



Regional Training on Climate-Smart Agriculture, Soil Fertility Management, and Soil Health Monitoring in Eastern and Southern Africa

September 23 – 27, 2024 | PridelInn Paradise Beach Resort | Mombasa, Kenya

Background and Justification

The agricultural sector in Eastern, Central, and Southern Africa is grappling with the impacts of climate change, land degradation, and declining soil fertility. These challenges demand innovative solutions and targeted capacity-building efforts to empower stakeholders with the knowledge and tools necessary for sustainable agricultural practices.

Climate-Smart Agriculture (CSA) practices are vital in building resilient agricultural systems that adapt to and mitigate climate change impacts. A key priority is the urgent need to accelerate the restoration and maintenance of soil productivity and ecosystem functions. This must be achieved alongside leveraging soil health management to advance gender equality. Recognizing the interconnections between soil health and gender equality and identifying gender-based constraints, opportunities, and potential unintended consequences when promoting soil management technologies are crucial.

Moreover, applying a gender-responsive framework to CSA, especially soil health interventions, can guide priority-setting. It is vital to consider the gendered differences in access to resources, such as land tenure security, which directly influence opportunities in soil management. This approach allows for more effective and equitable outcomes in agricultural development.

To address these pressing needs, ILRI, in collaboration with [CIFOR-ICRAF](#) and regional development and research organizations ([ASARECA](#), [CCARDESA](#) and [IGAD](#)), through the [AICCRA \(Eastern and Southern Africa\)](#) and [DeSIRA-Land-Soil-Crop Hubs](#) projects, is launching a comprehensive training program to build the capacity of agricultural professionals across the region. This program will focus on the fundamental concepts of CSA, especially soil fertility management and soil health monitoring, utilizing advanced techniques such as geospatial soil mapping, AI, and machine learning. The training will also integrate gender considerations, including measures to influence policy effectively.



Moreover, given the additional mandate that the regional partners of the AICCRA project have towards compliance with the World Bank environmental and social safeguard requirements. This training will also create a brief space for partners to be updated on the Environmental and Social Commitment Plan (ESCP) for the AICCRA-Additional Financing project. The ESCP outlines the mandatory environmental and social (E&S) measures that must be considered during project implementation to minimize harm to people, the environment, and institutional reputation. Compliance with these measures is mandatory, and it's crucial for partners to understand them to avoid any violations.

Objectives

The program aims to empower participants with comprehensive knowledge and practical skills in Climate-Smart Agriculture, soil health, and fertility management while integrating advanced monitoring techniques, policy advocacy, and gender considerations to effectively promote sustainable agricultural practices at both national and regional levels.

The specific objectives are:

1. **Fundamentals of Climate-Smart Agriculture:** Provide participants with a solid grounding in the fundamental concepts of Climate-Smart Agriculture.
2. **Skills in Soil Health and Fertility Mapping:** Equip participants with the skills necessary for soil health and fertility mapping, monitoring, and integrated management approaches tailored to different agroecological regions.
3. **Advanced Techniques in Soil Monitoring:** Train participants in geospatial soil mapping techniques and the use of AI and machine learning for advanced soil health monitoring.
4. **Policy and Gender Integration:** Facilitate discussions on policy and gender integration to scale climate-smart agriculture practices and soil health management into national and regional agricultural policies supported by appropriate legislation and funding mechanisms.

Target Participants, Partners and Collaborators

The training will target agricultural professionals and researchers from Eastern, Central, and Southern African countries constituting the ASARECA, CCARDESA, and IGAD member states. Partners, Collaborators, and Participants will include:

- The Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA) involving AICCRA and Food Systems Resilience Program for Eastern and Southern Africa (FSRP)



- The Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) involves AICCRA and DeSIRA-land-Soil-Crop hubs projects.
- The Intergovernmental Authority on Development (IGAD) Food Systems Resilience Program for Eastern and Southern Africa (FSRP)
- National Agricultural Research and Extension services
- Universities and academic institutions

Training Content

Topic-1: Basics of climate-smart agriculture

- Climate change, global warming and impacts of climate change on agriculture and food security.
- Climate-smart agriculture practices and technologies for crops and livestock.
- The importance of Gendered CSA technologies)
- Integrating Environmental Risk Management, Natural Resources Management, and Gender Considerations in Climate-Smart Technologies: Strategies for Sustainable Development

Topic-2: Soil fertility and soil health monitoring

Soil health indicators and assessment methods

- Techniques for soil fertility mapping
- Tools for monitoring soil health over time
- Integrated Soil Fertility Management

Principles of Integrated Soil Fertility Management

- Gender-sensitive best practices for enhancing soil fertility
- Case studies and practical applications
- Climate-Smart Rehabilitation of Degraded Lands

Topic-3: Digital soil mapping, including the role of AI and machine learning for soil health monitoring

- Introduction to Digital Soil Mapping, Data Collection Methods, Geospatial Data Integration,



- AI and Machine Learning in Soil Health Monitoring, Modeling and Prediction, Soil Health Indicators,
- Applications of Digital Soil Mapping, Challenges and Limitations, Future Trends and Innovations

Expected Outcomes

1. **Enhanced Capacity:** Participants will gain advanced knowledge and skills in Climate-Smart Agriculture (CSA) and integrated soil management techniques, equipping them to implement these practices effectively in their respective regions.
2. **Gender-Responsive Implementation and Integration:** Participants will use a gender-responsive approach to guide the implementation of climate-smart practices and integrated soil fertility management (ISFM) techniques, leading to more inclusive and effective agricultural practices in their countries.
3. **Improved Collaboration:** The training will foster stronger networks and collaboration among regional agricultural professionals and organizations, promoting knowledge-sharing and joint efforts in sustainable agriculture.
4. **Sustainable Impact:** The region will see long-term improvements in soil health, agricultural productivity, and resilience to climate change due to the undertaking of CSA practices guided by participants in different countries.
5. **Policy Influencing strategies:** Result in a set of policy-influencing actions for further engagement in scaling CSA.

Capacity Building Methodology

The training will utilize a participatory and interactive approach, combining theoretical lectures, group discussions, and multimedia resources, such as YouTube links. Sessions will be facilitated by experts in CSA, soil management, soil health monitoring, gender mainstreaming, environmental and natural resource management, and geospatial soil mapping using AI and machine learning. Integrating gender mainstreaming and policy-influencing dialogue will ensure all participants' comprehensive and hands-on learning experience.



Program Agenda

<i>Time</i>	<i>Topic</i>	<i>Activity/ responsible</i>
Day 1: September 23		
08:30 – 09:00	Registration	ILRI-AICCRA
Topic: Climate smart Agriculture (Co-Led by ASARECA, CCARDESA, IGAD, & ILRI)		
09:00 – 09:15	Welcoming and opening remarks	Dr. John Recha
09:15 – 09:30	Introduction of participants	All participants
10:00 – 10:30	Overview of the training workshop * Mapping expectations of participants	Dr. John Recha Dr. Ermias Betemariam
10:30 – 11:00	Group photo and health break	
11:00- 12:30	Introduction to Climate-Smart Agriculture (CSA) <ul style="list-style-type: none"> • Crops • Livestock, feed and forage • Agroforestry 	Lecture and discussion on climate change and global warming
12:30 – 14:00	Lunch	
14:00 – 15:30	Successful case studies on CSA implementations, Practices and their outcomes Climate-smart technologies in ESA Integrating Environmental Risk Management, Natural Resources Management, and Gender Considerations in Climate-Smart Technologies: Strategies for Sustainable Development	Mapping the CSA experience from the East and Southern Africa regions. Lessons learned from what has worked
15:30 – 16:00	Health break	
16:00 – 17:00	Group discussions on local climate challenges and their CSA solutions	Case studies and interactive session
17:00 – 17:30	Q&A, summary, reflections, and wrap-up session	John Recha



Land Soil Crop
Hubs



AICCRA
Accelerating Impacts of CGIAR
Climate Research for Africa



ILRI
INTERNATIONAL
LIVESTOCK RESEARCH
INSTITUTE



CCARDESA
Center for Sustainable Agricultural Research and Development in Eastern Africa



ASARECA
Transforming Agriculture for Improved Livelihoods



Day 2: September 24

Topic: Soil Fertility Management and Soil Health Monitoring Techniques (Led by Alliance Bioversity International & CIAT and ICRAF)

9:00 – 10:30	Soil Health Indicators and Assessment Methods Why measure soil health?	Lecture and discussions
10:30 – 11:00	Health break	
11:00 - 12:30	Techniques for Soil Fertility Monitoring for Targeting Interventions	Lecture on soil health assessment tools and methods
12:30 – 14:00	Lunch	
14:00 – 16:30	Techniques for Soil Fertility Monitoring for Targeting Interventions Soil oil sampling and basic fertility tests	Lecture and use case examples
	Spatial sampling using remote sensing Defining region of interest (boundary of the project area) Define the sampling method Define sample size (costs, accuracy, and precision) How many samples? Sample allocations	Lecture and demo
	Soil health measurement: Field and laboratory activities Soil sampling, Sample processing, soil laboratory analysis using standard wet chemistry and Infrared spectroscopy techniques	Lecture and examples
	Data analysis and interpretation for targeting interventions Soil health for agronomic gain Integrated soil Fertility management	Best practices and case study discussions
16:00 – 16:30	Tea Break	
16:30 – 17:00	Q&A, summary, reflections, and wrap-up session.	John Recha



Day 3: September 25

Topic: Introduction to Digital Soil Mapping (Led by ICRAF)

09:00 – 10:30	Basics of Geospatial mapping; introduction to GIS, RS and spatial analysis	Interactive sessions and demos
10:30 – 11:00	Health break	
11:00 – 12:30	Geospatial soil mapping techniques; data sources, tools and methodologies	Interactive sessions and demos
12:30 – 14:00	Lunch	
14:00 – 16:15	Using GIS software for soil mapping using open-source GIS (e.g., QGIS, Google Earth Engine)	Interactive sessions and demos
16:15 – 16:45	Health break	
16:45 – 17:00	Q&A, summary, reflections, and wrap-up session	John Recha

Day 4: September 26

Topic: Role of AI and ML in CSA and Soil Health Monitoring (Led by Alliance Bioversity International & CIAT and ICRAF)

09:00 – 10:30	Basic concepts and their applications in agriculture and soil health	Lecture
10:30 – 11:00	Health break	
11:00 – 12:30	Introduction to R programming for data analysis and ML	Lecture and demo
12.30 – 14:00	Lunch	
14:00 – 16:00	Hands-on exercise: implementing simple ML models for CSA and soil carbon data analysis	Individual and/or group assignment
16:00 – 16:30	Health break	
16:30 – 17:00	Q&A, summary, reflections, and wrap-up session.	John Recha



Day 5: September 27

Topic: Policy influencing and gender dialogue (Co-Led by ASARECA, CCARDESA, IGAD, & ILRI)

09:00 – 10:30	<p>Dialogue Facilitate policy influencing dialogue and identify strategies to scale climate-smart agriculture practices and soil health management into national and regional agricultural policies, ensuring relevant legislation and funding mechanisms support these practices.</p> <p>Existing enabling policies, gaps, and policy harmonization:</p> <ul style="list-style-type: none"> Integrating soil organic carbon into Nationally Determined Contributions in Africa: a critical opportunity (soils for climate) Synergies among the environmental goals Soil initiatives for Africa 	<p>IGAD: Sylvia Henga IGAD FSRP Policy and Food Security Expert</p> <p>ASARECA: Julina Barungi</p> <p>CCARDESA: Majola Mabuza APPSA-FSRP Regional Programme Coordinator</p> <p>ILRI: John Recha</p>
10:30 – 11:00	Health break	
11:00 – 12:15	Gender mainstreaming in CSA for improving soil health and Integrated soil Fertility management for agronomic gains	ILRI: Therese Gondwe & John Recha
12:15 – 13:00	Environmental and social safeguard requirements on the AICCRA project.	Alliance Bioversity-CIAT: Adams Kwaw & ILRI: Elizabeth Ngungu
13.00 – 13:30	Closing the event	ILRI: Dawit Solomon
13.30	Lunch and departure	



Conclusion

This capacity-building training on Climate-Smart Agriculture is critical to fostering a resilient and sustainable agricultural sector in Eastern, Central, and Southern Africa. The training will enhance the region's food security, economic development, and environmental sustainability by equipping agricultural professionals with essential knowledge and skills. Additionally, it aims to strengthen the capacity of regional organizations to generate climate-relevant knowledge products that will enhance knowledge networks through a community of practice on CSA, provide an enabling environment for the adoption of CSA technologies by member states- including the provision of enabling environment for policy development on CSA, continuous learning and decision-making tools, and advisory services. Notably, the initiative ensures that at least 30% of participants engaged in capacity development activities are women.

Key references

- CSA 101: your online guide to climate-smart agriculture:
- <https://ccafs.cgiar.org/news/csa-101-your-online-guide-climate-smart-agriculture-now-spanish-and-french>
- FAO. 2019. [Measuring and modelling soil carbon stocks and stock changes in livestock production systems](#) – A scoping analysis for the LEAP workstream on soil carbon stock changes. Rome. 84 pp.
- FAO: Digital soil mapping guide: <https://fao-gsp.github.io/SOC-Mapping-Cookbook/>
- Aynekulu E, Shepherd KD. 2015. Measuring rangeland health and soil carbon in Africa. Milne, E., Hoag, D., Boem R. (Eds), [In Grazing Lands, Livestock and Climate Resilient Mitigation in Sub-Saharan Africa: The State of the Science](#) (pp. 100).
- Aynekulu E, Vagen T-G, Shepherd K, Winowiecki L. 2011. A protocol for measurement and monitoring soil carbon stocks in agricultural landscapes. Version 1.1. World Agroforestry Centre, Nairobi. <https://apps.worldagroforestry.org/soc/index9.html>
- Vagen, T., Winowiecki, L., Neely, C., Chesterman, S., and Bourne, M. (2018). Spatial assessments of soil organic carbon for stakeholder decision-making - a case study from Kenya. *Soil*, 4, 259–266.



- AICCRA Environmental and Social Commitment Plan (ESCP):
<https://cgspace.cgiar.org/items/d26e1bd8-81ac-4682-ab2c-6b39a5241dab>

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