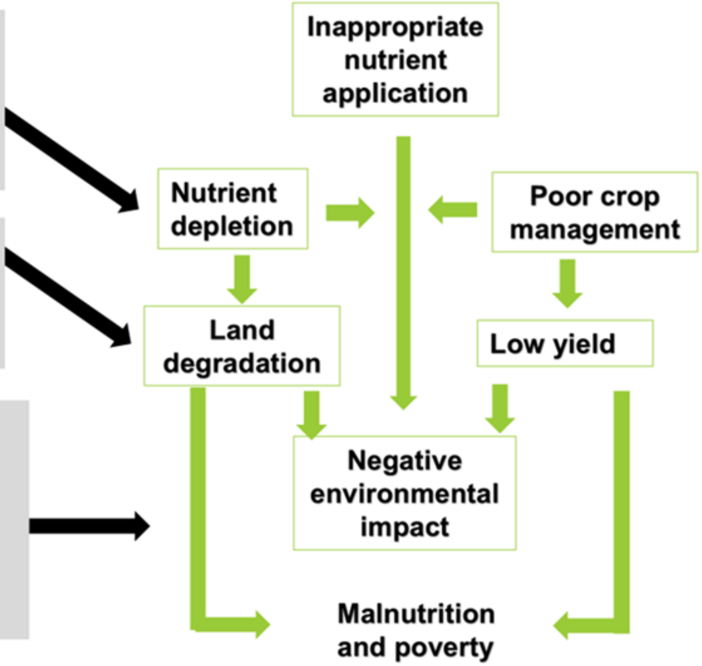
- Negative Nutrient Balance in croplands, average of -40kg NKP/ha. The soil nutrient losses cost $ 4-10 Billion/yr.
- Overgrazing in the livestock system

Acute land degradation

- 65% of cropland are degraded. Land degradation cost $68 Billion/yr
- Higher risk of non-responsive soil

Cause and Effect

- Increase in extensive farming practices
- Increase in carbon and biodiversity losses
- Reduced ecosystem services
- Increase in Green house gas emission (Biomass burning)
- Aggravated effects of climate change.



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The Vision

Implementing the Action Plan will contribute to **Reversing soil degradation**, **increasing fertilizer consumption and efficiency**, **Improve Soil health**, **Accelerating inclusive agricultural transformation** and **ending hunger, malnutrition**, **and poverty on the continent**.

Reminiscence of the Nairobi Declaration of Fertilizer and Soil Health

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2024 Nairobi Declaration on Fertilizer and Soil Health

Key Output

"Endorsement of the Fertilizer and Soil Health Action Plan and the Soil Initiative for Africa Framework as key guiding documents to harness multi-stakeholder partnerships and investments to drive policies, finance, research and development, markets, and capacity building for fertilizer and sustainable soil health management in Africa"

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Essentials of the Declarations (I)

300%	Triple domestic production and distribution of certified quality organic and inorganic fertilizers by 2034.
70%	Make available, by 2034, targeted agronomic recommendations for specific crops, soils, and climatic conditions, to at least 70% of smallholder farmers on the continent.
30%	Reverse land degradation and restore soil health on at least 30% of degraded soil by 2034.
100%	Fully operationalize the Africa Fertilizer Financing Mechanism to improve the production, procurement, and distribution of organic and inorganic fertilizers, and soil health interventions.
100%	Formulate and implement policies and regulations to create a conducive environment for fertilizer and soil health interventions.
100%	Develop and promote systemic national capacity building for locally relevant fertilizer and soil health management practices and technologies.

- Africa’s soils are **healthy and resilient**, supported by a robust
- **African-led soil management system** with sound institutions, policies, programs, investments, partnerships, and services that support and
- **Empower land users** across Africa to use practices that **restore and sustain soil health**, significantly agricultural productivity, income and prosperity, resilience to climate change, and **reflect national priorities**.

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Soil Initiative for Africa

Soil Initiative for Africa is an Africa Union Initiative developed to practically implement the African Fertilizer and Soil Health Action Plan.

Implementation will use the subsidiarity principle

Priority Action

1.Optimize integrated soil health and water management planning and implementation.
2. Build human, institutional, and social capital for research, development, education, extension, and support for sustainable soil management.
3. Optimize data and information for effective planning and monitoring.
4. Ensure enabling policy, legal and regulatory frameworks.

Essentials of the Declarations (I)

300%

Triple domestic production and distribution of certified quality organic and inorganic fertilizers by 2034.

70%

Make available, by 2034, targeted agronomic recommendations for specific crops, soils, and climatic conditions, to at least 70% of smallholder farmers on the continent.

30%

Reverse land degradation and restore soil health on at least 30% of degraded soil by 2034.

100%

Fully operationalize the Africa Fertilizer Financing Mechanism to improve the production, procurement, and distribution of organic and inorganic fertilizers, and soil health interventions.

100%

Formulate and implement policies and regulations to create a conducive environment for fertilizer and soil health interventions.

100%

Develop and promote systemic national capacity building for locally relevant fertilizer and soil health management practices and technologies.

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Essentials of the Declarations (II)

70%

Ensure that at least 70% of smallholder farmers have access to quality extension and advisory services on fertilizer and soil health from public and private extension systems.

Domesticate the continental Action Plan into national agricultural investment plans for implementation.

Disaggregation of Roles and Action at Different Governmental Levels

Country Level

Domestication of AFSH-Action Plan and Integration in Country Plans.

Engagement of country actors for field implementation including SIS.

Coordination of national-level efforts by multiple actors.

Implementation of technology, communication, capacity development, policies action etc.

MEL data collection and pooling into CAADP BR processes.

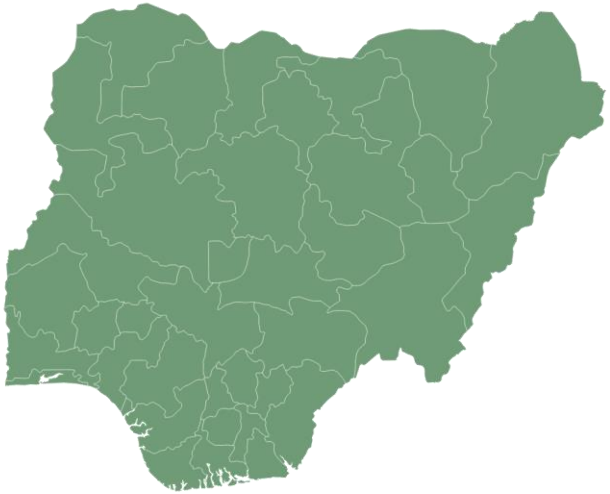
Regional Level

- Organization of regional Hubs to identify regional priorities, provide targeted country support, and clear technology, and respond to advanced knowledge and skill demands from countries.
- Cross-border knowledge and technology development and sharing.
- Exchanges, scaling, and Knowledge management.
- Cross-country policy development, regional policy harmonization, mobilization of resources, and regional coordination.

Continental Level

- Continental coordination of action; monitoring, learning
- Collation of progress and reporting to the Heads of State / CAADP BR processes
- Facilitating intercontinental exchange of knowledge and technologies.
- Partnership management among actors and donor and development partners' relations
- Hosting continental SIS and facilitating the development of related tools
- Exchanges, knowledge sharing, and exchange with the global community

Development Partners & IAR&D Organizations



National

Successful implementation of the Summit outcomes will require domestication of the AFSH Action Plan and SIA Framework, and effective coordination of related national activities.

National focal points would be critical as the central contact point with both regional and continental coordination functions.

Thoughts on Nigeria's Progress on Soil Management

Soil Information System

Nigeria is transitioning from fragmented soil data systems to an integrated, digital Soil Information System but the system is still emerging and not yet fully institutionalized.

Facilitate Linkage with AUSO for joint learning, data harmonization.

Development of robust soil advisory instrument.

Human Capital Development

Nigeria has a moderate but uneven human capital base on soil health; strong in research and policy awareness, but weak in farmer-level skills, extension reach, and private-sector capacity.

Communication, awareness creation and structured policies on land use is needed

Mineral fertilizer manufacture and use

Nigeria has solved the "mineral fertilizer production problem" but not the "effective fertilizer use problem."

Efforts in Affordability constraints, Weak last-mile distribution, Poor soil response conditions and Policy distortions.

Organic fertilizer manufacture and use

Organic fertilizer remains <1% of the total fertilizer production scale.

Nigeria's organic fertilizer sector is not yet an industrial industry, it is an emerging ecosystem

Strategic policy, investment is needed to ensure increased organic fertilizer manufacture and use

1. Contribute scientific knowledge on SIS.
2. Lead the generation of new knowledge and technologies.
3. Lead collective action for human capital development.
4. Host veritable soil technology & Information portal.
5. Become the entry point for soil issues in Nigeria

Why AUSO

- There have been several efforts on the continent to provide a real-time soil information system
- A notable one is the effort from the Soils4Africa project, a five-year project to establish an African Soil Information System (SIS).
- The Africa Union Soil Observatory (AUSO) project, funded under the Horizon Europe Program (2025–2030), builds on what is done Soils4Africa project.
- The AUSO project aims to establish a continental soil observatory that will serve as
  - A digital hub for soil data
  - Knowledge and decision-support tools to guide soil restoration, sustainable land management, and climate-smart agriculture across Africa.
  - Source of credible data for soil advisory tool

Conclusion

1. **The productivity and resilience of Nigeria's agriculture need to increase significantly for it to meet the food and fiber needs of the nation.**
2. **The resilience of the agricultural system in the country is multidimensional; all must be addressed concurrently.**
3. ***"If soils are weak, resilience is impossible; no matter the policy."***
4. **Halting land degradation and increasing soil health requires urgent technical and policy actions.**
5. **Integrated soil fertility management is core, that includes, soil water management, physical soil degradation control etc.**
6. **The need for veritable soil information and the development of advisory tools from such is important to managing Nigerian soils.**
7. **Human capital development is a must for sustainable soil management in Nigeria.**

Thank you for listening