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POLICY BRIEF

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Including soil organic carbon into nationally determined contributions: Insights from Ethiopia

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Context

Healthy soils are the foundation of sustainable and regenerative food systems and provide several vital ecosystem services. Sequestering carbon in agricultural soils, for example, can have mutual benefits for climate change mitigation and adaptation, food and nutrition security, biodiversity, and water resilience. Despite these benefits, there are few policies that incentivize farmers to invest in maintaining and improving soil health.

This policy brief highlights opportunities for the inclusion of soil health and soil organic carbon (SOC) into the National Determined Contribution (NDC) in Ethiopia as a key step for governments to support farmers in investing in their soil. We interviewed key informants involved in the NDC process to understand the process for the developing the NDC targets and investigated reasons why policy makers did or did not include soil in these targets.

This set of policy briefs focus on the action countries in Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA)¹ (Ethiopia, Kenya, Ghana, Mali, Senegal and Zambia). We interviewed several key informants in each country involved in the NDC process to:

1. Understand the process for the developing the NDC targets;
2. Understand why policy makers did or did not include soil in their target; and
3. Identify opportunities going forward to improve the process including the target setting.

¹ <https://aiccra.cgiar.org/>

Ethiopia Context

Ethiopia affirmed its commitment to climate change mitigation and adaptation goals through the Nationally Determined Contributions (NDCs) (EFCCC, 2021). This policy brief explores the challenges and opportunities for integrating soil organic carbon (SOC) to enhance Ethiopia's NDC targets. Ethiopia did not include SOC in its earlier NDCs but added it in the revised NDC in 2021. The revised NDC considered agroforestry and grassland management as major mitigation and adaptations measures to climate change. The insights from key informant interviews with relevant stakeholders in the NDC target setting process pinpoint to the following key policy recommendations to enhance the impact of the NDCs:

- Broaden wider stakeholder participation in the NDC planning, implementation and updating process involving sub-national stakeholders operating at meso (e.g., research institutions) and micro-levels (e.g., farmer communities), in addition to the macro-level stakeholders (e.g., line ministries), to enhance informed decision making and evidence-based reporting;
- Strengthen institutional capability in monitoring, reporting and verification (MRV) of the status of SOC under various land management strategies to determine the level of contribution to climate change mitigation and adaptation (CCMA) to help policy makers appreciate the integration of SOC in NDC;
- Promote climate smart agriculture & tree-based landscape restoration practices (as a win-win strategy) to enhance SOC contribution to NDC targets;
- Strengthen land-use planning policies, awareness/knowledge of institutions on climate change impact and existing international agreements on CCMA;
- Strengthen institutional capacity (e.g., technical, finance, and institutional) to lead and coordinate the integration of climate, land and biodiversity commitments of the Rio-conventions;
- Foster the establishment of nationally coordinated and well-equipped soil research (central data repository system) to facilitate the continuous monitoring and reporting of SOC as part of NDC progress tracking.

Background and policy nexus

Ethiopia faces tremendous impacts of climate change posing a threat to the environment, the livelihood of its society and the economy (Concern Worldwide, 2022). Agriculture, forestry and other land use (AFOLU) are responsible for the largest share (nearly 80%) of greenhouse gas (GHG) emissions in Ethiopia, while the energy sector only plays a minor part (about 15%) in Ethiopia's emissions (Wang-Helmreich et al., 2019).

Ethiopia has adopted several climate change mitigation and adaptation policies and strategies to reduce greenhouse gas (GHG) emissions since the ratification of the United Nations Framework Convention on Climate Change (UNFCCC) in 1994 (EFCCC, 2021). Some of the policy initiatives include the National Adaptation Plan of Action in 2007, the Ethiopian Program of Adaptation on Climate Change and the Nationally Appropriate Mitigation Actions in 2010, and the endorsement of Climate Resilient Green Economy (CRGE) strategy in 2011, and the Green Legacy Initiative most recently in 2019.

Ratifying the Paris Agreement (PA) in March 2016 (Paris Agreement, 2015), Ethiopia aspired to reduce emissions from all sectors by 64% by 2030 with its first NDC. While the updated NDC in 2021 represents a clear progression in ambition with 68.8% emission reduction target by 2030 (EFCCC, 2021). The Environment Protection Authority (EPA), the former Environment, Forest and Climate Change Commission (EFCCC), is the lead agency for the coordination of Ethiopia's response to climate change and is the national focal point to the UNFCCC. Under the lead and coordination of EPA, key implementers of the CRGE strategy including Ministry of Agriculture (MoA), Ministry of Water, Irrigation and Energy (MoWIE), Ministry of Innovation (Mol), Ministry of Transport and Logistics (MoTL), Ministry of Urban Development and Construction (MoUDC), Ministry of Mines (MoM), and Ministry of Finance (MoF) were involved in the NDC target setting process.

As such Ethiopia's NDC builds on its CRGE (FDRE, 2011) strategy which is also continuing to be one of the key strategic pillars of the 10 Year Development Plan (10YDP).

While it is well recognized that sequestration of soil organic carbon (SOC) is vital to increase the SOC stock and mitigate the impact of climate change (Lal et al., 2021; Abera et al., 2013; Demessie et al., 2016), however, the contributions from SOC are not explicitly addressed in the NDC targets. This policy brief provides insights from eight key informant interviews (KII), who participated in the NDC process either as members of the NDC updating group, working group, or technical group members representing either Ethiopian Forestry Development (EFD), United Nations Convention to Combat Desertification/Land Degradation Neutrality (UNCCD/LDN), MoA, United Nations Development Program (UNDP), and Ethiopian Environment and Forest Research Institute (EEFRI) to identify the challenges and opportunities for integrating SOC into the NDCs.

SOC and the NDCs

The insights from the KIIs clearly indicated the importance and potential contributions of SOC in CCMA. However, the level of contribution of SOC in the NDC targets is not known, nor is there an institution designated for MRV of SOC, under various land use and land cover (LULC) in Ethiopia. This leaves avenue for research and informed decision making for the update of NDC due in 2025. On the other hand, the insights also disclosed potential opportunities including the availability of relevant institutions, even though efforts are fragmented, existing CCMA policies and strategies (e.g., the Green Legacy Initiative) and high interest from national stakeholders that can be best exploited to strengthen the integration of SOC related targets in the NDCs.

NDCs target setting process

In Ethiopia, the NDC target setting process was conducted under the lead and coordination of the EPA guided by a consultant, World Resource Institute (WRI). The process mainly involved stakeholders operating at macro-level such as MoA, MoWIE, MoI, MoTL, MoUDC, MoM, and MoF (line ministries). At the outset, a national technical working group was established to facilitate the NDC updating process. All relevant line Ministries that were mandated for the implementation of Ethiopia's CRGE were engaged to contribute their respective sector targets following terms of reference (ToR), which were eventually combined to become the updated NDC. As such, the NDC target setting process builds on an existing country initiative employing Ethiopia's Green Economy Model (GEM) to project the GHG emission pathways taking into consideration the country's development ambitions during 2020 - 2030. It was also mentioned that the NDC target setting process also involved public consultation with Civil Society Organizations (CSOs), and inputs from development partners (donors) and international institutions (such as WRI). However, the level of inclusiveness of the NDC updating process was not clear. For example, the insights from the KII results disclosed that sub-national stakeholders such as regional forest and environmental protection bureaus were only consulted for their inputs at the later stages of the process during the national consultation and validation processes. It is, therefore, suggested that the NDC updating process planned for 2025 should be improved by involving broader stakeholders at various stages from different institutions, including universities, research institutions and regional bureaus.

Integration of SOC into NDCs

In general, all the respondents agreed that improved land management interventions to enhance soil health and SOC are important. They also indicated that soils across Ethiopia's mixed land use systems and natural forests have a high potential to store carbon, contributing to CCMA. For this reason, SOC was included as part of the updated NDC. However, the level of contribution of SOC in the NDC target is not clear, nor was an institution tasked to monitor SOC in Ethiopia. Therefore, there is a need for establishing an MRV team to properly document the contribution of SOC in the NDCs. This requires the use of appropriate evaluation methodology under various LULC to help apply informed decision making with regards to the integration and contribution of SOC in the NDCs. These insights point into strengthening institutional capability required for effective MRV of the status of SOC to help policy makers fully integrate and account for the contribution of soil to sequester carbon as a pathway to achieve the NDC targets.

Integration of climate, land, and biodiversity commitments

The integration of climate and land related commitments are mainly housed in EPA and/or MoA while the Ethiopian Biodiversity Institute (EBI) is mainly responsible for biodiversity related commitment. The KII results indicated several bottlenecks that constrained the effective integration of climate, land and biodiversity commitments in Ethiopia. These mainly concerned policies (particularly the lack of land use policy and planning), institutional capability (awareness/knowledge, personnel, finance), coordination/fragmentation of efforts and MRV systems. It was suggested that lack of appropriate land use planning has hindered the potential for creating favourable enabling environment for bringing together the land, climate and biodiversity conservation issues at a common platform. The institutions responsible for climate actions are less aware about the impacts of climate change and/or the existing international agreements on CCMA, and have limited capacity to lead, coordinate, monitor and reporting lessons from the integration of climate, land and biodiversity commitments.

Ethiopia developed several strategies and programs to realize its commitments with regards to the integration of climate, land and biodiversity. The country's CRGE strategy that sets attaining a lower-middle-income status with low GHG emission by 2025 is profound (FDRE, 2011). Others include Environmental Policy (EPA, 1997), Forest Development, Conservation and Utilization Proclamation (FAO, 2018a); National REDD+ Strategy (FAO, 2018b); Ethiopian Bamboo Development Strategy and Action Plan (INBAR, 2020); National Forest Sector Development Program (MEFCC, 2018); 10YDP (EUBFE, 2022); Great Green Wall of Africa Initiative (AU, 2007), and Green Legacy Initiative (OPM, 2019). The priority climate actions were mainstreamed into national development planning processes based on the national CRGE guidelines through the establishment of the CRGE management Committee, the CRGE Forum as well as sectoral CRGE units in the line ministries and associated technical working group (TWG) regular meetings.

The respondents highlighted that climate action strategies are often designed based on carbon offsetting projects either through national, regional, and global initiatives. As a win-win strategy, the respondents suggested that the contributions of SOC to NDC targets could be used and best realized through promotion of climate smart agriculture & tree-based landscape restoration. However, despite the fact that soil is the largest terrestrial carbon sink (Scharlemann et al., 2014), lack of capacities to monitor SOC stocks under various LULC and agroecology makes it difficult for carbon offsetting and marketability projects. Other suggestions include the development of agroforestry systems which has the potential to supply the growing demand of wood-based industries while also reducing deforestation of the remnant natural forests, as well as encouraging ecotourism to be considered as climate adaptations options which is not currently recognized in the updated NDC.

Monitoring NDCs progress

The EPA is responsible for coordinating and leading the NDC processes in Ethiopia. Some of the respondents indicated that EPA is responsible for monitoring and reporting SOC as related to NDCs. Yet, others related the responsibility to MoA, while others still make the CRGE implementing line ministries and the Ministry of Planning and Development (MoPD) and/or collectively the Agriculture, Forestry and Other Land Uses (AFOLU) responsible for MRV. In the updated NDC, it is indicated that the MRV and M&E framework will be integrated for each sector (AFOLU), without clearly indicating which institution is responsible for the overall coordination of data collection and reporting on SOC (EFCCC, 2021). It seems there is no as such transparent and systematically organized data collecting, analyses and documentation for SOC in the country. In addition, the methodological limitation in valuing the SOC under various LULC/agroecology and the potential of SOC for carbon offsetting and marketability (as compared to forest tree stands) poses a challenge.

For a successful implementation of NDC, it is suggested to strengthen the physical and technical capacity of national institutions on robust monitoring tools that can assess SOC under the diverse landscapes and land uses across Ethiopia. This may also include investments in laboratory infrastructure and technologies for field level soil health and SOC dynamics monitoring. In addition, suggested technical capacity needs include appropriate technical skills, long and short-term training for staff to conduct state-of-art SOC dynamics monitoring and documentation system (including data repository system).

Status of SOC in the country and key evidence from monitoring

Ethiopia is among the top 10 countries with the highest mitigation potential for SOC in croplands and grasslands. There are some studies conducted in Ethiopia regarding SOC (e.g., Abera et al., 2013; Demessie et al., 2016; Lehtonen et al., 2020). However, as indicated earlier, there remains much unknown regarding the accounting of SOC under various agroecology settings in the country and carbon offsetting and marketability.

Areas of support

Future support is needed to enhance the capacity of EPA and/or other responsible institutions to lead and coordinate inter-sectoral cooperation and stakeholder engagement in NDCs planning processes. In the short term, this includes knowledge of stakeholder engagement and facilitation of multi-stakeholder processes (resource mobilization, alignments and overlaps in policies, strategies, guidelines), climate change analysis, modelling and assessment of GHG emissions to inform the NDC planning process. In the long run, more emphasis should be given to the development of local institutional capacity building which is self-reliant in human and financial capital in planning, monitoring, reporting and documentation to reduce future dependence on external support.

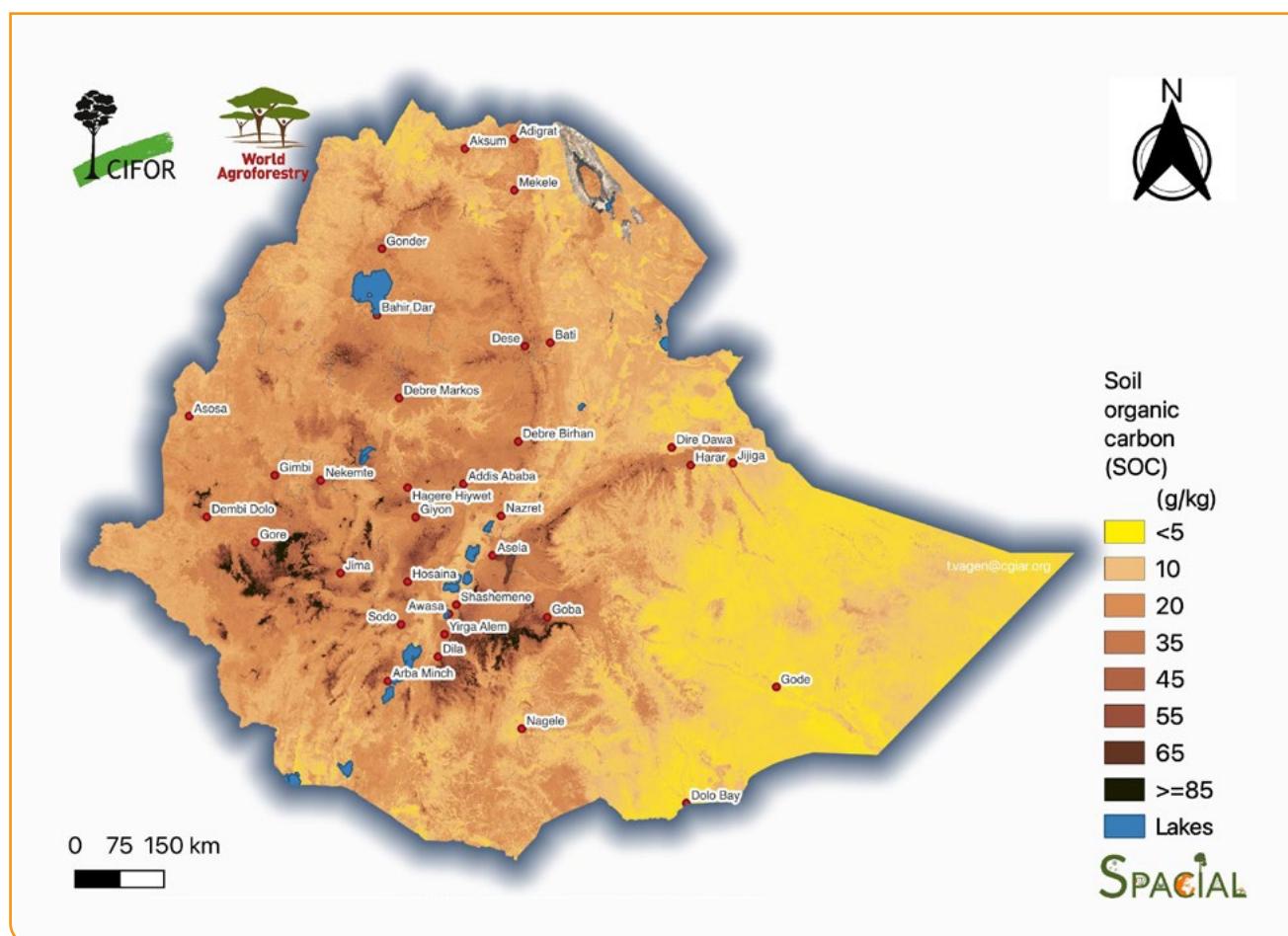
Needed support with regards to the successful integration and implementation of SOC in the NDC activities include:

1. At policy level, first, there is a need for a paradigm shift to agricultural practices that enhance SOC, while also increasing efficiency of external inputs and ultimately reducing expenditures on inorganic fertilizers. Second, there is a need to design and develop supporting policies (e.g., land use policy), and the effective implementation and/or functionalization of the existing policies/strategies on Climate Smart Agriculture & tree-based landscape restoration interventions that enhance the contributions of SOC and NDC
2. Future support on soil health and specifically SOC research is required to quantify SOC stock by LULC types and determining its potential for CCMA. The gap in method standardization for determining SOC across LULC could be a research area on its own.
3. Future research support should also focus on assessing the changes in SOC in areas where land restoration interventions have been practiced and the contribution of these to the NDC targets. However, the NDC planning process should involve Universities and Research Institutes to collaborate and/or establish a research consortium together with other stakeholders like MoA to prioritize research in soil health. Develop projects / program to mobilize resources to enhance SOC and soil health.

Opportunities for collaboration to improve use of soil organic carbon data

Advancements in soil health monitoring have improved the accuracy and accessibility of SOC maps. For example, the [Land Degradation Surveillance Framework \(LDSF\)](#) was developed by EPA in response to a need for systematic landscape-level assessment of soil and ecosystem health. The methodology is designed to provide a biophysical baseline at nested spatial scales across a landscape, covering a range of indicators, from soil properties, land degradation, biodiversity, land cover, and land use, including soil organic carbon. The LDSF method has been applied in over 43 countries, across a number of projects at multiple scales (from farm scale to national level), and the methodology has been widely published in peer-reviewed journals (Vågen and Winowiecki, 2013; Vågen et al., 2013; Winowiecki et al 2016; Vågen and Winowiecki, 2019) Including in Ethiopia, with funding from various donors. Because the LDSF includes a robust analytical framework that builds on field data collection and uses machine learning algorithms and remote sensing satellite data to produce spatial assessments, the accuracy of these maps is above 80%. This allows for the monitoring of changes of these indicators, over time, which is needed when including such variables in NDCs and other policies. The below map is an example of the spatial variation of SOC across Ethiopia, using the global LDSF dataset, at a resolution of 30-m using Landsat 8.

Figure 1: Spatial variation of SOC across Ethiopia produced using the global LDSF database at ICRAF.



References

- Abera, G., & Wolde-Meskel, E. (2013). *Soil properties, and soil organic carbon stocks of tropical andosol under different land uses*. Demessie, A., Singh, B. R., & Lal, R. (2016). Soil carbon sequestration: Ethiopia. *Encyclopedia of Soil Science, third ed. CRC Press, Taylor & Francis, Florida, United States, 2066-2072*.
- AU. (2007). *Great Green Wall Initiative*.
- Concern Worldwide. (2022). *Climate change in Ethiopia: What happened in 2021, and what's the forecast for 2022* <https://www.concern.net/news/climate-change-in-ethiopia>
- EFCCC. (2021). *Updated Nationally Determined Contributions (NDC)*.
- EPA, F. (1997). *Environmental Policy*.
- EUBFE, E. U. B. F. E. (2022). *Ethiopia 2030-The Pathway to Prosperity-10 Years Perspective Development Plan- Ethiopia*. https://eubfe.eu/images/10_year_plan_english_final.pdf
- FAO. (2018a). Forest Development, Conservation and Utilization Proclamation No. 1065/2018. <http://chilot.me>
- FAO. (2018b). *National REDD+ Strategy (2016 - 2030)*. <https://ethiopiareddplus.gov.et>
- FDRE. (2011). *Ethiopia's Climate-Resilient Green Economy*.
- INBAR, I. B. a. R. O. (2020). *Ethiopian Bamboo Development Strategy and Action Plan*.
- Lal R, Monger C, Nave L, Smith P. 2021 The role of soil in regulation of climate. Phil. Trans. R. Soc. B 376: 20210084. <https://doi.org/10.1098/rstb.2021.0084>
- Lehtonen, A., Ľupek, B., Nieminen, T. M., Balázs, A., Anjulo, A., Teshome, M., Tiruneh, Y., & Alm, J. (2020). Soil carbon stocks in Ethiopian forests and estimations of their future development under different forest use scenarios. *Land Degradation & Development*, 31(18), 2763-2774.
- MEFCC, M. o. E., Forest and Climate Change. (2018). *National Forest Sector Development Program, Ethiopia*.
- OPM, F. (2019). *Green Legacy Initiative*. <https://greenlegacy.et/green-legacy/home>
- Paris Agreement. (2015). *Paris agreement. Report of the Conference of the Parties to the United Nations Framework Convention on Climate Change (21st Session, 2015: Paris)*.
- Rose S, Khatri-Chhetri A, Stier M, Wiese-Rozanova L, Dittmer KM, Shelton S, Wollenberg E. 2020. Ambition for soil organic carbon sequestration in the new and updated nationally determined contributions: 2020-2022: Analysis of agricultural sub-sectors in national climate change strategies. Updated October 2022. CCAFS Info Note. Wageningen, The Netherlands: CGIAR Research Program on Climate Change, Agriculture & Food Security (CCAFS).
- <https://cgispace.cgiar.org/bitstream/handle/10568/115887/CCAFS%20Info%20Note%20SOC%202021%20NDCs.pdf>
- Scharlemann, J. P., Tanner, E. V., Hiederer, R., & Kapos, V. (2014). Global soil carbon: understanding and managing the largest terrestrial carbon pool. *Carbon Management*, 5(1), 81-91.
- Vågen, T.-G., Winowiecki, L.A., 2013. Mapping of soil organic carbon stocks for spatially explicit assessments of climate change mitigation potential. *Environmental Research Letters* 8, 015011. doi:10.1088/1748-9326/8/1/015011
- Vågen, T.-G., Winowiecki, L.A., Abegaz, A., Hadgu, K.M., 2013. Landsat-based approaches for mapping of land degradation prevalence and soil functional properties in Ethiopia. *Remote Sensing of Environment* 134, 266–275.
- Wiese, Lies; Eva Wollenberg, Viridiana Alcántara-Shivapatham, Meryl Richards, Sadie Shelton, Susanna Esther Hönle, Claudia Heidecke, Beáta Eموke Madari & Claire Chenu (2021) Countries' commitments to soil organic carbon in Nationally Determined Contributions, *Climate Policy*, 21:8, 1005-1019, DOI: [10.1080/14693062.2021.1969883](https://doi.org/10.1080/14693062.2021.1969883) <https://www.tandfonline.com/doi/full/10.1080/14693062.2021.1969883>
- Winowiecki, L., Vågen, T.-G., Huising, J., 2016. Effects of land cover on ecosystem services in Tanzania: A spatial assessment of soil organic carbon. *Geoderma* 263, 274–283. doi:10.1016/j.geoderma.2015.03.010
- Vågen, T.-G., Winowiecki, L.A., 2019. Predicting the Spatial Distribution and Severity of Soil Erosion in the Global Tropics using Satellite Remote Sensing. *Remote Sensing* 11, 1800. doi:10.3390/rs11151800.
- Wang-Helmreich, H., & Mersmann, F. (2019). *Implementation of nationally determined contributions: Ethiopia country report*.

Acronyms

AFOLU	Agriculture, Forestry and Other Land Use	MoI	Ministry of Innovation
CCMA	Climate Change Mitigation and Adaptation	MoTL	Ministry of Transport and Logistics
CRGE	Climate Resilience and Green Economy Strategy	MoUDC	Ministry of Urban Development and Construction
CSOs	Civil Society Organizations	MoM	Ministry of Mines
EBI	Ethiopian Biodiversity Institute	MoF	Ministry of Finance
EEFRI	Ethiopian Environment and Forest Research Institute	MRV	Monitoring Reporting and Verification
EFCC	Environment, Forest and Climate Change Commission	M&E	Monitoring and Evaluation
EPA	Environment Protection Authority	NDC	National Determined Contribution
FAO	Food and Agriculture Organization	PA	Ministry of Finance
GEM	Green Economy Model	SOC	Soil Organic Carbon
GHG	Greenhouse Gas	TWG	Technical Working Group
LDSF	Land Degradation Surveillance Framework	ToR	Terms of Reference
LDN	Land Degradation Neutrality	UNDP	United Nations Development Program
LULC	Land Use and Land Cover	UNCCD	United Nations Convention to Combat Desertification
MoA	Ministry of Agriculture	UNFCCC	United Nations Framework Convention on Climate Change
MoPD	Ministry of Planning and Development	KII	Key Informant Interviews
MoWIE	Ministry of Water, Irrigation and Energy	ICRAF	World Agroforestry

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The main objective of CA4SH is to improve global soil health by addressing critical implementation, monitoring, policy, and public-private investment barriers that constrain farmers from adopting and scaling out healthy soil practices.

www.coalitionforsoilhealth.org

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About AICCRA

Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA) is a project that helps deliver a climate-smart African future driven by science and innovation in agriculture. It is led by the Alliance of Bioversity International and CIAT and supported by a grant from the International Development Association (IDA) of the World Bank.

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