FARA
Forum for Agricultural Research in Africa

CAADP XP4 PROGRAMME

Biennial Africa Climate Smart Agriculture Stakeholders Conference

Proceedings

14th-16th September, 2022

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Section 1: Introduction

The agricultural sector is seen as the prime contributor and the sector to be most affected by climate change, the recent global evil. To mitigate the vagaries of climate change across the globe, a Climate-Smart Agriculture (CSA) framework was developed and well accepted by global leaders, social movements, scientists, and youth and gender groups. The implementation of CSA has gained ground among these stakeholders and other stakeholders within the African agriculture space. The Forum for agricultural Research in Africa (FARA) in collaboration with the Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA), the West and Central Africa Council for Agricultural Research and Development (CORAF), the Association for Strengthening Agricultural Research in East and Central Africa (ASARECA), the African Forum for Agricultural Advisory Services (AFAAS), DeSIRA-LIFT and other major partners jointly organized the 2nd Biennial Africa Climate-Smart Agriculture Stakeholders Conference as part of the Science and Partnership for Agricultural conference.

The central objective of the conference was **Introspection on CSA Action to Strengthen Accountability, Resource Use, and Impact in Africa**. The specific objectives were to discuss and update progress on the state of CSA initiatives and contributions of science; present foresight analysis relevant to CSA and what took place in the last ten years within the continent, to provide direction for action where everyone is involved and included and to foster discussion on policy and advocacy on CSA actions. The conference delivered the following outputs: ***i). The role of digitalization in advancing CSA in the smallholders' systems, ii). the nexus of CSA and the mechanization of the smallholder system in Africa., iii). Bottom-up and system-wide capacity development approaches; to enhance CSA practices, iv). Strengthening the support of extension and advisory services to ensure CSA compliance among smallholder farmers in Africa, v). Advances in CSA technology generation and use in crops, livestock, fisheries, and aquaculture, and vi). Compatibility assessment of agroecology and CSA practices.***

The conference was held from 14th to 16th September 2022 and attracted many stakeholders across the continent and other parts of the globe, with over 500 participants attending physically and about 300 joining on zoom, FARA Facebook page and YouTube channel. The conference featured a three-day packed programme with opening remarks, lead paper presentations and discussions, three commissioned studies and discussions, and a breakout session for research paper presentations on the above six (6) different themes on the first day. The ACSAF plenary was held on the second day and featured paper presentations, panels, discussions, and a field visit.

Goodwill Message from FARA Board Chair, Dr Alioune Fall

The Board chair of FARA, Dr Alioune Fall presented a goodwill message to open the SPAC conference. He welcomed everyone to the conference and expressed his excitement as this conference is coming up at a very good time in the history of African agriculture. is the conference was also timely due to the upcoming COP27; and paved the way for stakeholders in AR4D to contribute to issues that will be discussed at the COP27.

Dr Fall said: "you will agree with me that we have come a long way in confronting the different challenges facing the sector. Indeed, we have had good success and the face of the sector is gradually changing. This is owing to the political will of the leaders of thought at the continental level and the collective will of the technocrats and citizens. The research fraternity that I represent, as the chair of FARA, has been doing a great job in bringing the coalition of actors together to address these issues.

Despite the observed progress, the sector is yet to be at the point we desire, we still have productivity constraints, the predominance of the smallholder system and its inherent economic limitations, and other old constraints. New challenges are also emerging: the new wave of technologies, climate change, push and pressure from social movements behind agroecology, circularity, green revolution and the challenges of the transition, youth population explosion, global problems of fertilizer supply, and so on.
It is obvious that the current challenges need intercontinental partnership and collaboration. We have explored this through the South-South, the North-South, and the North-South-South collaboration. In this regard, the collaboration of the European Union Commission as well as other development partners such as the USAID, BMGF, Australian-AID, DANIDA etc. is enormous. The four initiatives that made this conference are supported by different institutions: the PANAP by DG INTAP, LEAP4FNSSA through Horizon 2020, the KM4AgD, and Biennial CSA by the DeSIRA instrument of the European Commission.

Recent happenings around the globe are confirming our linkages with one another and the strength of our interconnectedness is all that is required to find a sustainable solution. In our world, whatever happens to one country tends to have a ripple effect on all others. The Covid-19 pandemic and the ongoing war between Ukraine and Russia affect the global economy, the fiduciary systems and our food systems. This is a clear indication that no nation can operate in a silo.

Our partnership is a good instrument for mutual learning, the exchange of knowledge and technologies, and for fostering synergies and complementarity. This will help strengthen the strong and help the weak to come to good speed in their craving for development and self-actualization.

The Theme of this conference; "**Introspection on CSA Action to Strengthen Accountability, Resource Use and Impact in Africa**" is indeed thought-provoking. It made me reflect on when the discussion on the issue of climate change started almost three decades ago and how the reality of the projected danger seems to be suddenly hitting us in the face. In the last 27 years or so of CoP annual discussions, resolutions, and actions, what have we done with the various analysis, and what positive changes can we project for the continent? Who is doing what? And what should we be doing to have the Africa we need in alignment with the agenda 2063 that expresses our joint desires as a people?

Let me express my concern about the vagaries of weather in recent years and its devastating effect on agriculture and food security in the different parts of the continent, the growing desertification, the drying of the Sahel, the movement of headers down South and its accompanying social and violent conflicts between farmers and headers and the need for peaceful coexistence. I think that our science and policy fraternity need to run coherent actions to foster the change we need. I have mentioned science

because it holds the responsibility to generate knowledge and technologies as a solution to problems. Policies must drive down the change we need; they must be enforced to bring about the change we need. I think that we need to embrace a bit more of an urgent spirit to birth the change we truly want.

As we deliberate over these three days; let us come up with a clear assessment of the pace of technologies in Climate-Smart Agriculture. Let us be clear on what we want to put on the table as a continent in the upcoming CoP27 and the direction we truly want our food systems to tread. What do we want to do with our knowledge generation and management systems; what advances are we projecting for policy coherence and the emerging New Partnerships for mutual benefit between Europe and Africa?

Opening Speech of the Hon. Minister of Food of Agriculture of Ghana at the Opening Plenary of the Advance 2022: Science and Partnerships for Agriculture conference

Dr Owusu Afriyie Akoto

Your Excellencies, distinguished guests, ladies and gentlemen,

It gives me great pleasure to welcome each and everyone of you to Ghana, our peaceful and beautiful country and to the great city of Accra. Akwaba.

This conference has brought all of us together to deliberate on various issues that affect our agriculture, food, nutritional security, and our national prosperity. Apparently, "we are what we eat", our life and well-being individually and collectively respond perfectly to our food system and by implication, our agriculture.

The central theme of this conference is **"Introspection on Climate-Smart Agriculture (CSA) Action to Strengthen Accountability, Resource Use and Impact in Africa"** which calls for collective thinking on how we have run our agriculture in recent decades. I think this kind of thought will lead us to the point of identification of the gaps in our actions that have resulted in our current condition as a people.

Actions around climate-smart agriculture are topical and I think this is one subject that should be given prime attention to devise a solution that will move the continent forward. I want to thank Her Excellency, the Commissioner for the Department of Agriculture, Rural and Blue Economy at the Africa Union Commission) for her brilliant submission, I equally want to thank other goodwill speakers for their immense intellectual contribution. Recent data on the effect of climate change suggest increasing temperatures and sea levels; changing precipitation patterns and the possibility of more extreme weather that will threaten human health, safety, food security, and socio-economic development in Africa. Predictions for 2024 show the possibility of continued warming and decreasing rainfall, especially over North and Southern Africa, and increased rainfall over the Sahel. The temperature rise will go up to 2^0C beyond the pre-industrial level. The rise in the sea level will go up to 5mm, far beyond the conventional 3-4mm in coastal areas. We already have a serious problem with the degradation of the coastal area in West Africa. Up to 56% of the coastlines in Benin, Togo, Côte d'Ivoire, and Senegal are getting eroded, and this is expected to grow worse. It is obvious that our world will experience the development of a new normal, as the climate will change our production systems, as well as the commodities. The scientific report indicated that the direction of these changes is not very clear, just as the implications on the different variables that define our system. We need to prepare adequately and strengthen the resilience of our agriculture, health, and social system to weather the transition.

Agriculture is reported to be contributing about 20% of greenhouse gas emission, which is the main culprit of climate change, but the eventual effect of the change has the largest toll on the agricultural sector. To combat the negative effect of climate change on the agriculture and food system, we will need to devolve science for the generation of appropriate knowledge and technologies to sustain production. The Food and Agriculture Organization of the United Nations (FAO) has defined Climate-Smart Agriculture (CSA) and clearly indicated the need for adaptation and mitigation efforts. I think our research efforts should help develop adaptation mechanisms to emerging changes in the short run while we will all concurrently work on the creation of living culture and practices that will help mitigate climate change.

We can reduce the adaptation and mitigation action to a few things in a cradle. But I also know that these issues are complicated because they require change in the way things are done, both at the local level and at industrial level. I think mitigation action will demand for a change in the way we live. That suggest a complete change, possibly in the type of technologies we have now, the way our industry work, the type of mineral resources we explore and our day-to-day action. Mitigation of climate change will require effort from all and sundry. More importantly, from all of us that are gathered here, I mean the technocrats, the elites, the policymakers, and most importantly, the scientists.

Scientists will need to come up with new technologies and knowledge that will help produce food and fiber in a sustainable way that aligns with the new climate realities. Possibly, we will need to come up with a new farming system; we will need to come up with techniques that will help us produce more with less external input. We need to develop new varieties, and new livestock breeds that are tolerant to adverse weather conditions and can withstand the vagaries of climate change. I am referring to crop varieties that are heat-tolerant; tolerant to high moisture conditions, and low nutrient regimes that may emerge due to climate change.

Let me intimate you of what the current administration of Ghana is doing around this subject matter. We have put together a strategy to ensure that agriculture in Ghana is climate-smart or compliant with the changes in climate. The goal of this effort is linked to the Sustainable Development Goals; it is to promote sustainable agriculture and thriving Agri-businesses through research and technology development, effective extension, and other support services to farmers, processors, and traders for improved livelihoods. The programme has six important pillars:

1. To promote a demand-driven approach to agricultural development.
2. To ensure an improved public investment.
3. To improve production efficiency and yield.
4. To improve post-harvest management.
5. To enhance the application of science, technology, and innovation.
6. To promote agriculture as a viable business among the youths and to promote livestock and poultry development for food security and income generation.

These six objectives are pursued rigorously with a lot of investment from the current government. Pillar five, which dwells on the enhancement of the application of science, technology, and innovation is intriguing. Under this objective, we have invested heavily in science to ensure that technologies that meet the needs of the farmers are generated. Moving this agenda forward, the government of Ghana has established Sustainable Land Management Projects across the country. These projects are using pivotal instruments, which include capacity development, policy intervention, and generation of technologies. To ensure that lands are used in such a way that we maintain it and be able to generate what we need from the land; but more importantly, to be able to hand over the land to the next generation in a form that will meet their needs. We cannot overemphasize the importance of sustainable land use to our posterity. And I reckon that the issues of land and soil degradation align directly with the issues of climate change. Apparently, the soil is the source and sink of carbon whose chemistry is vital to climate change. This suggest that if we manage our soils very well, and prevent soil degradation, possibly we will be able to significantly control the changes in the climate. We ensure that all our projects, be it research, or development are climate-smart compliant, and this is done using our tracking mechanism and all the other instruments. All regions in Ghana have access to the Sustainable Land Management Protocol that is compliant with CSA, and there is now a conscious effort at the government level to boost the use of organic fertilizer. While mineral fertilizer still has its merit; we are of the opinion, based on science,

that the use of organic fertilizer is a veritable tool to boost the soil's colloidal properties and balanced use of soil nutrients.

I am glad to inform you thhat the effort of the Ghana government towards the goal is yielding very good results. Ghana scored very high in the last African Union Biennial review, which is an indication of our compliance with the agreed continental action and meeting up with the various indicators of the Malabo Declaration. We hope to improve these efforts and keep the nation on a forward move.

The various initiative of the government of His Excellency President Akufo Addo, including the planting for food and jobs; planting for export and rural development are aimed at providing decent livelihoods and quality of life to rural dwellers. It aims at enhancing rural income and significantly improve the contributions of agriculture to food and nutritional security as well as national economic development.

As it relates to the need to reduce carbon emission; the Government of Ghana has established the Tree Crop authority. The role of this authority is to enhance the greening of the country and the provision of carbon sink in the vegetation. A lot of efforts are going on at different layers of government to ensure that we do not decimate our forest nor harvest a tree without replanting. This effort is already yielding good returns in terms of biomass generation and increase of the population of trees in the country. On fostering the transition of our farming systems to a more sustainable model, we are mapping out an approach that will ensure systematic transition to agroecology model without creating a shock in our food system or destroying our agriculture which provides livelihoods to about 40% of our teaming labour force. We are exploring the use of the agricultural innovation system approach to ensure that the capacities of the different stakeholders are enhanced. I would like to inform this audience that the Ghanaian government is not oblivious of the need to take strong action to halt the pace of land degradation on the continent; we have embarked on training farmers on the best practices for sustaining soil management.

Distinguished ladies and gentlemen, as we look at the objectives of this conference, I am excited about the different subjects that form the building blocks of our discussion. These four pillars will drive the delivery of the desired developmental outcomes from our agriculture. The first block is science, we cannot overemphasize the importance of science in our development journey. I reckon that the amount of science we put into use will determine the level of our development. The two key outputs of science, knowledge, and technology are the drivers of development. Distinguished ladies and gentlemen, the transformation we see in our time is intriguing as the use of ICT is fast transforming every sector and we cannot leave our agriculture behind the ICT-propelled development. We need to maximize the benefit from biological advantages, chemical and mechanical advantages to ensure that we move things forward. As this conference will discuss ways to leverage science to generate knowledge and technology, there is the big role that knowledge management will play, and this is also very vital. I also see the role of policy and finally the role of partnerships. It is essential that all these four work together seamlessly to develop African agriculture.

Permit me to speak a bit about the upcoming COP27, which will hold in Egypt in November 2022. I think that as a continent we will need to go to COP27, with a well-defined message, which should address the core issues around climate change on every segment of our national as well as our continental life. I reckon that this conference will be discussing the issues of COP27. As such permit me to put my sentiment on the table for discussion. I think that what is important for COP27 is the need for higher investment in African agriculture. I think it is important that we see agriculture as a pivotal issue in our life as a continent, we also need to see agriculture as a key instrument for our development. What am I trying to say is that our culture is linked to our politics, our agriculture is linked to peaceful coexistence, our agriculture is linked to our cultural values, and our agriculture is linked to our national development. The African continent will need to devise his own unique pathway of achieving agricultural

development; we cannot copy any pathways used by our development partners and be successful. We have ve done this with our economies over the years and it is not working very well for the continent. As we go to COP27, we need to think carefully about what we want to put on the table for discussion. For countries that have petroleum on the continent, and it is currently their sole source of national income; are they going to COP 27 to join the bandwagon of countries that want to stop the petroleum economy? Is that going to work for us? As a continent, we need to think inwards and come up with a position. We need to think carefully about the current productivity level of our agriculture vis-a-vis the use of external inputs in our agriculture, especially fertilizers. Are we going to CO27 to preach a complete ban on fertilizer, when the current average use of fertilizer on the continent is still 17 kilograms per hectare. Meanwhile, in some more developed countries, it is already at 400 kg per hectare. We need to think seriously about the implication of the different decisions we want to take to COP27 on the livelihood of our people and on the quality of life.

Let me close this address on an appreciation note to FARA and its partners for bringing this conference to Accra, Ghana, and drawing the broad group of stakeholders from all corners of the globe to Ghana. I want to thank the development partners for not leaving us alone under our challenging conditions and contributing intellectually and financially to many of the things that were put together at the country level. Once again, I want to welcome you to the beautiful city of Accra. Please feel free to enjoy the hospitality of the Ghanian people, please enjoy it to the fullest. I mean, do intellectual things in this conference, but do not forget also to visit our markets where you will find assorted goods that meet your needs and show the beauty of our culture. Thank you once again. On this note, distinguished ladies and gentlemen, I declare this conference open. Thank you.

Keynote Address

H.E Jeanine Milly Cooper, Minister of Agriculture, Liberia

Excellencies, distinguished guests, ladies and gentlemen,. It is a great honour for the Republic of Liberia through me to speak to you alongside this illustrious panel of experts, scientist, and global leaders of thoughts.

I convey warmest greetings from His Excellency President George Manneh Weah to the government and people of the Republic of Ghana and to the organizers of this SPAC 2022. Thank you for your hospitality.

Returning to Accra for me was quite nostalgic yesterday. I was sitting in the VIP lounge at the Kotoka International Airport and I could not help but reflect on my last time here when I was part of the United Nations mission for Ebola emergency relief in 2014. Ghana's actions in hosting and facilitating the lifesaving mission during a period of devastation in the affected countries can be appreciated enough. But in thinking back to those days and times I'm reminded of the myriad challenges for my country Liberia, only a few years emerging from the terrible civil war. Faced with a deadly pandemic, which prompted our agricultural hundreds of our farmers died and thousands of our farming families are still impacted by that shock.

A few years later, I put aside my UN career and joined my compatriots to develop the rice industry and by extension, the agricultural sector in Liberia. From the perspective of a private sector operator, if there is a value chain that epitomizes the challenges of doing agricultural business in Africa, it will be the rice value chain in Liberia. Rice is Liberia's staple food, and we have the highest consumption per capita on the continent, yet we do not produce enough rice to feed ourselves.

The President advised me to do for Liberia, what I did with my company; a challenge to foster the transformation of agriculture in Liberia! This came barely three weeks after he commissioned me as the minister.

My country like most of the world, went through the COVID lockdowns and so I had not even met all of the staff in the ministry or even gotten to know the sector; the broader agricultural sector, and there we were faced with the sheer vulnerability of our food systems that depend heavily on the outside world. We were worried about disruptions in the agricultural input supply chains, and for some of constrained by the inability to export our produce as many countries were locking down their port. Liberia agriculture is no different from that of many African countries.

Production is largely at the subsistence level, and 70 to 80% of our rural populations are engaged in agriculture or agricultural livelihoods. Forty percent of our national GDP is derived from agriculture; we are challenged with low-yield production systems without regard for our demographic patterns. Currently, the youth constitute the majority of our population, yet they are less and less involved in agriculture and our women who are the backbone of our agriculture are disempowered. Our extension and advisory services are suboptimal with a ratio of one public extension officer to 35,000 farmers. In this context, Ebola, Climate, COVID and Conflict (E3C) with the constellation of limited funding and growing external debt increasingly restricting our progress along the path of national growth. It is challenging to transform the sector under these conditions.

And you know Excellencies, distinguished guests, ladies, and gentlemen, this is a common decimal in the development of most African countries. In Liberia, people keep celebrating the progress of Ghana, you often hear "see Ghana, Ghana is doing this and that," and my fellow minister has just indicated that

Ghana agriculture has grown in five years from 3.4% to 8.4%. “Look at Sierra Leone, Sierra Leone gone. See Nigeria how they are producing rice on the line. Why can’t Liberia be like that?”

The simple answer is that Liberia can, and we are willing to roll our sleeves and make it happen, first by taking stock not just of the challenges, which get overwhelming, but also of the assets and benefits that we have going forward. Many of the projects in the portfolio that I inherited as Minister of Agriculture were designed to overcome the challenges that we face. I reckon that a project approach to development feels like drinking soup with a fork, it is frustrating to our goals to say the least.

Often, energy and money are spent on defining problems, redefining problems and admiring them, studying them, researching them, and coming up with the same findings. Then we are apt to design solutions that are rarely comprehensive and usually limited in geography, scope, timing, and impact. Many of our development partners know what I am talking about. We will select six counties out of our 15 and say this is what we are going to do this year, and the other ones are left behind. We are going to say we are only going to focus on the cocoa value chain, and the other ones are left behind. You cannot really impact development using this approach.

As such, the government of Liberia has ignited the current transformation of our agricultural sector through several positive interventions which are starting to yield results. The first was defining the broad policy areas that needed attention and committing ourselves to an intentional focus on our agricultural priorities. Focus on agribusiness and commercialization models was one part of the solution. Looking at enabling factors such as access to finance, low rates of cultivation, low yields, high post-harvest losses, and limited markets; we must consider all of these. At the same time, we were heavily involved in two very important processes of COVID riddles in 2021. The global food system Summit was held in September and COP26 was held in November. Both events highlighted the importance of holistic approaches on working on multiple fronts at the same time; to deliberately design interventions to consider not only improving agricultural productivity but do the same in a climate-smart way, and simultaneously focus on the environment, food security, nutritional sufficiency and meeting the SDGs.

Transformation of agriculture is not just about agriculture, so we looked at what we have in the agricultural sector and looked for those enablers and catalysts for our agricultural transformation. We are working on building our agri-food systems using climate-smart agriculture to sustainably increase productivity and food security. Liberia contains more than half of the remaining upper Guinea forest, which is considered as the third chamber of the lungs of the world. It is also the West Africa's most important carbon sink and the most important biodiversity hotspot.

The valuation of our natural capital is more than $35 billion and with a carbon sequestration rate of more than 16 billion tons per year. Our greenhouse gas emissions are so low that our entire country's emissions are less than some country’s per capita emissions. Here is Liberia with all this wealth, we are still struggling to feed ourselves despite the fact that our climate portfolio is among the best in the world. Apparently, we will not meet any of the SDGs. So my initial thoughts about climate- smart agriculture were a skeptical question. CLIMATE-SMART for who? SMART, why and how? Because the heavy pollution as we heard is caused by global agri-businesses is not our experience; that is not in Liberia, or most parts of Sub-Saharan Africa. When I see some of the climate-smart solutions such as regenerative agriculture, in western countries, regenerative agriculture, it looks just like my farm and other farms in Liberia. It is another way to say shifting cultivation, which is what we do. When I hear the European Commissioner say that the EU wants to increase the number of family farms from 27% to 35% of their farming, that's great.

For us, the Liberian equivalent of family farms is what we call smallholders. That's the majority we had passed 25%; we are at 70 to 80%. I do not think we are talking about the same thing. So, if commercial agriculture and big farming have grown using chemicals and fertilizers that harm the planet and its people and we have. We in Liberia and many of us in Africa have avoided the use of these same chemicals and fertilizers. We barely mechanize our farming, and we have so few manufacturing plants. How much do we need to change the way we do agriculture in order to be climate-smart?

So, for us in Liberia, we determine the transformation of our agricultural sector in such a way that our traditional systems are not undermined, rather enhanced to be more productive. Mechanization at smallholder level using systems of aggregation of outputs for markets and sharing of inputs such as tractors and ploughs and simultaneously addressing the problems of youth unemployment, and women disempowerment; that seems to me like Africa Climate-Smart Agriculture. We look at our serious lack of mechanization, that is probably the greatest impediment to greater yields, and farm outputs. We need systems that are suited to our farm sizes and our rolling topography in Liberia. These machines and machinery would almost be exclusively operated by the youth. You do not see old folks there, young men mainly getting terrain-appropriate mechanization will attract more people to all farms, raising their incomes and raising also our food production. Using machinery and digitalized solutions is another youth magnet that will almost immediately impact the amount and quality of food that we produce. I think that is climate-smart for us. I am also amazed at how little innovation we actually applied to finding solutions to improve the lot of women in agriculture.

First thing in Liberia as a means of increasing their incomes, we are just creating more work for them, and we are now being more intentional about how we work with women in agriculture. For example, in my house, I have a food processor and a cold coffee mill that can process food in seconds rather than having to beat it in mortar for hours. I have a machine to dry fruits and vegetables; I have a vacuum sealing machine that I can safely package and store food. I have solar panels and running water, so I don't have to come from the farm with good yields and worry about losing them, since I have the machines, modern conveniences of course. There is no reason why rural women, women farmers cannot improve their lives and livelihoods with conveniences such as that. In fact, our cocoa queens as they call themselves are already fermenting and drying and producing fine flavored cocoa beans. With that kind of conveniences, they are already experimenting with innovations such as stainless-steel tops for fermenting rather than wood and other traditional methods. Our cereal producers are already using household size cassava graters and parching pens to ease the work of gari and fufu production.

So, the Ministry of Agriculture is planning to partner with UN women and IFAD and other partners to shift our capacity support for women further along the value chain, not just at the planning stage. But all of the other things that make up our food system, how can we ease the burden of women and improve their livelihoods and lives? We are looking to develop household and village level tools and equipment that will help improve productivity and production and reduce food waste. This is value addition that raises income, improves nutrition and reduces food loss and that is climate-smart for us. Organic production is another strength even if it is gained through long years of being unable to afford the yield boosting chemicals. We have innovative companies working on certified organic production not just on the plantation, but 30 communities that harvest the fruits wild palm tree that are growing (organically) in the forest. This not only adds value to the palms but also fetches higher prices on export markets. We have LFPI a new entrant which is going to turn an all-oil palm plantation into Africa's largest organic certified RSPO, Roundtable Sustainable Palm Oil for the people. While devoting more than half of its total production for environmental and biodiversity conservation purposes. We can do this and with almost 19% of our landmass (1.8 million hectares) considered degraded by environmentalists. We have room to explore nature-based solutions for carbon sequestration including agroforestry and tree crop reduction

and we have long history in Liberia with tree crops for food and livelihoods, and reforestation that removes carbon from the atmosphere, mulching and other practices that enhance soil carbon enhancing productivity in agro-food crops that grows up on trees. These are climate-smart for us.

Finally, Excellencies, distinguished guest, ladies, and gentlemen we cannot afford to theorize CSA to be anecdotal for us. Our lives depend on the kind of transformation that we make happen in our agri-food systems.

Climate, COVID, and conflicts have taught us that we cannot remain perpetually vulnerable to shocks in global supply chains no matter what the case. Self-sufficiency is a must but the kind of partnership at this conference, between scientists, researchers, innovators, and those who will apply that research and those innovations is the way to go. We must deploy and employ the best research now than at any other time in the history of Africa. We must pilot the innovations to try out the good ideas and keep looking to improve our triple bottom line of people, planet and prosperity. Thank you very much.

Section 2: Lead Paper

Advancing Climate-Smart Agriculture in Africa: Progress and Outlook

***Bruce M. Campbell*,**

Clim-Eat, Global Center on Adaptation, & University of Copenhagen

Abstract

Climate change is impacting, and will increasingly impact, rural livelihoods and food systems throughout Africa. The concept of climate-smart agriculture (CSA) was coined about a decade ago, and since then there has been an exponential increase in publications and reports on CSA. CSA has also achieved much in policy processes in Africa. Many countries now have climate-smart profiles, climate-smart investment plans or have references to CSA in their Nationally Determined Contributions (NDCs). CSA has informed multiple policy processes and shaped billions of dollars of investment. However, much still needs to be done on climate change adaptation. Based on current efforts, SDG2 on zero hunger will not be achieved. African countries are also not on track to achieve their own Malabo targets. Annual finance flows to adaptation are billions of dollars lower than the lowest cost estimates for near-term climate change. Improving enabling conditions and governance for climate change adaptation is crucial for success and for driving more private sector investment. Two key technologies are likely to be important in driving development and in enhancing resilience: digital agriculture and solar irrigation.

Introduction

The recent report from Working Group II (WG II) of the International Panel on Climate Change (IPCC) makes it clear that climate change is impacting, and will increasingly impact, rural livelihoods and food systems throughout Africa (Trisos et al., 2022). Many negative impacts will hit production systems, such as reduced yields, rising livestock mortality, increased pests and disease, heat stress on animals and agricultural workers, loss of agricultural assets through floods and cyclones and areas going out of production. But there will also be impacts on broader food systems and on livelihoods: rising food prices and price shocks, lower and more variable farmer incomes, increased level of uncertainty associated with rural livelihoods, increased food insecurity and malnutrition, reduced economic growth, migration, and conflict.

In response to climate change, the concept of climate-smart agriculture (CSA) was coined around 2010. Rather than seeing this as a specific technology, Lipper et al (2014) argue that CSA is an approach for transforming and reorienting agricultural systems to support food security under the new realities of climate change. CSA needs to promote coordinated actions by farmers, researchers, private sector, civil society, and policy makers towards climate-resilient and low emissions pathways. It is recognized that the solutions are highly context-specific and must be tailored to specific agro-ecologies and specific farmer profiles. CSA identifies synergies and trade-offs among food security, adaptation and mitigation and uses these to inform policy and practice in response to climate change.

Climate-smart agriculture studies and reports

Scholarly articles and reports on climate-smart agriculture have shown a rapid increase since the coining of the term, both globally and for Africa. If one searches Google Scholar, nearly 4000 articles that mention CSA and Africa were published in 2021 (Figure 1). While many of these have perhaps limited information, the degree to which the term is in common usage is indicated by the large numbers. The

CGIAR programme on Climate Change, Agriculture and Food Security (CCAFS), running from 2009-2021, also popularized the term through its research and action. Content from CCAFS was disseminated globally across 35 thousand URLs from 10000 unique domains from more than 150 countries (Carneiro et al., 2020). It is estimated that CCAFS ideas have reached nearly 60 million people.

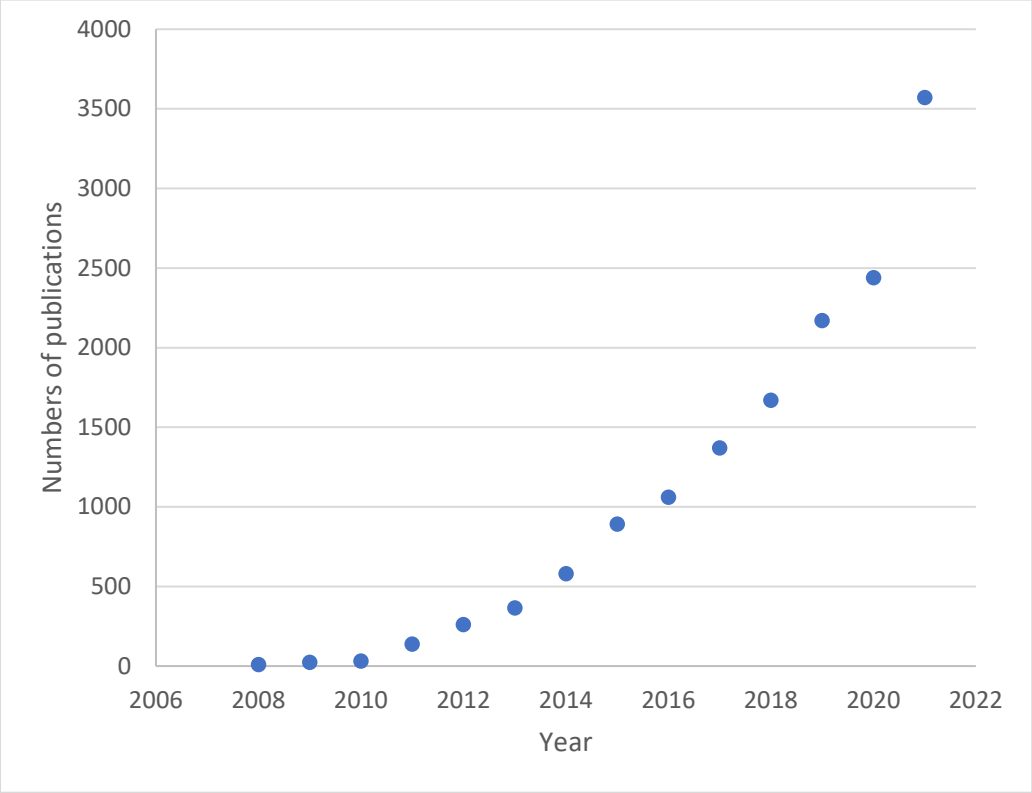

Figure 1. Numbers of publications in specific years with the words "climate-smart agriculture" and "Africa", as shown in the Google Scholar search.

Climate-smart agriculture in policy processes

Climate-smart agriculture has achieved much in policy processes. National climate-smart profiles have been prepared for many countries globally, including 16 in Africa. These describe the agricultural system in the country and the climate change challenges, and then go on to identify solutions and financing options (Sova et al., 2018). The profiles have been instrumental in facilitating investments and actions in countries, such as in Kenya where the Kenya profile and subsequent work at county level shaped a USD 250 million climate-smart agricultural programme.

Climate-smart investment plans (CSAIPs) have been developed for at least 10 countries in Africa, mostly by the World Bank and the Adaptation of African Agriculture (AAA) initiative. CSAIPs identify concrete actions governments can take to scale CSA through investments and policy design. They also help countries in developing and updating Nationally Determined Contributions (NDCs) and National Agriculture Investment Plans (NAIPs). In Zambia, the CSAIP recommends focusing on crop diversification, commercial horticulture, agroforestry, and infrastructure to reduce post-harvest losses. In Zambia and Zimbabwe, the CSAIP helped shape the NAIPs, while in Lesotho the CSAIP informed the design of a USD 50 million smallholder development project.

Globally, 32 countries, including 40% of LDCs, explicitly refer to CSA in their NDCs, and many others refer to elements of CSA. The NDC explorer tool states that "climate-smart agriculture is at the core of countries' climate ambitions to end hunger." Twenty-two African countries explicitly refer to CSA for their adaptation actions while 9 of them refer to it for mitigation actions (Richards et al., 2016).

CCAFS, probably one of the largest efforts to incentivize CSA uptake, recorded 70 national policy wins in its last two years of operation (Carneiro et al., 2021), and it was estimated that in its last five years it informed more than 3.5 billion USD in climate-related investments (Kristjanson, 2020). This included CSA projects in Niger and Africa, digital advisory systems, climate information systems, climate-smart livestock developments, drought tolerance initiatives etc.

There are a number of critiques of CSA; with calls for more attention to scaling up, greater focus on gender and social inequalities and more attention to the political economy. The literature does tend to be focussed on technologies rather than social and institutional issues (Bezner Kerr et al., 2022).

Current adaptation efforts are insufficient

Total emissions from Africa (for all sectors) are extremely low – 9% of the global total, compared to 44% for Asia and the Pacific and 24% for developed countries (Dhakal et al., 2022). Thus, climate change adaptation is the priority in Africa. In this regard, much still needs to be done, as highlighted by the IPCC WGII report (e.g., Trisos et al., 2022).

What predominates now is autonomous adaptation by farmers. This includes changing planting dates, switching livestock breeds and crop types, selling labour, reducing consumption and temporary migration (Ziervogel and Parnell, 2014; Jiri et al., 2017). This autonomous adaptation attempts to deal with short-term challenges – through coping – and is highly unlikely to reduce vulnerability in the longer term. IPCC WG2 makes it clear that based on current efforts, SDG2 on zero hunger will not be achieved.

African countries are also not on track to achieve their own targets (Gosling et al., 2022). For the Malabo agreement there is only a single country (Rwanda) on track to achieve the goals and targets. Nineteen other countries are classified as progressive.[1] Overall, the continent is not-on-track to meeting the Malabo goals and targets by 2025.

Lack of resilience in Africa, and its vulnerability, is indicated by the numbers requiring humanitarian assistance. Between 2015 and 2019, an estimated 100 million people in the Horn of Africa and eastern and southern Africa required assistance due to climate-related food emergencies (Trisos et al., 2022). In these cases, it is children and pregnant women that experience disproportionately greater adverse impacts.

Considering National Adaptation Plans (NAPs), by 2020 only three countries in Africa appeared to have implemented a monitoring and reporting system, and only one had published a NAP evaluation, indicating that adaptation efforts are not on track (Leiter, 2021).

Countries need to step up planned adaptation actions. However, annual finance flows to adaptation are billions of dollars lower than the lowest cost estimates for near-term climate change, and more finance commitments in the 2014-2018 period were debt than grants, adding to the debt burden of countries

[1] Countries are considered 'on-track' if their total score is equal to or higher than the benchmark of 7.28; or 'progressive' when their score is 5-7.28; or 'not-on-track' if their score is <5.

(Trisos et al., 2022). As far back as 2009 at the 15th Conference of Parties (COP15) of the UNFCCC in Copenhagen, developed countries committed to mobilizing USD 100 billion per year by 2020 for climate action in developing countries. By 2020, some 83 billion was being mobilized, c. 15% short of the goal (OECD, 2022). In the period 2016-2020, only 33% of the committed funds were relevant to adaptation and of the adaptation portion only about 20% went to the agriculture sector. Countries are also not meeting their own financial goals set in the Malabo agreement, with only one country on track to meeting the goal by 2025 (Gosling et al., 2022).

It is not only total funding that is limited, but also the capacity to access and use funds. For example, an analysis in 2017 showed that Africa has the highest percentage of rejected proposals going forward to the Green Climate Fund (GCF) (Trisos et al., 2022). Of the overall climate funding committed, only half has been disbursed, indicating capacity constraints in implementation, and further increasing the finance adaptation gap. In the 2017 analysis of the funding received from the GCF, much went towards readiness preparation – this needs to shift to implementation. The GCF also made a commitment to fund National Adaptation Plans (NAPs). However, four years after the decision to fund NAPs, only six African countries had completed their NAPs.

The WGII report of the IPCC makes a strong case that enabling conditions and good governance of climate change adaptation are crucial for success (Trisos et al, 2022; Bezner Kerr et al., 2022). Current governance has been characterized as incoherent and fragmented, with poor stakeholder participation, lack of community agency, gender inequalities, unaligned development and climate agendas, elite capture of climate governance systems, etc.

The way forward

The CSA concept and all the research and development and policy initiatives that focus on CSA have had a major impact on the course of development in Africa. However, much still needs to be done. CSA practitioners should give more attention to social inequity, policy processes, gender and governance (Bezner Kerr et al., 2022). This will make CSA more responsive to those most vulnerable to climate change and will help build an enabling governance framework for climate action. Enhanced governance should see greater alignment between agricultural development and climate agendas, reduce elite capture of climate governance systems, reduce the hierarchical and complex nature of state bureaucracies, promote stronger subnational institutions, and stimulate greater degrees of coordination (Trisos et al., 2022).

An enabling governance environment is also needed to attract more private sector investment. While public sector investment in climate adaptation needs to be stepped up, the private sector is likely to be the route to a steep change in finance (OECD, 2022). Although many adaptation projects have low returns on investment, the food sector in Africa could be worth one trillion dollars by 2030 (Byerlee and Haggblade, 2013) and urbanization will mean a further 200+ million persons to feed in African urban areas by 2030. This also highlights the importance of aligning agricultural development efforts with climate change initiatives.

Two key technologies are likely to be important in driving development and in enhancing resilience: digital agriculture and solar irrigation. Climate-informed advisories are crucial for decisions farmers will need to make regarding field operations. Bbut these need to be timely and context-specific (in relation to local agro-ecological and weather conditions, and farm assets). Digital technologies can deliver such

information, as well as being packaged with other services (e.g. credit, insurance, market information, scheduling mechanisation services etc.). But vast populations lack access to basic digital technologies (FAO, 2020). Barriers include limited infrastructure in rural areas, insufficient funding for agriculture, and inadequate investment in research and development, agro-innovation, and agricultural entrepreneurship (FAO, 2020).

Irrigation is seen as one key means to build climate-resilience, especially as Africa is only at one third of the global average in terms of cropland irrigated and there is plenty of research demonstrating that sustainable irrigation area can be greatly expanded. One study, focussing on only the drylands in Sub-Saharan Africa, suggests that there is potential for an expanded irrigated area of 6–14 million hectares (ha) (Xie et al., 2018). For success, this would need to go hand-in-hand with greater availability and accessibility to rural infrastructure such as roads, storage and credit and to agricultural inputs.

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Section 3: ACSAF Plenary

Commissioned Study 1

Foresight: Plausible futures of Climate Smart Agriculture (CSA) in Africa – A Systematic Review

Dr Nasiru Taura

Abstract

With growing interest on Climate-Smart Agriculture (CSA) in Africa, numerous studies have examined its implication for African agriculture. However, we still lack a holistic understanding of plausible futures of CSA in Africa. Given the significance and relevance to the future we want for Africa, this study utilises a desk-based exploratory systematic review and analysis to identify research gaps from published literature, to develop a summary of the current state of research on CSA plausible futures in Africa. Using a comprehensive systematic secondary search of 'the Science Direct' to identify, map, and analyse the most relevant articles, the study conducted an analysis of prior publications of CSA in Africa. The studies identifiedvarious foresight frames but mainly focused on planning and scenario frames, while the critical, and transformative frames – appeared to be under-utilized in our continuous search for a plausible future explanation of CSA in Africa. The study also identified some selected CSA best practices across the African continent suggesting the limitation for development in silos and calling for more collective intelligence through learning from our best practices. The study also notes the limited application of industry 4.0 for CSA in Africa, perhaps due to low absorptive capacity. Finally, the study identified some emerging CSA critical success factors necessary for developing a plausible future in Africa, namely the need for more training (awareness & capacity building), gender and youth mainstreaming, accommodating the voice of the smallholder farmers, and going beyond socio-economic barriers to encompass the analyses of relevant CSA policy instruments in Africa. The study concludes with a set of five (5) propositions with clear implication to technical and public policy options for plausible futures of CSA in Africa.

Key words: Foresight, Plausible Futures, & Climate Smart Agriculture, Africa

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Commissioned Study 2

Strategies for Continuous Development of CSA Technologies in Africa

Prof. Tunde Ajayi

Abstract

A literature study was carried out to answer some questions as to why there should be strategies for continuous development of climate-smart agriculture (CSA) technologies in Africa. CSA was developed by FAO and its goal is food security and development while three objectives for achieving this goal are productivity, adaptation, and mitigation (FAO 2013a and Lipper et al. 2014). As a result of the importance and attention given to CSA, several alliances have been formed and many institutions involved in CSA in Africa (Williams et al, 2015). Monitoring and evaluation framework has been found to be important for accountability framework for CSA research but needs to be backed up by a reporting system. Gender inequality is reported to hinder adaptation to climate change, including the adoption of CSA strategies and based on empirical study the average female share of labour input into crop production in Africa is 40%, which is substantially less than the previous quoted 60-80%. In agricultural production. CSA has proven to be sustainable and can increase smallholder farmers' living standards. A policy incentive is important to CSA as a positive significant correlation was found between incentives provided to farmers and their willingness to adopt CSA technologies (Shittu et al, 2021). Many CSA strategies/technologies have been tested in Africa and are found to be promising and different from other technologies as they focus on climate change, have outcomes, synergies, and trade-offs, and create new funding opportunities (IFAD, 2011). However, despite the development of CSA technologies, wide-scale adoption remains problematic in Africa as there are hardware and software barriers (Barnard et al, 2015). The climate finance landscape in Africa features many different funding channels with different objectives and eligibility criteria but financing for CSA needs to be scaled up considerably. However, to meet the challenges of climate change, agricultural production and food systems need to undergo a profound transformation to continuously produce more sustainable CSA technologies.

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Commissioned Study 3

10 Years Analysis of Africa's Progress on Climate Change/ Decadal Plan for ACSAF

Dr Genevesi Ogiogio

Durban+10 Synthesis Report: Africa's Policy Actions, Lessons and Recommendations in the Implementation of Agriculture Sector Decisions of UN Conference of Parties, 2011-2021

***Citation: Ogiogio, G**. 2022. Africa's policy actions, lessons, and recommendations in the implementation of agriculture sector decisions of UN Conference of Parties, 2011-2021. FARA / DeSIRA-LIFT*

Executive Summary

This is the executive summary of the Durban+10 Synthesis Report on the United Nations Conference of Parties (COP) deliberations and decisions adopted at the Summits held over the period 2011-2021 (COP17 in Durban, South Africa from 28 November - 11 December 2011, and COP26 held in Glasgow, Scotland over the period 31 October - 13 November 2021). The report reviews and analyses COP deliberations and decisions and assesses related policy actions by African countries and the international community. It points to somewhat weak and inadequate commitment to agriculture and sustainable food systems as a global community and the need to address this imbalance in future COP Summits starting with COP27 at Sharm El-Sheikh, Egypt on 6-18 November 2022. As host country for COP27, Egypt has indicated the need for prominence for agriculture and food systems issues.

Summary of the issues: The deliberations at the COP Summits over the past decade from COP17 - to COP26 have provided only tangentially for issues on agriculture and food systems. Climate activists and observers have been pungent and harshly critical that the COP Summits have so far failed to raise to prominence the role of the agriculture sector in meeting Paris Climate Change Agreement despite the fact that the sector is the second leading contributor to climate change after energy. In the same vein, COP decisions have not made significant dent on the strength of policy responses to agriculture issues. Nonetheless, it must be recognized that COP17 brought agriculture into negotiations and launched the Green Climate Fund (GCF), COP21 (Paris Climate Conference, 30 November-11 December 2015) launched the Nationally Determined Contributions (NDCs) that have featured adaptation and mitigation measures on Agriculture, Forestry and Other Land Use (AFOLU), COP22 (Marrakech, Kingdom of Morocco, 7-18 November 2016) brought about Adaptation of African Agriculture (AAA), while COP23 (Bonn, Germany, 6-17 November 2017) was a pathbreaking summit. It launched the Koronivia Joint Work on Agriculture (KJWA) under Fiji presidency and mandated the United Nations Framework Convention on Climate Change (UNFCCC) Subsidiary Body on Technical and Scientific Advice (SBSTA) to deliberate on the KJWA roadmap and present a report to COP26. And at COP26 (Glasgow, Scotland, 31 October - 13 November 2021) a number of organizations in the agriculture and food systems value chains made commitments to halt deforestation in their supply chains.

These are important developments from the COP Summits that have influenced policy decisions and collective actions on agriculture and sustainable food systems and security on the continent and globally. All African countries today have updated NDCs with robust agriculture measures, a growing number are implementing climate-smart or resilient agriculture policies, strategies and programmes. Green growth and recovery strategies and plans are in place, and the African Union Assembly has adopted the African Union Green Recovery Action Plan (AU GRAP) 2021-2027 and the AU has also launched the African Union Climate Change and Resilient Development Strategy and Action Plan 2022-2032. Major international development partners including the UN, G7, World Bank, EU/EC, USAID are at the forefront of initiatives to help respond to climate change induced agriculture and sustainable food systems challenges on the African continent. Some of these interventions are not necessarily linked to COP decisions, but more to a wider global call for decisive actions on agriculture and sustainable food systems.

Based on the survey conducted among stakeholders on issues relating to the COPs and agriculture, a number of findings emerged. The level of awareness of COP decisions on agriculture and food systems is good, but knowledge of influence of specific COP is weak, which points to inadequate composition of country teams and the need for pre-and post-COP briefings and information sharing at country level. COP meetings have influenced CSA capacity building and strengthening programmes as well as policy. They have not however had impact in influencing the development of gender-sensitive CSA framework, policy and support systems, among others. Effectiveness of COPs on agriculture and sustainable food systems is rated fair and thus not very impactful over the past decade.

The survey findings also pointed to key issues that national stakeholders felt should be tabled by negotiators at COP27. Prominent among these are access to climate finance, capacity building and strengthening, private sector engagement, access to technologies as well as support and incentive systems, effective early warning systems for farmers and gender-responsive CSA frameworks.

As regards improvements that national stakeholders would like to see in COP decisions on agriculture and sustainable food systems in order to meet climate change goals and targets, the survey brought up some findings. Prominent among these are the need for support for negotiation, capacity building for developing countries, the desirability for UNFCCC subsidiary bodies (SBSTA and SBI) to prioritize issues in agriculture within their present mandates and more effective support to developing countries, enhanced assistance to mitigate GHG emissions in the livestock sector while enhancing carbon sinks and promoting additional tools for assessing and monitoring effectiveness of adaptation interventions, participatory green technologies development and collaborative research.

As regards what do not seem to have worked very well with COPs on issues of agriculture and sustainable food systems over the decade, national stakeholders expressed views, which ranged from inadequate sustained engagement all through the year from one COP to the other, absence of continental stocktaking prior to the next COP, inadequate promotion of locally-tested technologies, a need to ensure better composition of country teams to include senior technocrats,

especially at Director level as currently a number of them have never participated in COPs and a need for them to have adequate first-hand information of COP processes, procedures and outcomes.

With regard to what has worked very well for countries' participation in the COPs, respondents to the survey were of the view that a number of these needed to be maintained and further enhanced. Among these is the fact that all countries are invited to the COPs, a feature that is seen as worth preserving. Also is the practice of holding preparatory meetings by various regions. Efforts by the COPs to mobilize climate finance for developing countries and assist in developing context-specific solutions that are country-driven are seen as key strong points of the COPs.

Conclusion: Based on the foregoing, in conclusion, this report expresses the view that it is fair to say that there have been considerably enhanced policy responses to the needs of the agriculture sector since the NDCs were launched. This, however, does not mean commensurate flow of resources to agriculture and food systems. Neither have they been the direct impetus for the adoption of CSA in countries. In fact, the agricultural financing gap in many African countries surpasses government budgets and funding currently available from the international development community. Climate finance flows from multilateral development banks to the agriculture sector in Africa increased from US$433 million in 2015 to US$2 billion in 2018 and then declined to over US$1 billion in 2020[2].

COP meetings have influenced CSA capacity building and strengthening programmes as well as policy. They have not however had an impact in influencing the development of gender-sensitive CSA framework, policy, financing and support systems, among others. Effectiveness of COPs on agriculture and sustainable food systems is rated fair and thus not very impactful over the past decade.

On the whole, there is generally a felt need for the COP summits to do more on agriculture and food systems. It is about putting sustainable agriculture and food systems on the core agenda for negotiations, plenary decisions and financing of responses to challenges reflected in continuing climate change induced losses and damage to Africa's agriculture and food systems. On this, attention will be on COP27 at which the onus will be on Africa to demonstrate leadership in putting agriculture and food systems on the agenda and ensuring a robust decision on programmes and financing, as well as appropriate institutional arrangements for future negotiations as the mandate of UNFCCC subsidiary bodies (SBSTA and SBI) on the KJWA comes to an end.

Recommendations: Based on the foregoing, this synthesis report recommends the following:

1) If COP17 brought agriculture into negotiations, COP22 launched the Adaptation of African Agriculture (AAA) and COP23 the KJWA and mandated the SBSTA and SBI to consider

agriculture, Africa must go to COP27 with a clear-headed position and a solid footprint on climate-resilient agriculture and sustainable food systems. This should go far beyond traditional position paper to concrete programmes and financing requirements for climate-resilient transition in the sector. Africa must put forward its requirements for just transition in the agriculture sector.

2) Africa should push for the establishment of a dedicated UNFCCC Subsidiary Body on Developing Countries and Agriculture and Food Systems. The current two SBs are overstretched and their mandate on KJWA has come to an end. Nothing concrete has been delivered on the KJWA programme.
3) There is a need for improved composition of country teams attending the COPs. Provision should be made for participation of senior technocrats, especially at the level of Directors of key sectoral ministries and agencies.
4) Country-level pre-and post-COP meeting briefings should be encouraged to share information and knowledge of outcomes and follow-ups.
5) There is need for the development of CSA policies, strategies, financing and support systems to be gender sensitive. The COPs over the decade have had little to no impact on gender-responsiveness of CSA practices.
6) Subsequent COPs and national policy responses should focus on climate finance, capacity building and strengthening, private sector engagement, access to green technologies, gender-responsive CSA support and incentives systems and collaborative research.

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Commissioned Study 4

Africa Climate Smart Agriculture Implementation Plan (2022-2032) ***In the Context of the African Union Climate Change and Resilient Development Strategy and Action Plan, 2022-2032***

Citation: Ogiogio, G. 2022. Africa's policy actions, lessons, and recommendations in the implementation of agriculture sector decisions of UN Conference of Parties, 2011-2021. FARA / DeSIRA-LIFT

Executive Summary

This is the executive summary of the decadal Africa Climate Smart Agriculture Implementation Plan (CSAIP) 2022-2032. It is an input for the operationalization of aspects of the African Union Climate Change and Resilient Development Strategy and Action Plan 2022-2032. The CSAIP is a framework for African countries, Regional Economic Communities (RECs) and other development stakeholders as they seek to implement their climate-smart or resilient agriculture (CSA) policies, strategies, programmes, financing and support systems in response to the devastating and unabating impact of climate change on agriculture and sustainable food systems on the African continent.

The CSAIP proposals are inputs and programme offerings for CSA policies, strategies, programmes, financing and support systems as well as institutional frameworks for governance, management and financing arrangements in the effort to promote transition to CSA practices across the African continent. These proposals will evolve over time in the implementation of the FARA broader Africa Climate-Smart Agriculture Framework (ACSAF). CSA options integrate traditional and innovative practices, including agroecological practices, technologies and services that are relevant for particular location, are sustainable, economic and environmentally sound. There is no consensus as to what set of practices constitutes CSA.

Aim and Objectives of the CSAIP: The aim of this CSAIP is to provide a continental framework for the implementation of the CSA priorities of the African Union climate change strategy 2022-2032 and the climate-resilient agriculture pillar of the African Union Green Recovery Action Plan (GRAP) 2021-2027 as well as to facilitate implementation of regional strategies and national CSA programmes. A CSA strategy needs to be aligned to other strategies on issues of food security, land degradation and biodiversity loss, among others. In essence, the CSAIP is not limited to

serving simply as a technical resource for the two African Union strategies but provides interventions and guidance to direct country-level engagements. The specific objectives are to:

a) Facilitate development of CSA policies, strategies and programmes in countries that have yet to embrace, adopt and transition to CSA practices.
b) Provide direct support to countries in the development of national CSAIPs and transition plans in the form of development of CSA investment plans.
c) Assist countries with undertaking institutional and policy reforms that are conducive for transition from conventional to CSA practices.
d) Lead, in collaboration with African Union organs and agencies and other major regional and continental organizations, the development of capacity building and strengthening programmes for the integration of climate change considerations into agriculture in Africa and sustainable food systems transformation programmes and the effective implementation of national CSAIPs.
e) Guide the development of appropriate means of implementation, including financing arrangements, for CSAIP implementation at country and regional levels.
f) Assist countries to establish CSA stakeholders consultative, knowledge and information sharing platforms for the dissemination of CSA best practices, advancing proposals on performance-improving reviews of policy requirements and institutional architectures for sustained transition from conventional to CSA practices.

State of CSA And Priorities of the CSAIP: To assess the present position of CSA practices on the African continent, including what is working and what is not, as well as gender issues and also, determine priorities for the CSAIP, the development of this plan involved a continental survey of national stakeholders, development partners and various actors working on CSA, agriculture and sustainable food systems.

Present Position: The present position on the continent is that more than 60% of African countries that responded to the survey questionnaire have CSA strategy and stakeholders' consultative platforms, while 50% have CSA policy frameworks. Only 25% of the countries, however, have CSA Investment Plans, 38% have CSA capacity building and strengthening programmes and CSA implementation support systems for farmers. The weakest areas of CSA adoption and implementation are in CSA gender frameworks, cost estimates for transition from conventional to CSA practices, capacity to estimate the expected level of GHG emissions reduction that CSA practices would bring about in a country. Only 13% of the countries had positive responses to these. What this means is that African countries need support for CSA policy framework, capacity building programmes, CSA investment plan and the development of CSA gender-responsive framework. Capacity for estimating GHG emissions in the agriculture sector needs to be developed in all African countries. The present situation depends too heavily on international consultants and is untenable.

Feedback from 80% of African countries points encouragingly and strongly to the evidence that CSA is currently widely practiced across the African continent. The most widely adopted practice is the use of improved seeds or new varieties of crops cultivars/ self-fertilizing/ climate-ready-and-resilient crops that are tolerant to extreme temperatures, droughts, floods and salinity, among others. This CSA practice is followed progressively by conservation agriculture and rangeland and pasture management through rotational grazing and improved forage, rainwater harvesting, and improved animal breeding and genetic selection for feed efficiency. This range of CSA practices is being undertaken by 70% of the respondent countries. It is worthy of note that some 60% of the respondent African countries practice alteration in land-use pattern, crop diversification and rotation or intercropping, integrated farming, integrated pest management and manure management. Only about 50% of the countries are, at present, investing in CSA practices involving integrated nutrient management, changes in planting times (changing cropping seasons), application of resource-efficient technologies, feed management, as well as relying on better weather forecasting and early warning systems. This needs rapid upgrading.

The implications are quite clear. CSA is widely practiced in Africa. What Africa needs is a comprehensive CSA implementation plan geared towards addressing each and every country's specific needs in the efforts to transition from conventional to CSA practices. The transition is not a case of "one size fits all".

Priorities: In response to the issue of countries' priorities in the launch of a Continental CSAIP, about 90% of African countries had as their highest priority the need to develop well-funded national incentives systems for transition to and adoption of CSA practices as well as ease of access to CSA technologies and innovations. This score is followed by the need for the development of CSA capacity strengthening programmes; the development and continuous enhancement of CSA national support systems; development and operationalization of an effective CSA national stakeholders' consultative and knowledge-sharing platform; development, institutionalization and enforcement of a national gender-sensitive or responsive framework for CSA policy, strategy and national support systems as well as access to CSA knowledge and information. These had a respectable score of 78%. Technical knowledge and models in GHG emissions estimation were considered critical by 67% of the responding countries. The same percentage or number of countries would like support in developing or updating their CSA Investment Plan and enhancing CSA financing arrangements. Slightly above 50% of the respondent countries worried about knowing the cost of transition from conventional to CSA practices.

What is Not Working Well: Survey results indicated that the following, among others, are not working adequately on CSA implementation:

1) Limited access to appropriate gender-sensitive technologies and innovations.
2) Poor technology transfers, especially to rural farmers. Interventions should target Africa's rural farmers by supporting emerging or building on the concept of *Lead Farmers* that can be used as pilots and later to inspire others.
1) Inadequate policy incentives to attract more farmers to participate in CSA practices.

2) Government's inability to harmonize CSA messages across all players including NGOs.
3) Inadequate climate finance for improved investment for CSA adoption, especially by smallholder farmers. Climate finance is central to the success of CSA transition and adoption.
4) Ineffective adoption and implementation of existing National CSA Investment Plans as guiding national framework documents.
5) Absence of effective continental CSA platform for fact-finding and lessons learning among countries on implementation.
6) There is a need to ensure CSA policy and strategy are in place for a country to guide the roll-out of a CSAIP.
7) There is a need for Government entities, especially Ministries of Environment, Climate Change and Agriculture, to work together in national synergy to facilitate implementation of CSA initiatives.
8) There is a lack of appropriate policies in some country context and climate finance to scale and speed up programmes for the expansion of utilization of newly released adaptable seed varieties of crops to combat droughts and diseases.
9) There is a need to allocate land to farmers to develop ranches for pastoral farming to minimize cattle headers-crop farmers conflicts arising from cross-border movements of cattle headers, which lead to the destruction of farmlands, crops and lives of farmers.
10) CSA adoption and transition need a variety of human and institutional capacity building and strengthening interventions in countries among stakeholders (public and private sector, NGOs, farmers, farmers organizations, extension service providers, research institutions, etc.). Weak institutional framework at the level of governments needs to be strengthened.
11) Bottlenecks in accessing funds from the Green Climate Fund and other Climate Investment Funds should be addressed as a matter of urgency.
12) There is a need for modification of labour-intensity of equipment to facilitate participation by different groups of farmers, especially women.

In addition to the foregoing, national stakeholders would like to see the following addressed by the CSAIP:

1) Financial constraint hindering effective implementation of conservation agriculture[3].
2) A need to step up soil, water catchment survey and analysis in selected areas of agro-ecological zones.
3) A need to significantly increase the introduction of drought, diseases and pests resistant crop varieties in marginal lands.
4) The CSAIP should set up a continental knowledge-sharing platform on CSA practices.

[3] For instance the Participatory Integrated Climate Services for Agriculture (PICSA) as well as the Lesotho Machobane Farming System need to be rolled out in all the districts of the country.

5) The CSAIP should provide for protection, improvement and use of some of the most indigenous farming systems on the continent so as to preserve important genetic resources, such as edible wild crop relatives that are likely to be at risk.
6) The CSA Implementation Plan should provide for a robust capacity building and strengthening programme that improves the effectiveness and efficiency of all institutions involved in CSA policies, strategies, practices and programmes.

What is Working in CSA Practices: From the national stakeholder survey, it was abundantly evident that some policies, strategies and programmes are working very well for farmers in CSA transition and adoption. Among these are the following:

1) Introduction of government support facilities for farming-land preparation and provision of extension services to farmers, especially small-holder farmers.
2) Improvements in biomass production and organic matter composting for commercial use.
3) Improvements in weather early warning systems and services with increased community integration for enhanced feedback and early actions.
4) Emergence of multi-stakeholder platforms and integration for improved harmonization of CSA implementation.
5) Increased adoption and intensification of conservation agriculture and its promotion through government programmes[4].
6) Involvement of increasing number of stakeholders, sectors and actors in the shaping of CSA policy, strategy and programmes.
7) Improvements in policies that support climate smart and conservation agriculture in terms of information dissemination and capacitation of most vulnerable members of communities, low-income households, indigenous people as well as small-holder farmers.
8) Development of CSA Practices Application Training Manual for agriculture colleges and extension services providers.
9) The use of *lead farmers* approach or model to pilot initiatives. The approach should be reinforced as it allows quicker adoption of conservation agriculture.
10) Growing investment in crossbred heifer, given very high demand.

Gender Issues in CSA Transition and Adoption: The national stakeholder survey showed that gender issues have not been given appropriate and adequate attention in the conception, development and implementation of CSA policies, strategies, programmes, financing as well as national support systems and services. Respondents strenuously stressed that gender

[4] See for instance Zimbabwe's Pfumvudza programme supporting about 2million vulnerable households in maize, sunflower, soya beans, small grains production. The crop intensification production programme has resulted in high rates of adoption since farmers get inputs support in the form of seeds and fertilizers with extension services being provided by the government.

mainstreaming is very weak in terms of outreach by institutions, and strongly recommended, among others, that:

1) Forums dedicated to addressing gender issues in the implementation and management of CSA policies, strategies and programmes be set up at national, regional and continental levels.
2) Land access for women, youth and the disabled needs to be improved considerably.
3) Participation of women and youth in CSA policy, strategy and programme development and implementation should be stepped up significantly.
4) Access to finance for women and youth in CSA implementation needs urgent attention. Ease of access to finance especially by rural women for farming and CSA adoption is particularly pressing.
5) National CSA investment gender targets be introduced, and performance assessed regularly, possibly quarterly and annually.
6) A need to promote CSA interventions that provide for time-saving techniques and technologies, especially for women and for the youth who need to be enticed into agriculture.
7) A need to reform laws, norms, policies and practices that continue to perpetuate gender inequalities. This is particularly the case with customary laws and practices, which adversely affect women and constrain their effectiveness and productivity in agriculture.
8) A need for the CSAIP to address the development of tillage systems that are friendly to women and reduce drudgery and labour-intensiveness through mechanization. For example, conservation agriculture involving the preparation of holes is excessively labour intensive.
9) Development of gender-sensitive CSA technologies and innovations should be stepped up. New and improved tools and technologies should consciously take into consideration the differentiated role of women in agriculture.

Key Components and Programmes of the CSAIP: Responses from the national stakeholder survey pointed to areas of priority needs, which range from country to country depending on the extent of ongoing CSA practices and resource support. The consolidated list of proposed areas consists of the following:

No.	**Table 1a: Stakeholder Responses on CSA Areas of Need**
1	Expansion and strengthening of the Participatory Integrated Climate Services Agriculture (PICSA) model
2	Upscaling of Conservation Agriculture/Tillage
3	Upscaling and enhancement of Farming Systems like the Machobane Farming System
4	Development and implementation of CSA gender sensitive framework for climate-smart agriculture policy, strategy, programmes, financing and national support system
5	Development of national institutional capacity for determining and monitoring cost estimates for transition from conventional to CSA practices in each and every African country

6	Building and nurturing technical capacity for determining and assessing expected level of GHG emissions reduction that CSA practices will bring about in African countries adopting such practices
7	Provision of support for the development of National CSA Investment Plan with the possibility of replacing NAIPs with CSAIPs
8	Development, institutionalizing and enhancing national CSA support systems
9	Building capacity and participating in the development and promotion of enhanced access to CSA technologies and innovation systems
10	Providing support for the development of CSA policy, strategy and programmes as per country's need
11	Enhancement of access to CSA technologies and innovations by all farmers, especially smallholder farmers
12	Encouragement of rainwater harvesting for irrigation
13	Development, implementation and monitoring of policies and strategies for institutionalizing grazing-land practice for livestock management
14	Vast expansion of provision of borehole water facility, especially in drought-stricken areas and generally in rural farming communities as part of social adaptation programmes
15	Encouragement of the CSA practice of integrated land use management system peculiar to each ecological zone in each African country
16	Integration of non-timber forest products (NTFPs) with annual cropping farming practices
17	Promotion of restoration and management of wetlands and integration of aquaculture

Based on the foregoing, the priorities of the CSAIP are as follows:

No.	**Table 1b: Emerging CSAIP 2022-2032 Priorities and Areas of Intervention**
1	Conduct of Country Readiness Assessment Survey for the integration of climate change considerations into agriculture and food systems and CSA transition (including review of agriculture sector mitigation and adaptation measures in the NDC)
2	Development/update of climate-smart agriculture policy
3	Development/update of climate-smart agriculture strategy
4	Development/update of climate-smart agriculture investment plan
5	Development of climate-smart agriculture capacity building and strengthening programmes
6	Development/enhancement of climate-smart agriculture financing arrangement
7	Development/enhancement of climate-smart agriculture support systems
8	Development of climate-smart agriculture national stakeholder consultative and knowledge sharing platform
9	Development of gender sensitive framework for climate-smart agriculture policy, strategy and support system

10	Access to climate-smart agriculture knowledge and information
11	Access to climate-smart agriculture technologies and innovations
12	Training on models for estimating GHG emissions in the agriculture sector and vulnerability assessments - exposure, sensitivity and adaptive capacity
13	Cost estimates for transition from conventional to climate-smart agriculture practices
14	Expected level of GHG emissions reduction that climate-smart agriculture practices will bring about in the country
15	Development of financing arrangements for the cost of transition from conventional to climate-smart agriculture practices
16	Design of incentive systems for transition to or adoption of climate-smart agriculture practices
17	Development of climate-smart agriculture research and innovation systems at national, regional and continental levels

In the implementation of these priorities, existing farming systems and practices will be strengthened and enhanced. While the responses to the stakeholder survey, which provided most of the inputs for the articulation of the CSAIP priorities only tacitly indicated the fundamental importance and role of agroecological farming systems and practices in the expansion of CSA across the African continent, this CSAIP will vigorously support CSA transitions that encourage agroecological farming systems and practices beyond conservation agriculture and other current intensification systems and practices. Appropriate gender-responsive policy measures, financing initiatives and incentives, as well as institutional and governance arrangements will be strongly encouraged to facilitate CSA transitions that promote the salient features of agroecological farming systems and practices particularly diversity, synergies, resilience, circularity and recycling and co-creation and sharing of knowledge (Box 1). CSA agricultural systems and practices under this CSAIP will need to protect the environment, biodiversity, nature-based processes, efficient utilization of natural resources and ecosystems, while enhancing productivity, incomes, livelihoods and health and preserving diversity of food traditions and culture.

Box 1: The CSAIP 2022-2032 and Agroecological Farming Systems and Practices

What is agroecology? It is not a particular farming system. Rather, it is a variety of farming practices that protect the environment, promote biodiversity, nature-based recycling processes and preservation of natural ecosystems, while enhancing agricultural livelihoods, productivity and incomes and preserving culture and food transitions and promoting health, among others, in support of CSA transitions and in response to climate change challenges. Agroecological practices combine and build on traditional knowledge with science for continuous improvement and innovation. Its practices are context-specific due to diversity of local knowledge and agricultural landscapes, culture, food traditions and practices.

As FAO noted, agroecology is not a new intervention in agriculture. It has been practised over the years in various dimensions since the 1920s[5]. It has a number of distinguishing features[6]. Among these are the following:

1) Diversity[7] of species, crops, genetic resources, etc., through farming systems and practices that conserve, protect and enhance natural resources, biodiversity, and ecosystems. Examples of such farming systems are agroforestry for vertical diversity; intercropping for spatial diversity; crop rotation for temporal diversity, diversity of livestock breed in livestock management systems, integrated farming systems such as mixed crop-livestock or crop-fish farming systems, among others.
2) Synergies in diversified agricultural systems that combine annual and perennial crops, livestock and aquatic animals, trees, soils, water and other components on farms and agricultural landscapes to enhance complementarities in the context of climate change. For instance, with about 15% of nitrogen[8] applied to crops coming from livestock manure, this points to benefits from mixed or integrated crop-livestock farming systems.
3) Resilience, as agroecologically diversified agricultural systems have better capacity to recover from shocks and disturbances, which include extreme weather conditions, floods as well as resist pests and diseases attacks. The community of interacting organisms tend to self-regulate pests and diseases outbreaks.
4) Circularity and recycling in the agriculture sector – agricultural systems that espouse agroecological practices imitate natural ecosystems and therefore support biological processes that drive recycling of nutrients, biomass and water within production systems.
5) Efficient use of resources resulting from diversity, synergies and natural recycling processes, among other practices:
6) Co-creation and sharing of knowledge through participatory processes that provide for shared knowledge that is context specific.

In addition, but not exclusively, agroecology promotes culture and food traditions in farming systems and practices, human and social values as well as responsible governance of the agriculture sector.

[5] FAO argued that "Agroecology is not a new invention. It can be identified in scientific literature since the 1920s, and has found expression in family farmers' practices, in grassroots social movements for sustainability and the public policies of various countries around the world. More recently, agroecology has entered the discourse of international and UN institutions". See FAO, Ten Elements of Agroecology – Guiding the Transition to Sustainable Food and Agricultural Systems (undated).

[6] These elements emanated from FAO regional seminars on agroecology (op. cit)

[7] As pointed out by FAO (op. cit), "increasing biodiversity contributes to a range of production, socio-economic, nutrition and environmental benefits. By planning and managing diversity, agroecological approaches enhance the provisioning of ecosystem services, including pollination and soil health, upon which agricultural production depends. Diversification can increase productivity and resource-use efficiency by optimizing biomass and water harvesting".

[8] See FAO, op. cit. Also, FAO observed that in Asia, integrated rice systems combine rice cultivation with the generation of other products such as fish, ducks and trees. By maximising synergies, integrated rice systems significantly improve yields, dietary diversity, weed control, soil structure and fertility, as well as provide biodiversity habitat and pest control.

In the implementation of this CSAIP, efforts will therefore be made to embed the foregoing features or elements in countries' implementation plans for the cultivation of the enabling policy, financing and institutional environment for the operationalization of agroecology. They will also provide the basis for planning, monitoring and evaluating CSA transitions to ensure agroecological compliance or friendliness.

In essence, to transform agriculture and food systems effectively and sustainably, agroecological practices will need to be mainstreamed into current and future farming systems. They provide a desired response to high-external input, resource-intensive agricultural systems that have caused massive deforestation, water scarcities, biodiversity loss, soil depletion and high levels of GHG emissions. Agroecology is therefore a key response to climate change challenges in agriculture.

It is to this end that this CSAIP will reinforce agroecological systems and practices using CSA as the intervention framework.

CSAIP Expected Outputs and Outcomes: The expected outputs and outcomes of this CSAIP include the following:

Table 2: CSAIP 2022-2031 Expected Outputs and Outcomes

No.	Performance Areas 2022-2032	Expected Outputs 2022-2032	Expected Outcomes 2022-2032
1	Development of CSA policies, strategies and programmes in countries that have yet to embrace, adopt and transition to CSA practices	Expanded CSA practices in 55 African countries and 8 AU-recognized RECs	Effective governance and management of CSA policies, strategies and programmes
2	Support to countries in the development of national agricultural transition plans in the form of CSAIPs and CSA investment plans	CSAIPs and CSA investment plans in 55 African countries and 8 AU-recognized RECs	All countries on the path of climate resilient transition in agriculture and sustainable food systems National investment programme for coordinated funding for CSA adoption and transition
3	Assistance to countries to undertake institutional and policy reforms that are	55 African countries and 8 AU-recognized RECs with enhanced institutional	Improved and responsive policy and institutional environment for CSA transition and practices

	conducive for transition from conventional to CSA practices	and policy environment for CSA practices	
4	Leading, in collaboration with AU organs and agencies and other major regional and continental organizations, the development of capacity building and strengthening programmes for the integration of climate change considerations into Africa's agriculture and sustainable food systems transformation programmes and the effective implementation of national CSAIPs	Enhanced capacity in 55 African countries and 8 AU-recognized RECs for integration of climate change considerations into agriculture and food systems and CSA practices	Sustained reform and adoption of agricultural transformation policies and strategies with integrated climate-change and gender-sensitive considerations
5	Guiding the development of appropriate gender-responsive means of implementation, including financing arrangements, for CSAIP implementation at country and regional levels	55 African countries and 8 AU-recognized RECs supported with innovative financing strategies and means of engagements for effective implementation of their CSAIPs and CSA investment plans	Improved access to finance and support infrastructures for CSA investment plans and smallholder farmers, especially women and the youth
6	Assistance to countries to establish CSA stakeholders consultative, knowledge and information sharing platforms for the dissemination of CSA best practices, advancing proposals on performance-improving reviews of policy requirements and institutional architectures for sustained transition from conventional to CSA practices	Shared knowledge, information and skills for 55 African countries and 8 AU-recognized RECs on CSA best practices and avoidable pitfalls	Ease of access to new knowledge and information services by policymakers and all categories of farmers, especially the majority of rural farmers (through channels including smart technologies and Apps)
7	Facilitation of development of national and regional innovation systems for climate-smart agriculture and food systems	National and regional innovation systems and institutional frameworks developed in 55 African countries and 8 AU-recognized RECs in aid of continuous improvements in CSA practices	Capacity within African countries and regions for continuous improvements and innovations in the integration of climate change into agriculture and food systems

			Strong link between CSA research and innovation-driven expansion of CSA practices and adoption

CSAIP Delivery Modalities: These will be through sensitization of African countries, regional bodies and other stakeholders, development partners supporting agriculture and sustainable food systems to tools and instruments for CSAIP implementation at continental, regional and national levels. The modalities will consist of the following, among others:

a) Organization of regional roll-out workshops for member states and regional bodies. These will be held in each of the regions.
b) Presentations and engagement with countries requiring direct support for application of the CSAIP framework in coherence with other strategies for food security, biodiversity loss, soil and water management.
c) Integration of the CSAIP into the broader AU climate change strategy and green recovery implementation frameworks.
d) Engagement of development partners for inclusion of the CSAIP in their agriculture and food systems support programmes for Africa.
e) Facilitation of the development of continental means of implementation for countries to transition to CSA from conventional agriculture.
f) Assignment of roles and responsibilities to members of CSA national platforms, especially the private sector, NGOs and farmers organizations to lead specific aspects of the national CSAIP and CSA investment plans[9].
g) Facilitation of an effective, responsive and representative composition of CSA teams at national level to provide for groups that are most vulnerable to climate change, the smallholder farmers, fisher communities, pastoral and agro-pastoral communities, women and youth.
h) Encouragement and facilitation of efforts by governments to ensure that CSAIPs are developed at subnational levels, especially at local government or communities' level in support of village and district levels participation in CSA planning process, transition and adoption[10].

[9] Development and implementation of CSA policies and strategies are too public sector centric. There is a need to assign roles to non-governmental organizations beyond mere consultations to lead implementation of aspects of the plans.
[10] This is already the practice in some countries like Rwanda where all 30 Districts (local administrative entities) usually develop their own District Development Plans building on national sectoral targets. Districts, therefore, have some autonomy to domesticate these national targets according to local conditions and priorities. More specifically, each district responds to the national targets according to the existing opportunities and challenges within their own districts. For example, a rural district with relatively higher land availability and having issues of increasing droughts will have to prioritize the climate-resilient agriculture actions as set by the Rwandan Government's Strategic Plan for Agricultural Transformation 4 (PSTA4), covering the period of 2018–2024.

i) Alignment of CSAIP with all ongoing initiatives and programmes of development partners at continental, regional and national levels and their working groups or task forces.

CSAIP Governance and Management: The application of this CSAIP framework requires established governance and management institutional framework at country level. Depending on each country's circumstances, such arrangement will be expected to include the following, among others:

a) A dedicated, well-staffed and equipped organizational structure within the Ministry of Agriculture or agency with responsibility for CSA. The composition and functions of the structure will be determined based on institutional needs assessment to determine requirements for effective operation and high-level performance.
b) A national stakeholders' platform for harvesting ideas and innovations for continuous reform and improvement of policies and programmes.
c) Production of an annual report of CSAIP performance will be expected. The reports will be consolidated to generate regional and continental level reports.
d) Establishment of a knowledge hub to profile CSA implementation and provide access to performance reports. These will be consolidated by FARA across the continent. The knowledge hub will also offer knowledge services to countries.
e) Creation of appropriate Apps for real-time access to knowledge and information by farmers seeking guidance in languages that are accessible.

Means of Implementation of CSAIP: The implementation of this CSAIP will be at national and regional levels. Domestication will therefore be the responsibility of each country. This could be facilitated by development partners, NGOs and agencies operating at country level through interventions, which include capacity building and strengthening programmes across the CSA value chains. This plan proposes the following financing arrangements for CSAIP implementation:

1) Creation of a dedicated country level CSA fund.
2) Establishment of a dedicated UNFCCC Subsidiary Body for Developing Countries, Agriculture and Food Systems.
3) Ring-fenced funding and improved allocation of resources under the Green Climate Fund, Global Environmental Facility and Climate Investment Funds for CSA transition and adoption in Africa.
4) Reform of domestic financial sector to ease access to resources for CSA transition and practices.
5) Prioritization and incentivization of private sector investment in CSA.
6) Offset of debt with national carbon credits for countries with repayments made to national Emissions or Green Transition Funds that will provide for the proposed dedicated CSA Fund to support immediate adaptation programmes in areas severely affected by droughts.

7) Regular presentation of the CSAIP in investment forums to support mobilization of financing for countries' CSA investment plans and programmes.

Monitoring, Evaluation and Reporting on the CSAIP: This CSAIP will be monitored by means of annual implementation reports issued by countries and consolidated by FARA. Evaluation will be done biennially, and reporting made to AUC and continental stakeholders. What will the CSAIP monitor and evaluate? These will consist of the following indicators:

1) Number of countries transitioning to CSA from conventional agriculture
2) Range of CSA practices being adopted across the continent
3) Rate of adoption of CSA practices
4) Impact of CSA practices on productivity, output, and incomes, carbon sequestration, GHG emissions, biodiversity, among others.
5) Funding made available for CSA implementation at the international level
6) Extent of financing of CSA investment plan at country level
7) Nature of CSA support systems put in place by governments
8) Gender responsiveness of national CSA policies, strategies and financing
9) Effectiveness of access to CSA information and knowledge by farmers
10) Effectiveness of CSA capacity development programmes

Risks and Risk Management Strategies in CSAIP Implementation: The risks facing implementation of this CSAIP and the strategies by which they can be managed are as follows:

Table 3: Potential Risks and Management Strategies

No	Potential Risk	Rating	Management Strategy
1	The CSAIP may not be adopted by countries due to poor resource support for CSA transition.	Medium	The commitment of 10% national budgetary allocation to agriculture sector made by African Heads of State and Government under the Maputo Declaration in 2003 and renewed in 2014 under the Malabo Declaration is yet to be met by many African countries. The sector is still not adequately funded, dependence on donor funds is high in some cases and budget execution rate low in other cases. Transition to CSA requires support systems, which need complementary resources. This CSAIP proposes sources of financing including reform of existing sources to facilitate CSA transition. There is a growing call for the CoPs to pay more attention to issues of agriculture and food systems. Egypt pledged to bring up agriculture at COP27 as host country.
2	Governments are not likely to be able to provide required	Medium	Experience from about 22 African countries implementing CSA programmes have shown encouraging commitment. There is a need to do more, especially given that the execution rate of

	support systems for CSA transition.		agricultural sector budget is on the low side in a context of inadequate resources. Given the urgency of the need to integrate climate change considerations in agriculture and food systems, governments will be compelled to step up responses. External support is reasonably available to supplement government's measures. Improvement in fund disbursement is however of vital importance.
3	Inadequate international funding for CSA transition will remain due to poor attention to agriculture and food systems issues at the UN COPs.	Medium	International concerns and interest in CSA transition in Africa is growing rapidly. These, however, have not been met with commensurate resource support. Strong voices at COP27 and a push for more resources from sources such as GCF, GEF and CIFs as well as bilateral and multilateral institutions could minimize this risk. African countries also need to improve execution rate of budgets for food and agriculture projects.
4	International financing for CSA investment programmes will remain low and grossly inadequate due to the inability of the international community to meet overall commitments for climate change responses.	Medium	Climate finance of US$100 billion annually by 2020 pledged by developed countries at the climate conference in Copenhagen in 2009 has not be fully met. There was a recommitment to this financing at COP26 with a pledge of US$500 billion by 2027. There is promising goodwill on the part of the international development community for climate finance, which will positively affect CSA investment programmes.
5	Domestic finance institutions will see CSA transition as riskier compared to conventional practices.	Medium	Domestic financing arrangements have not been very effective thus far. Encouragement of domestic finance institutions will help alleviate this risk. Appropriate incentives could have positive impact on the flow of domestic funds from finance institutions.
6	Continuing insecurity and conflicts across the continent will undermine successful transition to CSA practices and achievement of its benefits.	Medium to high	Insecurity arising from insurgencies is a major challenge to the farming community. This has displaced farmers and left farmlands to waste. Governments are committing resources to improve the security situation and displaced people are gradually being resettled. While this still remains a high risk to agriculture and food security, it is equally promising that within the period of this CSAIP the security situation will improve to allow farmers to expand production.

7	Crop and livestock insurance will remain out of reach for smallholder farmers thus undermining uptake of CSA practices.	High	Insurance is still out of reach for most farmers, especially those in rural communities. Loss of crops and livestock due to extreme weather arising from climate change remains a huge risk. The situation in the Horn of Africa and the Sahelian subregion attests to the devastating impacts of climate change. Innovative ways of insuring smallholder farmers need to be developed as part of social adaptation programmes. This should be part of a just transition in the planning of programmes for climate resilient agriculture and sustainable food systems.

Conclusion: National CSAIPs and CSA investment plans should supplant the CAADP NAIPs or be more dominant in ongoing agricultural transformation strategies and investment plans. For this strategic transition to take place, governments and the international development partner community may insist on supporting each country's agriculture and food systems through gender responsive national CSAIP frameworks. FARA should work with AUC and other institutions to push for a decision on this at COP27 or subsequent COPs.

Next Steps: The AU Climate Change and Resilient Development Strategy and Action Plan 2022-2032 for which this CSAIP is an input in the implementation framework will need to be adjusted. This should provide for the following, among others:

1) A consolidation of the agriculture, food systems, and related interventions into one Axis for coherence and coordination.
2) Provision for refinement of the objectives and outcomes to include expected reductions in GHGs that will result from each of the Axes and their priorities. The essence of climate-resilient development is a definitive and measurable reduction in GHG emissions through strategies, policies and programmes.
3) Propose implementable financing mechanisms and instruments for CSA expansion highlighting what is working and what is not, with concrete country cases of progress in this direction. African countries are not starting from scratch.
4) Recognize the need for and facilitate transition from country and regional National Agriculture Investment Plans (NAIPs) to gender-responsive Climate-Smart Investment Programmes (CSAIPs) and related investment plans.
5) Provide support to significantly increase the number of African countries with gender-responsive CSA-supportive policies, strategies, investment programmes, and financing arrangements.

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Section 4: Technical Panel Discussion

Towards a Common Africa Position at COP27 and COP28

Facilitated by Dr Ogiogio
Panelists.

1. **DrVanlauwe**
2. **Dr Akinbamijo**
3. **Dr Chapoto**

Outcomes from the African Climate Smart Agriculture Framework (ACSAF) Plenary

Preamble

The 2022 Biennial Climate-Smart Agriculture (CSA) conference organized by the Forum for Agricultural Research in Africa (FARA) hosted a continental dialogue on Africa Climate-Smart Agricultural Framework (ACSAF). ACSAF provided the opportunity for presentations and a panel discussion on strategies for continuous development of CSA technologies and foresight analysis of plausible futures for CSA in Africa. It further set the scene in putting the pedal ahead of the UN Climate Change Conference (COP27) in Egypt following discussions on Africa's progress on climate change, agriculture and food security over the past decade at COPs. The dialogue comprised two substantive plenary sessions and a panel discussion each covering an important facet of ACSAF. The participants were of diverse representation from government, civil society, national and international agencies, academia as well as representatives from private sector and media. There were extensive discussions on gaps, opportunities and pathways for integrating CSA into development planning aimed at mitigating and adapting to the impacts of climate change for the 'Africa we Want'. This writeup summarizes the main points and outcomes from the ASCAF plenary sessions.

Observations

The ACSAF meeting:

Recognized that over the past decade, COP Summits have failed to unravel the critical contribution of the Agricultural sector in the development of most African economies. While policy and programme responses under the sector have generally improved, particularly since the Nationally Determined Contributions (NDCs), flow of resources to Agriculture and Food Security (FS) have been limited. Consequently, the adoption of CSA in countries is affected. COP27 presents an opportunity to support countries in identifying and managing climate risks through shared steps on how to build climate-resilient and low-carbon economies. This could be achieved through committing to actions targeted at climate financing, reducing greenhouse gas emissions and building climate-resilient technologies and infrastructure.

Identified the need to provide inputs for Africa's negotiation position at COP27 by pushing for more structured support for Agriculture and FS in adaptation, mitigation and climate financing and investment funds. This could be market-oriented collaborations and themes addressing shared risks and opportunities particularly on low carbon and climate- resilient development pathways. To this end, more practical scientific research evidence is needed to contribute best CSA practices for Africa. Additionally, there is the need to resource existing climate funds and facilities to deliver more effectively.

Called for urgent climate actions through harnessing Africa's huge resource potential to enhance achievement of growth and development. Practical actions suggested include establishment of an effective CSA support system that compensates smallholder farmers for ecosystem services and for CSA transition; setting up of Green or Emissions Transition Funds in each African country which will be co-financed by the GCF, GEF, and other climate finance/investment funds; inclusive and meaningful mainstreaming of women and youth in CSA adaptation action in Africa; reforming investment policies on pension and sovereign wealth funds to invest a minimum of 25% of their resources on their climate change programmes and in support of agriculture and sustainable food systems; as well as profound transformation of agricultural production and food systems to address climate change and continuously produce more sustainable CSA technologies for building climate-resilience. More importantly, it was noted that the higher the opportunity to learn CSA best practices between countries in the continent, the higher the likelihood for achieving plausible futures in Africa.

Key Messages to COP27

Messages to be considered as inputs for COP27 negotiations include:

1. Push for a dedicated UNFCCC Subsidiary Body (SB) on Developing Countries and Agriculture and Food Security.
2. Strengthen planning towards ensuring financial gaps related to tackling climate change are delivered as earlier promised by developed countries at COP 26. This entails pushing for the re-commitment of US$500 billion to be further raised to US$1 trillion as AU GRAP places Africa's climate finance needs at US$1.264 trillion annually.
3. Promote the establishment of a Global Task Force to follow up on the recommitted financial pledge by 2021-2025.
4. Promote an African Credit Guarantee Facility to support green bonds and other climate financing instruments.
5. Promote a meaningful representation of specific CSA transition needs for Africa that integrates context as a key consideration. Thus, create an enabling environment for investment in research and interventions related to CSA opportunities in the region while strengthening capacity to empower and include women, men and youth, as well as address restrictive socio-cultural barriers.

Section 5: Presentation of Research Paper

Paper Number	NAME	Paper Title
1	**BASHIR M. AHMED**	**Climate-Smart Agriculture digital technologies for increased and sustainable agricultural production in Sudan** **Bashir Ahmed,** Joshua Sikhu Okonya, Moses Odeke and Enock Warinda **Citation**: Bashir M.A, Okonya J.S, Odeke M, and Warinda E. (2023). Climate Smart Agriculture digital technologies for increased and sustainable agricultural production in Sudan. FARA Research Report *Vol 7(3):1-9*. https://doi.org/10.59101/frr07230
2	**ANGELINE MUJEYI**	**Digitalization options for scaling Climate-Smart Agriculture in Smallholder Farming Systems: Lessons and Opportunities** **Angeline Mujeyi, Kingstone Mujeyi** **Citation**: Mujeyi A and Mujeyi K (2023) Digitalization options for scaling Climate-Smart Agriculture in smallholder farming systems: Lessons and opportunities. FARA Research Report *Vol 7(4):10-21*. https://doi.org/10.59101/frr072304
3	**Joseph Manzvera**	**Use of Digital Climate Services and Uptake of Climate-Smart Technologies Among Smallholder Farmers in Africa: A Review** **Joseph Manzvera** and Kwabena Asomanin Anaman **Citation**: Manzvera J and Anaman K.A (2023) Use of digital climate services and uptake of climate-smart technologies among smallholder farmers in Africa. FARA Research Report Vol 7(5):22-38. https://doi.org/10.59101/frr072305
4	**RALPH ADEWOYE**	**Big Data and Artificial Intelligence Deployment for Climate-Smart Agriculture Modelling of the Lake Chad Basin** **Adewoye, A. R**, Ukoha, P. A., Okonkwo, S.J **Citation**: Adewoye, A. R, Ukoha, P. A., and Okonkwo, S.J (2023) Big Data and Artificial Intelligence Deployment for Climate-Smart Agriculture Modelling of the Lake Chad Basin. FARA Research Report *Vol 7(6):39-47*. https://doi.org/10.59101/frr072306
5	**Awoniyi Samuel Olugbemiga**	**Digitalization of Agriculture: what relevance and challenges in enhancing Climate-Smart Agriculture** **Samuel Awoniyi,** Mobolaji Osunmakinde, Adekunle Eludire and Samuel Olatundun **Citation**: Awoniyi S, Osunmakinde M, Abdulkadir A. and Olatundun S. (2023) Digitalization of Agriculture: what relevance and challenges in enhancing Climate Smart Agriculture in Nigeria. FARA Research Report *Vol 7(7):48-58*. https://doi.org/10.59101/frr072307

6	**DOMINIC UCHI**	**Utilization of Rice Advice Smartphone-Technology in Enhancing Climate-Smart Agricultural Practices Among Small-Scale Farmers in Benue State, Nigeria** Bello, O. G., **Uchi, D.T.,** Muktar, B.G., Agbana, O., and Ehien, A.E. **Citation**: **Uchi, D.T.,** Bello, O. G., Muktar, B.G., Agbana, O., and Ehien, A.E. (2023) Utilization of Rice Advice Smartphone-Technology in Enhancing Climate-Smart Agricultural Practices Among Small-Scale Farmers in Benue State, Nigeria. FARA Research Report *Vol 7(8):59-69*. https://doi.org/10.59101/frr072308
7	**EKUNDAYO AFOLABI**	**Implications of Digital Divide in Digitalization of Farming Activities in the NAERLS Adopted Villages** **Afolabi, E. A.,** Atala, T. K., Akpoko, J. G., and Oladimeji, Y. U. **Citation**: Afolabi, E. A., Atala, T. K., Akpoko, J. G., & Oladimeji, Y. U. (2023). Implications of Digital Divide in Digitalization of Farming Activities in the NAERLS Adopted Villages. FARA Research Report *Vol 7(9):70-79*. https://doi.org/10.59101/frr072309
8	**MORUF ABIOLA OLAIDE AKINTUNDE**	**Assessment of Use of Selected Social Media Tools by Extension Workers to disseminate Climate-Smart Agriculture (CSA) Information to Farmers in Lesotho** **Moruf Abiola Olaide Akintunde** **Citation**: Akintunde M.AO. (2023) Assessment of Use of Selected Social Media Tools by Extension Workers to disseminate Climate-Smart Agriculture (CSA) Information to Farmers in Lesotho. FARA Research Report *Vol 7(10):80-94*. https://doi.org/10.59101/frr072310
9	**FRANCK NGOYI TSHITE**	**Temporal Climate Variability in Luki Biosphere Reserve, Mayombe, Democratic Republic of Congo** **Franck Ngoyi Tshite**, Ludivine Lassois, Bhely Angoboy Ilondea, Ernestine Lonpi Tipi, Jean Pierre Kabongo Tshiabukole, Joshua Sikhu Okonya, Moses Odeke, Enock Warinda, Raoul Sambieni, Charlot Mikobi Mikobi, Daniel Dibwe Munkamba, Alain Kaka di Makwala, Baudouin Michel, Roger Ntoto M'vubu, Joseph Lumande Kasali, Justin Mudibu wa kabangu, and Alexix Ndayiragije **Citation**: **Tshite F.N**, Lassois L, Ilondea B.A, Tipi E.L, Tshiabukole J.P.K, Okonya J.S, Odeke M, Warinda E, Sambieni R , Mikobi C.M, Lunze L.D., Munkamba D.D., Kaka di Makwala A., Nzomono A.N, Michel B., M'vubu R.N., Kasali J.L., kabangu J.M and Ndayiragije A. (2023) Temporal Climate Variability in Luki Biosphere Reserve, Mayombe, Democratic Republic of Congo. FARA Research Report *Vol 7(11):95-107*. https://doi.org/10.59101/frr072311
10	**KAREEM LONGWE**	**Effects of Soil Amendments on Incidences of Bacterial Wilt and Tuber Yield of Potato at Different Environments in Malawi**

		Kareem Longwe[1], Obed J. Mwenye[1], Gbenga Akiniwale[1], Felistus Chipungu[1], Daniel Van Vugt[1], Margret Chiipanthenga[2], Austin T. Phiri[3] **Citation**: Longwe K, Mwenye O.J., Akiniwale G, Chipungu F, Van Vugt D, Chiipanthenga M, Phiri A.T. (2023) Effects of Soil Amendments on Incidences of Bacterial Wilt and Tuber Yield of Potato at Different Environments in Malawi. FARA Research Report *Vol 7(12):108-119*. https://doi.org/10.59101/frr072312
11	**RICHARD NJUE**	**Technical and Economic Evaluation of a Mechanical Cassava Harvester in Busia County of Kenya** **Richard Njue**, Susan Maingi, Noah Wawire, Charles Bett **Citation**: Njue R, Maingi S, Wawire N, Bett C. (2023) Technical and Economic Evaluation of a mechanical Cassava harvester in Busia County of Kenya. FARA Research Report *Vol 7(13):120-127*. https://doi.org/10.59101/frr072313
12	**VINCENT ADURAMIGBA-MODUPE**	**Scaling Precision Agriculture in West Africa Smallholder Irrigation and Water Management Systems** Adebayo O. Oke and Vincent O. Aduramigba-Modupe **Citation**: Aduramigba-Modupe V.O. and Oke A. O (2023) Scaling Precision Agriculture in West Africa Smallholder Irrigation and Water Management Systems. FARA Research Report *Vol 7(14):128-133*. https://doi.org/10.59101/frr072314
13	**RAHETLAH Volatsara Baholy**	**Effects of Mulching/Green Manuring and Intercropping with *Crotalaria Grahamiana* on Growth and Yield Parameters of Potato in the Vakinankaratra Region, Madagascar** Ovaniaina D Andriamiarisoa, Fanjaniaina C, Rakotoarimanga Nirina, **RAHETLAH Volatsara Baholy** **Citation**: Andriamiarisoa L. D, Fanjaniaina C, Rakotoarimanga N, Rahetlah V.B. (2023) Effects of Mulching/Green Manuring and Intercropping with Crotalaria grahamiana on Growth and Yield Parameters of Potato in the Vakinankaratra Region, Madagascar. FARA Research Report *Vol 7(15):134-141*. https://doi.org/10.59101/frr072315
14	**PONTIOUS MUBIRU MUKASA**	**Drivers of Holistic Agricultural Risk Management Training Transfer** Pontious Mubiru Mukasa **Citation**: Mukasa P.M, Miiro R, Obaa B, and Kizza J. (2023) Drivers of Holistic Agricultural Risk Management Training Transfer. FARA Research Report *Vol 7(16):142-150*. https://doi.org/10.59101/frr072316
15	**PETER KATHULI**	**Effect of Nitrogen Fertilizer on Water Use Efficiency of 11 Selected Sorghum Genotypes Grown in Semi-Arid Regions in Kenya** Kathuli P., J.M. Kinama S.N Nguluu, O.M. Kitonyo, Catherine M. Citation: Kathuli Peter., J.M. Kinama., S.N Nguluu., O.M. Kitonyo., Catherine Muui., R.M. Muasya. (2023) Effect of Nitrogen Fertilizer on Water Use Efficiency

		of 11 Selected Sorghum Genotypes Grown in Semi-Arid Regions in Kenya. FARA Research Report *Vol 7(17):169-186*. https://doi.org/10.59101/frr072317
16	**ANTHONY AGBONGIARHUOYI**	**Evaluating Climate-Smart Adaptation Practices on Cocoa Insect pests and Diseases Incidences among Farmers in Cross River State, Nigeria** **Agbongiarhuoyi, A. E**, Famuyiwa, B. S, Uwagboe, E. O, Adedeji, A. R, Asogwa, E. U, and Ndoye, M. A **Citation**: Agbongiarhuoyi, A. E, Famuyiwa, B. S, Uwagboe, E. O, Adedeji, A. R, and Asogwa, E. U. (2023) Evaluating Climate Smart Adaptation Practices on Cocoa Insect pests and Diseases Incidences among Farmers in Cross River State, Nigeria. FARA Research Report *Vol 7(18):187-195*. https://doi.org/10.59101/frr072318
17	**EMILY NGUYEN-PERPERIDIS**	**Advancing a Gender-Responsive Delivery Model for Mitigating Climate Impacts in Ghana's Cocoa Landscape** **Emily Nguyen-Perperidis**, Faustina Adomaa Obeng, Phuong Minh Nguyen and Bram Nana Safo Kyeretwie **Citation**: Nguyen-Perperidis E., Adomaa F.O, Nguyen P.M and Kyeretwie B.N.S. (2023) Advancing a Gender-Responsive Delivery Model for Mitigating Climate Impacts in Ghana's Cocoa Landscape. FARA Research Report *Vol 7(19):196-213*. https://doi.org/10.59101/frr072319
18	**LYDIAH C MIRITI**	**Factors Influencing Access to Rural Finance Market by Different Actors in Climate-Smart Agriculture in Kenya** **Miriti Lydiah**, Matere Stella, Karienyeh Margaret, Murage Alice, Kariuki Samuel, Wambua Solastica, and Khatali Anne **Citation**: Miriti L, Matere S, Karienyeh M, Murage A, Kariuki S, Wambua S, and Khatali A. (2023) Factors Influencing Access to Rural Finance Market by Different Actors in Climate-Smart Agriculture in Kenya. FARA Research Report *Vol 7(20):214-226*. https://doi.org/10.59101/frr072320
19	**MICHAEL OMODARA**	**Deployment of Monitoring Devices to Address Quality Degradation in Bagged Grain in Storage** **Michael Omodara**, Michael Montross, and Samuel McNeill **Citation**: Omodara M, Montross M., and McNeill S. (2023) Deployment of Monitoring Devices to Address Quality Degradation in Bagged Grain in Storage. FARA Research Report *Vol 7(21):227-234*. https://doi.org/10.59101/frr072321
20	**MTISUNGE MNGOLI**	**Analysis of the Soyabean Value Chain: A Case of Malawi and Zambia**

		Mtisunge Mngoli **Citation**: Mtisunge B.M. (2023) Analysis of the soyabean value chain: A case of Malawi and Zambia. FARA Research Report *Vol 7(22):235-273*. https://doi.org/10.59101/frr072322
21	**OLABISI DAMILOLA OMODARA**	**Factors Influencing Cassava Farmers' Choice of Climate Change Adaption Practices and Its Effect on Cassava Productivity in Osun State, Nigeria** **Olabisi Damilola Omodara**, Oluwakemi Abosede Ige, Oluwemimo Oluwasola, Akinsola Temitope Oyebanji, Oluwatunmise Oyebisi Afape **Citation**: Omodara O.D., Ige O.A., Oluwasola O., Oyebanji A.T., Afape O.O. (2023) Factors Influencing Cassava Farmers' Choice of Climate Change Adaption Practices and Its Effect on Cassava Productivity in Osun State, Nigeria. FARA Research Report *Vol 7(23):274-288*. https://doi.org/10.59101/frr072323
22	**OLADELE IDOWU**	**Mainstreaming Climate Smart Agriculture into Agricultural Extension Curricula in West Africa: The Roles of Sasakawa Africa Association** Oladele O.I **Citation**: Oladele O.I. (2023) Mainstreaming Climate-Smart Agriculture into Agricultural Extension Curricula in West Africa: The Roles of Sasakawa Africa Association. FARA Research Report *Vol 7(24):289-295*. https://doi.org/10.59101/frr072324
23	**OSUMBA, JOAB**	**Towards a Replicable Innovative Tool for Adaptive Climate Monitoring and Weather Forecasting Using Traditional Indigenous and Local Indicators to Strengthen Agro-Weather Resilience at Scale** **Joab J. L. Osumba***, Maren Radeny, John W. Recha, George W. Oroma, Oscar Nzoka, Joyce Mbingo, Enock Warinda, and Simon Mwale **Citation**: Osumba J.J. L., Radeny M, Recha J.W., Oroma G.W, Nzoka O, Mbingo J, Warinda E, and Mwale S. (2023) Towards a Replicable Innovative Tool for Adaptive Climate Monitoring and Weather Forecasting Using Traditional Indigenous and Local Indicators to Strengthen Agro-Weather Resilience at Scale. FARA Research Report *Vol 7(25):296-320*. https://doi.org/10.59101/frr072325
24	**AKYALA ABRAHAM**	**Using Gender-Land Rights to Increase Climate Resilience Among Smallholder Farmers in The Least Developed Countries (LDCS)** **Akyala Abraham** **Citation**: Akyala A. (2023) Using Gender-Land Rights to Increase Climate Resilience Among Smallholder Farmers in The Least Developed Countries. FARA Research Report *Vol 7(26):336-350*. https://doi.org/10.59101/frr072326
25	**ALIKU OREVAOGHENE**	**Yield Response of Sorghum to Micronutrient-Fortified Fertilizer in the Savanna Agroecological Zone of Nigeria**

		Donald Kelechi Madukwe, Ishaku Y. Amapu and **OrevaOghene Aliku** **Citation**: Madukwe D.K, Amapu I.Y and Aliku O. (2023) Yield Response of Sorghum to Micronutrient-Fortified Fertilizer in the Savanna Agroecological Zone of Nigeria. FARA Research Report *Vol 7(27):351-358*. https://doi.org/10.59101/frr072327
26	**DIRIBA TULU**	**Adaptation Capacity of Indigenous Sheep to Saline Lake Drinking Water in Dry Area of Ethiopia Under Climate Change** **Diriba Tulu,** Mengistu Urge, Yisehak Yusuf **Citation**: Tulu D, Urge M, Yusuf Y. (2023) Adaptation Capacity of Indigenous Sheep to Saline Lake Drinking Water in Dry Area of Ethiopia Under Climate Change. FARA Research Report Vol 7(28):358-368. https://doi.org/10.59101/frr072328
27	**SUNITA FACKNATH**	**Climate-Smart Agriculture as an Innovative Socioeconomic Sector for the National Economy** **Sunita Facknath***, Bhanooduth Lalljee, Vagish Ramborun **Citation**: Facknath S, Lalljee B, Ramborun V, Nazurally N, Hardowar S, Bhoyroo V, and Tataree, S. (2023) Climate-Smart Agriculture as an Innovative Socioeconomic Sector for The National Economy. FARA Research Report *Vol 7(29):369-374*. https://doi.org/10.59101/frr072329
28	**ZAKARIA FOUAD FAWZY**	**Applied of Climate-Smart Agriculture Approach for Agricultural Development to African Food Security and Sustainability of Agriculture as well as Adaptation Future Climate Changes** Zakaria Fouad Fawzy **Citation**: Zakaria F.F. (2023) Applied of Climate Smart Agriculture Approach for Agricultural Development to African Food Security and Sustainability of Agriculture as well as Adaptation Future Climate Changes. FARA Research Report *Vol 7(30):375-394*. https://doi.org/10.59101/frr072330
29	**PHILIPPA OJIMELUKWE**	**Climate adaptation strategy for cassava processing and storage by a Niger Delta Community in Nigeria** **Philippa Ojimelukwe**, Tasie Uchechukwu, Doris Akachukwu, Nkechi Louisa-Daniel, Chinechendu Ubadire-Agua, and Maureen Theodore-Ojinnaka **Citation**: Ojimelukwe P. C., Uchechukwu T, Akachukwu D, Daniel L. N., Ubadire-Agua C. and Theodore-Ojinnaka M. (2023) Climate adaptation strategy for cassava processing and storage by a Niger Delta Community in Nigeria. FARA Research Report *Vol 7(31):395-407*. https://doi.org/10.59101/frr072331

30	**ANGELINE MUJEYI**	**Disseminating and Scaling Up Climate-Smart Agriculture adoption through participatory action research: Lessons from the Agriculture Centre of Excellence Methodology** **Angeline Mujeyi**, Farai Dube, Martin Philani Moyo, Melesse Mequanint, Ronald Veremu, Daniel Chawatama, Kumbirai Nhongo, and Tawanda Hove **Citation**: Mujeyi A, Dube F, Philani M.M, Mequanint M,Veremu R, Chawatama D, Nhongo K, and Hove T. (2023) Disseminating and Scaling up Climate-Smart Agriculture adoption through participatory action research: Lessons from the Agriculture Centre of Excellence Methodology. FARA Research Report *Vol 7(32):408-422*. https://doi.org/10.59101/frr072332
31	**BLAISE AMONY**	**Strategies for Extension and Advisory Services to Promote Climate-Smart Agriculture Among Smallholder Farmers in Sub Saharan Africa** **Blaise Amony***, Moses Odeke and Enock Warinda **Citation**: Amony B*, Odeke M and Warinda E. (2023) Strategies for extension and advisory services to promote Climate-Smart Agriculture among smallholder farmers in Sub-Saharan Africa. FARA Research Report *Vol 7(33):423-428*. https://doi.org/10.59101/frr072333
32	**BRIAN OGENRWOTH**	**Impact of Climate Change on Food Security in Uganda: A Panel Regression Analysis** **Brian Ogenrwoth**, Ronald Walusimbi, Peter Ssali, Michael Hübler, Jackline Bonabana, Vegard Martinsen and Samuel Kyamanywa **Citation**: Ogenrwoth B, Walusimbi R, Ssali P, Hübler M, Bonabana J, Martinsen V and Kyamanywa S. (2023) Impact of Climate Change on Food Security in Uganda: A Panel Regression Analysis. FARA Research Report *Vol 7(34):429-440*. https://doi.org/10.59101/frr072334
33	**OLASHINDE OLADEJI**	**Factors Influencing the Adoption Intensity of Climate-Smart Maize Varieties Among Rural Farming Households in Southern Guinea Savannah of Nigeria.** **Oladeji O**, Kolade O, Fasakin I.J, Sowunmi F, and Abdoulaye T **Citation**: Oladeji O., Kolade O, Fasakin I. J, Sowunmi F, and Abdoulaye T. (2023) Factors Influencing the Adoption Intensity of Climate-Smart Maize Varieties Among Rural Farming Households in Southern Guinea Savannah of Nigeria. FARA Research Report *Vol 7(35):441-452*. https://doi.org/10.59101/frr072335
34	**AMINA AHMED**	**Implications of Climate Data Application for the Enhancement of Extension Services Delivery to Smallholders Farmers in Tanzania** **Amina Ahmed**, Isege Mihayo, Ramadhani Ally and Jeremia Makindara **Citation**: Ahmed A, Mihayo I, Ally R and Makindara J. (2023) Implications of Climate Data Application for the Enhancement of Extension Services Delivery to Smallholders Farmers in Tanzania. FARA Research Report *Vol 7(36):453-473*. https://doi.org/10.59101/frr072336

35	**DIGNA MLENGULE**	**Experience of Smallholder Farmers on Climate-Smart Agriculture on Soil Fertility and Moisture Conservation in Ludewa District, Tanzania** **Digna Mlengule** **Citation**: Mlengule, D. (2023) Experience of Smallholder Farmers on Climate Smart Agriculture on Soil Fertility and Moisture Conservation in Ludewa District, Tanzania. FARA Research Report *Vol 7(37):474-487*. https://doi.org/10.59101/frr072337
36	**GILBERT K. KORIR**	**Can Climate-Smart Forages Replace Concentrates in Dairy Milk Production?** **Gilbert K. Korir**, Phoebe B. Mose and Caroline C. Wambui **Citation**: Korir G.K, Mose P.B and Wambui C.C. (2023) Can Climate Smart Forages Replace Concentrates in Dairy Milk Production. FARA Research Report *Vol 7(38):488-496*. https://doi.org/10.59101/frr072338
37	**IFEANYI-OBI**	**How are Rural Women Crop Farmers in Southern Nigeria Coping with Climate Change?** **Ifeanyi-obi, C. C.** **Citation**: Ifeanyi-obi, C. C. (2023) How are Rural Women Crop Farmers in Southern Nigeria Coping with Climate Change. FARA Research Report *Vol 7(39):497-509*. https://doi.org/10.59101/frr072339
38	**KOLAWOLE OLAJIDE ALAKA**	**Assessing Household Socio - Economic Factors Affecting Smallholder Farmer's Investments in Climate-Smart Agriculture Practices in Eastern Cape Province, South Africa** **Kolawole Olajide Alaka** **Citation**: Alaka K.O. (2023) Assessing Household Socio-Economic Factors Affecting Smallholder Farmer's Investments in Climate Smart Agriculture Practices in Eastern Cape Province, South Africa. FARA Research Report *Vol 7(40):510-520*. https://doi.org/10.59101/frr072340
39	**ABA-TOUMNOU LUCIE**	**Using Radiation-Induced Novel Genetic Diversity to develop pest-resistant Maize in Central African Republic** Lucie ABA-Toumnou, Ruffin Reo Ndouba, Felix Allah-Barem, Augustin Dokofiona, Stève Dieudonné Mbenda, H. M. Mbedane, Jephté Juste Kaïne, Joshua Sikhu Okonya, Moses Odeke, Enock Warinda, Olivia Semboli, Imen BenTouhami and Shoba Sivasankar **Citation**: ABA-Toumnou L, Ndouba R.R, Allah-Barem F, Dokofiona A, Mbenda S.D, Mbedane H. M, Kaïne J.J, Okonya J.S, Odeke M, Warinda E., Zinga I., Semballa S. and Bell J.A. (2023) Using Radiation-Induced Novel Genetic Diversity to develop pest-resistant Maize in Central African Republic. FARA Research Report *Vol 7(41):521-530*. https://doi.org/10.59101/frr072341
40	**ADEOLA LYDIA ADEJUMO**	**Dissemination and adoption of Sustainable Soil Management technologies among farmers; advances in Climate-Smart Agricultural practices in Nigeria**

		Adeola Lydia Adejumo* and Solomon Adedapo Adesoji **Citation**: Adejumo A.L and Adesoji S.A. (2023) Dissemination and adoption of Sustainable Soil Management technologies among farmers; advances in Climate-Smart Agricultural practices in Nigeria. FARA Research Report *Vol 7(42):531-544*. https://doi.org/10.59101/frr072342
41	**DESALEGN YAYEH AYAL**	**Smallholder Farmers Adoption of Climate-Smart Livestock Production: Practices, Status and Determinants in HidebuAboteWoreda, Central Ethiopia** Bassa Mamo and DesalegnYayeh **Citation**: Mamo B. and Yayeh D. (2023) Smallholder Farmers Adoption of Climate-Smart Livestock Production: Practices, Status and Determinants in HidebuAboteWoreda, Central Ethiopia. FARA Research Report *Vol 7(43):545-562*. https://doi.org/10.59101/frr072343
42	**GADDAFI SANI**	**Physiological and Behavioural Adjustment of Livestock to Climate Change: Coping Mechanisms** ***Gaddafi S.,** Yahaya, M. A., Garba, M.G., Usman, H.B., Jibia, Z.S. and Ibrahim, M. **Citation**: Gaddafi S., Yahaya, M. A., Garba, M.G., Usman, H.B., Jibia, Z.S. and Ibrahim, M. (2023) Physiological and Behavioral Adjustment of Livestock to Climate Change: Coping Mechanisms. FARA Research Report *Vol 7(44):563-569*. https://doi.org/10.59101/frr072344
43	**Garba MG**	**Towards Exploring Development Intervention of Three Key Pillars of Climate-Smart Agriculture (CSA) as Options for Livestock Farmers** **Garba, M.G**., Gaddafi, S. and Bichi, A.H **Citation**: Garba, M.G., Gaddafi, S. and Bichi, A.H. (2023) Towards Exploring Development Intervention of Three Key Pillars of Climate-Smart Agriculture (CSA) as Options for Livestock Farmers. FARA Research Report *Vol 7(45):570-578*. https://doi.org/10.59101/frr072345
44	**EVANS SICHARANI**	**Fluxes of Greehouse Gas (Methane (CH_4), Carbon dioxide (CO_2), and Nitrous oxide (N_2O) Emissions as Influenced by Livestock Production Systems** **Evans Sicharani,** Gelas Simiyu, Frank Masese, Godfrey Barasa, Christine Owade and Wilhelmina Juma **Citation**: Sicharani E, Simiyu G, Masese F, Barasa G, Owade C and Juma W. (2023) Spatio-Temporal Dynamics of Greenhouse Gases (GHGs) Emissions from Watering Points along Livestock Production Systems in Taita-Taveta, County, Kenya. FARA Research Report *Vol 7(46):579-593*. https://doi.org/10.59101/frr072346
45	**HAMDINO M. I. AHMED**	**Heat Stress Management in Bean (*Phaseolus vulgaris* L.) through Nitric Oxide and Trehalose Interventions**

		Hamdino M. I. Ahmed **Citation**: Ahmed M. I.H. (2023) Heat Stress Management in Bean (*Phaseolus vulgaris L.*) through Nitric Oxide and Trehalose Interventions. FARA Research Report *Vol 7(47):594-603*. https://doi.org/10.59101/frr072347
46	**ISAAC AMEGBOR**	**Yield Performance and Genetic Analysis of Drought Tolerant Provitamin-A Maize Under Drought and Rainfed Conditions** **Isaac Kodzo Amegbor*,** Kwabena Darkwa, Charles Nelimor, Kulai Amadu Manigben, Gloria Boakyewaa Adu, Paulina Abanpoka Aboyadana, Francis Kusi and Henry Ackah **Citation**: Amegbor I.K, Darkwa K, Nelimor C, Manigben K.A, Adu G.B, Aboyadana P.A, Kusi F, Keteku A.K, Owusu E.Y, Ackah H, and Labuschagne M.T. (2023). Yield Performance and Genetic Analysis of Drought Tolerant Provitamin-A Maize Under Drought and Rainfed Conditions. FARA Research Report *Vol 7(48):604-621*. https://doi.org/10.59101/frr072348
47	**Kimwemwe Kitenge Paul**	**Phenotypic Variation Among Rice (Oryza sativa L.) Germplasm Accessions for the Eastern Democratic Republic of Congo and Traits Association Based on Yield and Yield Components** **Paul Kitenge Kimwemwe *,** Bukomarhe Bahati Chance, Dibue Munkumba Daniel, Jean Pierre Kabongo Tshiabukole, Joshua Sikhu Okonya, Moses Odeke, Enock Warinda, Innocent Ndikumana, Paul Martin Dontsop Nguezet, Edward George Mamati and Mamadou Fofana **Citation**: Kimwemwe K.P., Bukomarhe B.C., Mudarhi B.L., Munkumba D.D., Tshiabukole P.K.J., Okonya S.J., Warinda E., Ndikumana I., Mamati G.E. and Fofana M. (2023) Phenotypic variation among rice (*Oryza sativa* L.) germplasm accessions for the Eastern Democratic Republic of Congo and traits association based on yield and yield components. FARA Research Report *Vol 7(49):622-641*. https://doi.org/10.59101/frr072349
48	**OLAWALE SELESI**	**Influence of Enriched Rice-Husk Biochar on Soil Quality, Growth and Yield of Cucumber (*Cucumis sativus*) on an Utilsol in Epe, South-West Nigeria** **Selesi O. S,** Rosulu H. O, Adanlawo A. O, Osho K and Ajayi B. T **Citation**: Selesi O. S, Rosulu H. O, Adanlawo A. O, Osho K and Ajayi B. T. (2023) Influence of Enriched Rice-Husk Biochar on Soil Quality, Growth and Yield of Cucumber (*Cucumis sativus*) on an Utilsol in Epe, South-West Nigeria. FARA Research Report *Vol 7(50):642-650*. https://doi.org/10.59101/frr072350
49	**OSINNOWO ADEGBOYEGA**	**Optimizing Climate-Smart Aquaculture for Sustainable Catfish Production in Nigeria** Oshinowo A.J and Fatunbi A.O **Citation**: Oshinowo A.J and Fatunbi A.O. (2023) Optimizing Climate-Smart Aquaculture for Sustainable Catfish Production in Nigeria. FARA Research Report *Vol 7(51):651-659*. https://doi.org/10.59101/frr072351

50	**PETER CHUKWU EZE**	**Soil Physical and Chemical Properties as Affected by Land Configuration and Cow Dung Manure at Minna, Niger State, Nigeria** Eze P.C, Onyekwere, I.N., Ayankeye, O.E., Musa, J.J., Mohammed, A. and Adava, A.O **Citation**: Eze P.C., Mohammed, A., Musa, J.J., Onyekwere, I.N., Ayankeye, O.E. and Adava, A.O. (2023). Soil Physical and Chemical Properties as Affected by Land Configuration and Cow Dung Manure at Minna, Niger State, Nigeria. FARA Research Report *Vol 7(52):660-664*. https://doi.org/10.59101/frr072352
51	**PETER CHUKWU EZE**	**Soil Properties as Affected by Crop Residue Management Practice at Minna, Niger State, Nigeria** **Eze, P. C, Onyekwere**, I. N., Mohammed, A., Azuatalam, C. E. and Musa, J. J. **Citation**: Eze, P. C., Musa, J. J., Mohammed, A., Azuatalam, C. E. and Onyekwere, I. N. (2023). Soil Properties as Affected by Crop Residue Management Practice at Minna, Niger State, Nigeria. FARA Research Report *Vol 7(53):665-670*. https://doi.org/10.59101/frr072353
52	**VINCENT ADURAMIGBA-MODUPE**	**Climate-Smart Agriculture and Soil Fertility Mapping: Nigeria Soil Information Service (NISIS) Pilot Project** **Vincent Aduramigba-Modupe** and Ishaku Amapu **Citation**: Aduramigba-Modupe V.O and Amapu I. (2023) Climate-Smart Agriculture and Soil Fertility Mapping: Nigeria Soil Information Service (NiSIS) Pilot Project. FARA Research Report *Vol 7(54):671-676*. https://doi.org/10.59101/frr072354
53	**ADEWALE ADETAYO**	**Adaptation Strategy to Climate Change and Variability for Sorghum (*Sorghum bicolor* L. Moench) Production in Forest-Savannah Agro-Ecological Zone of Nigeria** **Adetayo Adewale.O*,** Balogun Ahmed A, Balogun Ifeoluwa A. and Akinseye Folorunso, M **Citation**: Adewale.O.A, Ahmed A.B, Ifeoluwa A.B and Folorunso, M.A. (2023) Adaptation Strategy to Climate Change and Variability for Sorghum (*Sorghum bicolor L. Moench*) Production in Forest-Savannah Agro-Ecological Zone of Nigeria. FARA Research Report *Vol 7(55):677-684*. https://doi.org/10.59101/frr072355
54	**ANYAIT RITAH**	**Characterization of Chemical Composition and Availability of Pastures in Pastoral and Agro-Pastoral Production Systems of Uganda: Tackling Barriers to Enteric Methane Inventorying Using the Tier 2 Approach** **Anyait R,** Nambi-Kasozi J, Tumwebaze B.S and Katongole B. C **Citation**: Anyait R, Nambi-Kasozi J, Tumwebaze B.S and Katongole B. C. (2023) Characterization of Chemical Composition and Availability of Pastures in Pastoral and Agro-Pastoral Production Systems of Uganda: Tackling Barriers to

		Enteric Methane Inventorying Using the Tier 2 Approach. FARA Research Report *Vol 7(56):685-743*. https://doi.org/10.59101/frr072356
55	**CONFIDENCE KALU**	**Factors Influencing the Adoption of Climate-Smart Agricultural Technologies Among Root Crop Farming Households in Nigeria** **Kalu, C. A** and Mbanasor, J. A **Citation**: Kalu, C. A and Mbanasor, J. A. (2023) Factors Influencing the Adoption of Climate-Smart Agricultural Technologies Among Root Crop Farming Households in Nigeria. FARA Research Report *Vol 7(57):744-753*. https://doi.org/10.59101/frr072357
56	**ESHETU ZEWDU**	**Climate Change Adaptation Practices for Sustainable Sorghum and Wheat Production in Drylands of Ethiopia** **Eshetu Zewdu** and Olika Desalegn **Citation**: Zewdu E and Desalegn O. (2023) Climate change adaptation practices for sustainable sorghum and wheat production in drylands of Ethiopia. FARA Research Report *Vol 7(58):754-766*. https://doi.org/10.59101/frr072358
57	**EUNICE BAMISHAIYE**	**Agrobacterium-Mediated Transformation of Tomato CV Arka Vikas with Cry2ax1 Gene for Insect Resistance** ***Bamishaiye E.I**, Bala I., Bamishaiye O.M., Sudhakar D **Citation**: Bamishaiye E.I, Bala I., Bamishaiye O.M., Sudhakar D. (2023) Agrobacterium-Mediated Transformation of Tomato Cv Arka Vikas with Cry2ax1 Gene for Insect Resistance. FARA Research Report *Vol 7(59):767-776*. https://doi.org/10.59101/frr072359
58	**FUNMILOLA OLUWAFEMI**	**Climate-Change Mitigation: A Case Study of Soil Biochar Influence on Morpho-Physiology of Crop Species and Genotypes** **Funmilola Oluwafemi***, Andargachew Gedebo, Amsalu Gobena, Meseret Tesema, Omodele Ibraheem and Olubiyi Ropo **Citation**: Oluwafemi F.A, Gedebo A, Gobena A, Tesema M, Ibraheem O and Ropo O, Debo-Ajagunna O.P. (2023) Climate-Change Mitigation: A Case Study of Soil Biochar Influence on Morpho-physiology of Crop Species and Genotypes. FARA Research Report *Vol 7(60):777-782*. https://doi.org/10.59101/frr072360
59	**HAROUNA OUEDRAOGO**	**Soil Properties and Tomato Productivity Improvement by Use of Polyter and Turbo-Bio in Sudanese Zone of Burkina Faso** **Harouna Ouédraogo***, Edmond Hien and Alou Coulibaly **Citation**: Ouédraogo H, Hien E, Coulibaly A, and Diallo Y. (2023) Soil Properties and Tomato Productivity Improvement by Use of Polyter and Turbo-Bio in

		Sudanese Zone of Burkina Faso. FARA Research Report *Vol 7(61):783-799*. https://doi.org/10.59101/frr072361
60	**KAREEM LONGWE**	**Effects of Intercropping Sweet potato (*Ipomea. Batatas*) With Pigeon pea on Productivity and Major Pest of Sweet potato in Malawi** **Kareem Longwe,** Gbenga Akiniwale, Obed J. Mwenye, Daniel van Vugt, Margret Chiipanthenga, Austin T. Phiri **Citation**: Longwe K, Akiniwale G, Mwenye J.O, Van Vugt D, Chiipanthenga M, Phiri T.A. (2023) Effects of Intercropping Sweet potato (*Ipomea. Batatas*) With Pigeon pea on Productivity and Major Pest of Sweet potato in Malawi. FARA Research Report *Vol 7(62):800-809*. https://doi.org/10.59101/frr072362
61	**KEDIR KEBERO**	**Bio-fortification of Cereals Based Bread Using OFSP for Alleviating of Vitamin-A Deficiency** **Kedir Kebero*** and Kelbesa Urga **Citation**: Kebero K and Urga K. (2023) Bio-fortification of Cereals Based Bread Using OFSP for Alleviating of Vitamin-A Deficiency. FARA Research Report *Vol 7(63):810-818*. https://doi.org/10.59101/frr072363
62	**MOSHOOD POPOOLA**	**Physiological Response of Hyla Weaner Rabbits Fed Wheat Offal-Carried Watermelon Rind** ***Popoola M.A**, Olosunde A.O, Awoyomi O.V, Mathew B.K, Olaniyi T.A, Awopetu-Adetoro B.O and Raji A.M **Citation**: Popoola, M.A., Olosunde, A.O., Awoyomi, O.V., Mathew, B.K., Olaniyi, T.A., Awopetu-Adetoro, B.O. and Raji, A.M. (2023). Physiological Response of Hyla Weaner Rabbits Fed Wheat Offal-Carried Watermelon Rind. FARA Research Report *Vol 7(64):819-826*. https://doi.org/10.59101/frr072364
63	**MUHAMMAD LAWAL**	**Mitigation of Enteric Methane Emission in Africa as a Climate-Smart Livestock Strategy** **Muhammad Lawal*** **Citation**: Lawal M. (2023) Mitigation of Enteric Methane Emission in Africa as a Climate-Smart Livestock Strategy. FARA Research Report *Vol 7(65):827-843*. https://doi.org/10.59101/frr072365
64	**SCOLASTICA WAMBUA**	**Technical Efficiency of Improved Indigenous Chicken Producers in Kenya: A Stochastic Frontier Approach.** **Scolastica Wambua**, Ibrahim Macharia and Gabriel Mwenjeri **Citation**: Wambua S, Macharia I and Mwenjeri G. (2023) Technical Efficiency of Improved Indigenous Chicken Producers in Kenya: A Stochastic Frontier Approach. FARA Research Report *Vol 7(66):844-853*. https://doi.org/10.59101/frr072366

65	**ADEBOLA ADEDUGBE**	**Smallholder Farmers and the Need for Climate-Smart Agriculture in Nigeria** **Adebola Adedugbe[1]** **Citation**: Adedugbe A. (2023) Smallholder Farmers and the Need for Climate Smart Agriculture in Nigeria. FARA Research Report *Vol 7(67):854-857*. https://doi.org/10.59101/frr072367
66	**IREDELE OGUNBAYO**	**Climate-Smart Agricultural Practices for Sustainable Food System in Nigeria: An Agroecology-Specific Analysis** A.E. Adekoya, A.F. Adenikinju, **I.E. Ogunbayo**, B.O. Oyelami, N.S. Olutegbe, U.G Osadebamwen, O.A Oyeranti, O.F Olajubutu, E.I. Enya & P. Aburime **Citation**: Adekoya E.A, Adenikinju F.A, Ogunbayo E.I, Oyelami O.B, Olutegbe S.N, Osadebamwen G.U, Oyeranti A.O, Olajubutu F.O, Enya I.E and Aburime P. (2023) Climate-Smart Agricultural Practices for sustainable food system in Nigeria: An Agroecology-specific Analysis. FARA Research Report *Vol 7(68):858-883*. https://doi.org/10.59101/frr072368
67	**OLUYINKA ADEWOYIN**	**Ecological Organic Agriculture: A Mitigating Alternative for Climate Change** **Oluyinka Adewoyin** **Citation**: Adewoyin O. (2023) Ecological Organic Agriculture: A mitigating alternative for climate change. FARA Research Report *Vol 7(69):889-898*. https://doi.org/10.59101/frr072369
68	**SUWILANJI SINYANGWE**	**The Contribution of Agroecology to CSA** **Suwilanji Sinyangwe*,** Sithembile Mwamakamba, Njongenhle Nyoni, **Citation**: Sinyangwe S, Mwamakamba S, Nyoni N M B. (2023) The Contribution of Agroecology to CSA. FARA Research Report *Vol 7(70):899-922*. https://doi.org/10.59101/frr072370
69	**VICTOR OLOWE**	**Agronomic Evaluation of Soybeans (*Glycine max* (L.) Merrill) Under Crop Rotation System in the Forest-Savanna Transitory Location in the Humid Tropics** **Olowe, V.I.O**., Adigun, J.A., Enikuomehin, O.A. and Adejuyigbe, C.O **Citation**: Olowe, V.I.O., Adigun, J.A., Enikuomehin, O.A. and Adejuyigbe, C.O. (2023) Agronomic Evaluation of Soybeans (*Glycine max* (L.) Merrill) Under Diversified Crop Rotation System in the Forest-Savanna Transitory Location in the Humid Tropics. FARA Research Report *Vol 7(71):923-935*. https://doi.org/10.59101/frr072371
70	**ADEOLA OLOYEDE**	**Analysis of Agroforestry Practices among Small-Scale Farmers in Southern Guinea Savannah Zone of Nigeria** **Adeola Olarewaju*** and Opeyemi Ayinde

		Citation: Olarewaju A and Ayinde O. (2023) Analysis of Agroforestry Practices among Small-Scale Farmers in Southern Guinea Savannah Zone of Nigeria. FARA Research Report *Vol 7(72):936-947*. https://doi.org/10.59101/frr072372
71	**ANTHONY OYEOGBE**	**Stimulating Ecological Intensification of Cropping Systems in Nigeria – Short-Term Impact of Ecological Cropping Systems on Maize Productivity, Weed Management, Soil Health and Nitrogen Fertilizer Economy** **Anthony Oyeogbe** **Citation**: Oyeogbe A. (2023) Stimulating Ecological Intensification of Cropping Systems in Nigeria – Short-Term Impact of Ecological Cropping Systems on Maize Productivity, Weed Management, Soil Health, and Nitrogen Fertilizer Economy. FARA Research Report *Vol 7(73):948-957*. https://doi.org/10.59101/frr072373
72	**FUNMILAYO MARY OLOYEDE**	**Biodiversity Conservation of Neglected and Underutilized Nigerian Horticultural Crops** ***Oloyede, F. M.,** Ola, D. S. and Iwalewa, E. A **Citation**: Oloyede, F. M., Ola, D. S. and Iwalewa, E. A. (2023) Biodiversity Conservation of Neglected and Underutilized Nigerian Horticultural Crops. FARA Research Report *Vol 7(74):958-974*. https://doi.org/10.59101/frr072374
73	**NEVER MUJERE**	**Examining the Strengths, Weaknesses, Opportunities and Threats of Agroecology in Ensuring Food Security and Environmental Sustainability** **Never Mujere** **Citation**: Mujere N. (2023) Examining the Strengths, Weaknesses, Opportunities and Threats of Agroecology in Ensuring Food Security and Environmental Sustainability. FARA Research Report *Vol 7(75):975-981*. https://doi.org/10.59101/frr072375
74	**OGUNNAIKE GBEMISOLA**	**Mangrove Forest Restoration Nature-Based Solution to Climate Change: An Agroecological Contribution to Climate Sensitive Agriculture in Coastal Communities** **Maria Gbemisola Ogunnaike** [1]*and Olumide David Onafeso **Citation**: Ogunnaike M.G and Onafeso O.D. (2023). Mangrove Forest Restoration Nature-Based Solution to Climate Change: An Agroecological Contribution to Climate-Sensitive Agriculture in Coastal Communities. FARA Research Report *Vol 7(76):982-998*. https://doi.org/10.59101/frr072376
75	**TAOFEEQ YEKINNI**	**Assessment of Stakeholders' Satisfaction for Sustainable Ecological Agricultural Practices that Promote Climate-Smart Agriculture in Northeastern Nigeria** **Taofeeq Oyedeji Yekinni** and Temitope Adejoju Ladigbolu

		Citation: Yekinni O.T. and Ladigbolu T. A. (2023) Assessment of stakeholders' satisfaction for sustainable ecological agricultural practices that promote climate-smart agriculture in Northeastern Nigeria. FARA Research Report *Vol 7(77):999-1006*. https://doi.org/10.59101/frr072377
76	**TEMITAYO ADEYEMO**	**Agroecological Differentials in Crop Production: Evidence from Smallholder Rice Producers in Nigeria** Olorunfemi O. Ogundele[1] and **Temitayo A. Adeyemo** **Citation**: Ogundele O.O and Adeyemo T. A (2023) Agroecological Differentials in Crop Production: Evidence from Smallholder Rice Producers in Nigeria. FARA Research Report *Vol 7(78):1007-1014*. https://doi.org/10.59101/frr072378

Section 6: Summaries of Side Events

2nd Biennial Africa CSA Stakeholders Conference

Side event 1: Climate Information Services in Climate-Smart Agriculture: Enhancing Resilient Agrifood Systems Through Scaling of Land and Water Innovations.

Organizer: One-CGIAR [International Water Management Institute (IWMI)]

Background

It is well-established that Africa is a climate change hotspot and is highly vulnerable due to inherently low adaptive capacities. Most agriculture in Africa (~90%) is rainfed and done by smallholders residing in marginal environments of rural areas. Various factors, including lack of access to climate information services (CIS), and poor agronomic and agricultural water management, limit productivity. Therefore, climate-smart agriculture (CSA) is being promoted to sustainably increase productivity and incomes while adapting to or mitigating climate change. This side event was organized within the context of the One CGIAR Regional Integrated Initiative Transforming AgriFood Systems in West and Central Africa (TAFS-WCA). The aim was to facilitate discussion on how linking CIS to CSA can enable sustainable scaling of bundled land, water, aquaculture, and climate-smart agronomic and digital innovations to strengthen agrifood systems and landscape resilience planning and investment. Four presentations on topics such as scaling bundled innovations, Climate-Smart Landscapes, the interface of gender, CIS and CSA were given to address this. Also, a panel discussion was held.

Discussion

Across Africa, women and youth are most vulnerable in agriculture and susceptible to climate change impacts. Climate-smart agriculture (CSA) and climate information services (CIS) have been proposed to adapt agricultural systems. Although farmers have used various techniques to cope with high climate variability, these strategies may not be sufficient to avert the negative impacts of climate change. Given their different needs, preferences, and capacities, more action is needed on the appropriateness of alternative strategies and technologies for women and youth farmers. On the contrary, adopting a gender transformative approach is required to scale up technologies and digital tools, including CIS and CSA.

Within this context, scaling bundled innovations for resilient agrifood systems has become more critical than ever. The intensive nature of agriculture and the fragmentation in designing solutions requires inclusive landscape management practices supported by Climate Information Services (CIS). Climate-informed agro-advisory services and the presence of widely available high-resolution met, soil data and knowledge of the farming system improve the quality of

planning and decision- making. Additionally, digital tools which are game changers for scaling bundled information need to be provided with adequate capacity building initiatives. Therefore, there is a need for potentially scalable business models where CIS and CSA can be bundled together with other agricultural products and services to support sustainable scaling in the delivery of the same.

However, due to fragmentations in landscape and conflicting nature of land use, implementation of CIS and CSA initiatives can have trade-offs and synergies at the landscape level. Therefore, managing CIS and CSA at the landscape level is necessary. Hence Climate-Smart Landscapes offer an alternative lens through which CIS and CSA can be managed to address trade-offs and synergies in food production, ecosystem conservation, and rural livelihoods across the entire landscape. However, despite the prospects of Climate-Smart Landscape initiatives, it requires new governance and institutional frameworks to overcome the barriers to collaborative decision-making through multi-stakeholder planning processes.

Despite the relevance of CIS and CSA for climate adaptation in Africa at various scales (i.e. farm or landscape), uptake and integration into decision-making remain highly variable and not always fit for purpose and scale. This suggests a challenge in the appropriateness of current CIS for CSA at multiple scales. Both end-users and service providers of CIS and CSA technologies experience barriers. The barriers are gendered and affect different end-users disproportionally, with poor farmers, women and sometimes youth increasingly vulnerable. Major obstacles to adopting CIS include illiteracy and technical format of CI, a mismatch between CI and farmers' needs, low awareness, and information for long-term planning. Critical barriers to CSA include land tenure, limited access to credit, financing, limited knowledge and regulatory support. These barriers are sometimes context-specific, situated and embedded in large political processes of environmental change and everyday activities.

Amidst these barriers, two issues are critical: (i) building social capital and (ii) integration of indigenous knowledge systems (IKS). Firstly, community structures and institutions are determinants of dissemination and the adoption of CSA. Social capital significantly influences people's perceptions of information sources. For cost-effective transmission, CIS should facilitate the exchange of information on best-bet practices through community structures. Social capital can allow community involvement in co-developing CIS and CSA practices, increasing the reach and trust of CSA practices.

Lastly, IKS play a significant role in enabling African farmers to plan, manage and mitigate the negative impacts of climate change (CC) and climate variability (CV). IKS tend to be built over time, are low cost, are embedded in the farmers' psyche and practices, are fairly reliable and are relatively adaptable to changing conditions on the ground. IKS play an essential role in linking Climate Information Systems (CIS) to CSA through being a repository of knowledge on CC and CV, as well as communicating this to the farmers in ways that are understandable to the end user.

Conclusion

There are several tools already in existence, with most of them being technical and often do not address the wider adaptation needs of end-users. The mismatch is also evident in the limited integration of indigenous knowledge to develop tools. It is now imperative to integrate diverse knowledge systems, especially indigenous knowledge, in developing CIS tools and CSA technologies to improve a local sense of ownership, scale up adoption and improve sustainability. However, appropriate documentation of indigenous knowledge is a first step toward bridging the gap between end-users needs and service providers' technicalities. Adopting a landscape-based approach is critical to developing context-specific solutions bespoke to the needs of farmers within these landscapes and ensuring that such solutions consider system-level dependencies, trade-offs and synergies. Tailored CIS and CSA technologies, at the appropriate scale, and co-developed with communities, can help transform agrifood systems towards greater sustainability.

Key Messages

1. Agricultural intensification for strengthening food system resilience requires inclusive climate-smart landscape management practices supported by climate information services (CIS) to address trade-offs and synergies in food production, ecosystem conservation, and rural livelihoods.
2. Despite the relevance of CIS and CSA for climate adaptation in Africa at various scales, several gendered barriers, including a mismatch between CI and farmers' needs, land tenure issues, limited access to credit, financing, knowledge, and regulatory support constrain the adoption of existing CSA and CIS solutions.
3. Tailored CIS and CSA solutions, at the appropriate scale, and co-developed with communities, can help transform agrifood systems towards greater sustainability. However, this requires new governance and institutional frameworks, application of a gender transformative approach, strengthening social capital, and integration of indigenous knowledge into CIS.

Side event 2: A Communiqué on the Soil Initiative for Africa Side Event held at the FARA Science and Partnerships for Agriculture Conference Accra, Ghana, 14-16 September 2022

Organizer: Soil Initiative for Africa (FARA, CRS, USAID, CORAF, ASARECA, CCARDESA, AFAAS)

Background

A decade-long decline in soil health and fertility continues across the African continent. This decline in soil health has had many harmful consequences – reduction in agricultural productivity and in agricultural GDP (by an estimated 5% annually!); less water capture and lowered water quality across the Continent; natural resource degradation and increased vulnerability to climate change; threatened food security and rural livelihoods; political instability and population migration; and expanding need for disaster relief (for droughts and floods).

A Soil Initiative for Africa (SIA) is being developed to reverse the continental decline in soil health – farm by farm – and to put into place a robust African soil management system of sound institutions, policies, programmes, and services that empower land users to adopt practices that restore and sustain soil health, improve crop and livestock productivity and income, ecosystem services, and environmental health. The SIA is an initiative of the African Union Commission (AUC). Initial plans for the SIA have been formulated (at the request of the AUC) by a FARA-led SIA working group. The SIA will be launched at the AUC Fertilizer and Soil Health Summit in June 2023. The launch of the SIA will initiate action at scale at every level – plot, farm, landscape, community, country, region, and Continent. It will also be a call for coordinated support for the SIA from Africa's leaders as well from Africa's partners from across the world. The launch of the SIA will signal the beginning of the sustainable renewal of soil health and fertility across the Continent.

The development of the SIA has technical and financial support from several partners including the Bill and Melinda Gates Foundation, the USAID, the CGIAR, the FAO Global Soil Partnership (and its African Soil Partnership), and the Catholic Relief Services (CRS). A Consultation on Plans for the Soil Initiative for Africa, a Day-long stakeholder consultation on the initial plans for the SIA was held on September 15, 2022, in Accra, Ghana as a special side event of the 2022 FARA Science and Partnerships for Agriculture Conference (held 14-16 September 2022). Representatives of dozens of countries and many African institutions (and several global institutions) participated (some in-person, and many others through virtual connection) in a broad co-creating discussion.

The objectives of the consultation were to:

- Seek stakeholders' opinions and views on the vision, purpose, and content of the SIA.
- Describe the unique value proposition of the SIA.
- Actively engage with member states for co-development of the initiative to ensure a shared sense of ownership.

- Foster discussion on the state of soils and ongoing initiatives at the country level as a contribution to the SIA.
- Provide input and feedback on the draft framework for the SIA.

Conclusions

The consultation side event had the following outcomes:

- Shared understanding of the SIA (why, what, who, how - vision, purpose, and the content of the SIA and of its unique value proposition).
- General collective confirmation of attendees including member states to support the SIA and to engage in the co-development of the initiative.
- Initial shared sense of ownership.
- Initial feedback on the SIA's intent, approach, objectives, foundational areas of work, and scaling approach.
- Initial feedback from member states on their national efforts in terms of soil management.

For additional information on the SIA, please contact Dr Oluwole Fatunbi, Senior Technical Cluster Leader/Innovation Systems Specialist, FARA, ofatunbi@faraafrica.org

Side event 3: FARA Technical Think-Tank on Emerging Technological Issues within African Agriculture

Organizer: FARA (CAADP-XP4)

Background

The Continental Think-Tank to respond to Technological Issues in African Agriculture is established to carry out discussions, networking, and hands-on studies on the various emerging technological issues around African agriculture and to generate solutions. The Think-Tank is expected to liaise widely and use infrastructures within universities and research institutes to create solutions and options for advocacy and action. The continental Think-Tank's establishment aligns with the Sub-Regional Organizations (SROs) (ASARECA, CCARDESA, and CORAF), AFAAS, and all other willing international organizations, donor projects, and national and continental initiatives.

The vision of the Think-Tank is to constitute a consortium of experts from the continent to form a research response alliance that would rapidly attend to knowledge and technology generation on emerging issues within African agriculture. The think-Tank aims to create a platform for a group of competent individuals who will engage in a dynamic context to the research and interact on how to generate solutions to emerging challenges in agriculture within Africa with foresight projections. It will be a platform to process ideas scientifically and analyze and develop strategies to combat biotic and abiotic factors affecting agricultural productivity on the African continent.

The Role and Function of the Think-Tank; The Think-Tank Strategy

Prof. Offei gave a brief background of African agriculture with an outlook on the broader contributions of agriculture to the African economy in terms of its contribution to employment and GDP. He also gave a general picture of its opportunities and current challenges, and where challenges are noted to outweigh the opportunities, causing stagnation and constant decline in the agriculture sector in Africa despite the available opportunities. He attributed the challenges faced in the agricultural sector in Africa to biological, environmental, technological, poor market, and low investment factors within the continent. However, the solutions used to curtail the challenges are often inopportune, untimely, late, uncoordinated, and frequently not context-specific, he noted in his presentation.

So, FARA considered creating a research think-tank to form a research response alliance that would rapidly respond to knowledge and technology generation on emerging issues. The goal is to process ideas scientifically and analyze and develop strategies to combat biotic and abiotic factors affecting agricultural productivity on the African continent. The maximum number of members of the think-tank will be 15 accomplished scientists with leadership experience, knowledge, and professional experience in different areas of Africa's agricultural research and development. The Think-Tank shall be elastic, with its membership being voluntary. The Think-Tank will be an instrument of FARA; its operation will be limited to the FARA mandate of

forming a coalition of actors to foster broad-based agricultural innovation through research drafting policy documents on emerging technological issues around African agriculture, which will fit into FARA's new programmes and project documents, to donors, international organizations, and government officials at the country level. Resources for the Think-Tank activities will be drawn from the CAADP-XP4 projects and other ancillary sources.

The role of the think-tank is to commission research and generate knowledge and technological solutions to the emerging technological issues in African agriculture. The Think-Tank will capture and share existing knowledge to advocate for investment and other action toward generating solutions. The Think-Tank will facilitate learning and enable dialogue to solve challenging problems. It will also facilitate partnerships and linkages between the Think-Tank and advanced laboratories for joint sourcing solutions to identified issues and organize knowledge and technology dissemination action as well as policy and advocacy discussions.

Some of the operational modalities of the think-tank highlighted were that the think-tank would consider programmes that would promote and enhance human capital within the agricultural sector and research to convert innovations and opportunities in agriculture into productive outputs. The think-tank may set up a committee responsible for monitoring global issues around agriculture. FARA directorate of research and innovation cluster (DRI) shall also present emerging issues on African agriculture to the Think-Tank for discussions and actions and finally, commissioned studies.

Finally, he explained the reporting lines of the think-tank. He stated that outputs from studies would be formulated as briefs, tools, posters, research publications, and instruments to engage with Governments and agencies, donors, and other partner organizations for further detailed studies and implementation where FARA shall involve external reviewers to review all studies before packaging and dissemination.

Developing a Guiding Framework to Respond to Emerging Technological Issues Within African Agriculture

The think-tank saw a need of having a developed architectural framework as an approach to use in solving emerging issues with the agricultural sector in Africa. The think-tank identified three approaches as the baseline of all entry levels with the agriculture sector. These three approaches identified included, production, distribution and consumption. Some cross-cutting elements identified included policy, ICT, building resilience, nutrition, and gender mainstreaming. It was agreed that the major challenges, solutions, and food system approach identified in the meeting will be fitted into developing framework diagram. The identified challenges, solutions and food systems were shown in their draft architectural framework as an approach to solving real time problems within the agricultural sector in Africa.

Side event 4: The contribution of agroecology to climate change adaptation and mitigation

Organizer: The DeSIRA-Lift Initiative (FARA and DeSIRA LIFT)

Background

The 2022 edition of the Biennial Climate-Smart Agriculture Conference was held during the Science and Partnership for Agriculture Conference (SPAC) led by the Forum for Agricultural Research in Africa (FARA) on 14th to 16th September 2022 in Accra, Ghana and online. It provided a platform to discuss sustainable models of agriculture which contribute to climate change adaptation and mitigation such as agroecology.

A session was convened by DeSIRA-Lift and FARA to discuss the contribution of agroecology to climate change adaptation and mitigation where experts from policy, finance and private sector presented successful agroecological initiatives and practices contributing to climate resilience and concrete ways in which agroecology can support adaptation and mitigation strategies.

Main messages and recommendations

- There is strong evidence from research and practice that diversity in agroecological systems reduces vulnerabilities to climate variability. However, it was recognized that the findings are not sufficiently disseminated across stakeholders and that the investments made on research in agroecology are very low compared to those in conventional agriculture.
- The use of traditional knowledge from smallholders and value chain actors combined with the dissemination of scientific knowledge are recognized as effective in managing climate risks. It is recommended to support and document multistakeholder dialogues which bring complementary perspectives and support to agroecological transitions. In this context, the experience of the Alliance for Agroecology in West Africa (3AO) is very interesting.
- The efforts in promoting the circular economy, reducing waste, and recycling it into productive resources combined with resources use efficiency contribute to limit greenhouse gas emissions and support climate change mitigation and are a source of income for smallholders. Furthermore, the rising cost of agricultural fertilizers and the impact on most African economies makes the use of organic fertilizers an urgent necessity. It is recommended to support local farmers and businesses to access organic fertilizer and to upscale its adoption and use.
- It is recognized that the entrepreneurial ecosystem (research, policy, finance) needs to be more favorable to the agroecological wide-scale transition. In that context, incentives need to be available for smallholders and small and medium-sized enterprises (SMEs) to expand successful agroecological practices along the chain, from production to consumption. Conducive policies can also be instrumental to foster the domestic

demand for agroecological products and consolidate new markets and well-informed consumers.

- The importance of financial investments and public-private partnerships was underlined as a key pathway to expand economic viable solutions adopted by smallholders, and as such, the role of finance in supporting green practices and technologies is well recognized.

Proposed actions:

1. There is a need to disseminate and promote successful agroecological practices across Africa. FARA has mapped CSA innovations at the continent level and therefore is well placed to develop a roadmap to inform about and promote the contribution of agroecology to climate change adaptation and mitigation.
2. Recognizing that the next generation must be equipped with the right knowledge, skills, and technologies (situation analysis, ecosystem support, enabling environment and exchange of best practices), it is recommended to carry out a mapping of youth and women-led innovations which support agroecological principles and practices at field level. DeSIRA-LIFT could consider supporting such an activity.
3. Increased investments from financial institutions and development partners, as well as increased evidence from practitioners and research are needed to inform policy and expand successes from the field and thus to upscale agroecological practices. FARA and DeSIRA-LIFT can partner with the private sector and finance institutions to identify scalable solutions, facilitate agribusiness exchanges on responsible value chains and further access to agroecological inclusive markets.
4. Green technologies and green services offer growing economic opportunities for operators in the agri-food sector, especially in the context of the implementation of the African Continental Free Trade Area (AfCFTA). However, the knowledge about existing accessible green technologies is scattered. There is a need to map green solutions and innovations led by or adopted by local smallholders and entrepreneurs.
5. It is urgent to promote the potential and successes of agroecology amongst a wide range of stakeholders from farm to fork through support to communities of practice where knowledge co-creation and findings from research are widely disseminated. FARA and DeSIRA-LIFT with other key partners can support inclusive innovation platforms engaging stakeholders in AKIS.
6. The existing sustainable and agroecological solutions which contribute to climate change adaptation and mitigation need to be documented, disseminated, and expanded by FARA and partners to inform the COP27 and COP28 and feed the continental agricultural initiatives and processes. The Climate-Smart Agriculture Biennial Conferences have a key role to play in this regard.

Summary of the presentations

This session gathered around 70 on site and online participants from a wide range of stakeholders: development partners, policy institutions, research organizations and projects, finance institutions, farmers' organizations, private sector, and project implementers. Discussions brought different perspectives from policy to practice on how agroecology can contribute to climate change adaptation and mitigation.

The session was organized around three themes:

(i) Successes from the field supporting climate change adaptation and mitigation.
(ii) Smart solutions and local-led technologies from farmers and entrepreneurs - Promoting waste reduction and circular economy.
(iii) Public and private investments and policies needed to scale up successful agroecological practices.

Section 7: Conclusion

Owing to the central intent of the Biennial Africa Climate-Smart Agriculture Stakeholders Conference; to foster continental and national CSA readiness to avert the negative effects of climate change and ensure the sustainability of agriculture, food, and nutritional security, taking a food system approach. The conference provides an opportunity to bring all stakeholders working on CSA together to harmonize action that will foster effective coordination of action and reporting. It offers the continent the opportunity to discuss and update progress on the state of CSA initiatives and contributions of science. It promotes the need to analyze the sector and use the foresight system to define the desired plausible futures and jointly develop a continental direction for CSA action based on a bottom-up approach.

The first Biennial CSA conference organized in December 2020 indicated the need to have a structured research agenda to foster clear technology generation that meets the felt need of the end users. The CSA analysis and technology adoption have too often focused on productivity and food production systems; with less attention paid to the whole value chain including the management and storage of production after harvest. There is a need to develop a guidance note on CSA interventions that generates benefits for both the farmers and the environment, as well as help to deliver the SDGs, DRR, ecosystem services, etc. There is also the need to effectively engage the youth and gender issues in the CSA activity development and to enhance the policy-science interface, to plan agricultural investment plans and investment mobilization to respond to the specific contexts and needs of the African food systems, farmers, and rural communities. Efforts should be channelled into unlocking financial resources from different sources viz., responsible development banks, African philanthropy, impact funds, and global funds (Green Climate Fund (GCF), Global Adaptation Fund, Africa Climate Change Fund). The national designated institution in the country can access climate financing (Green Climate Fund) and to coordinate across economic sectors and develop integrated projects that mainstream CSA.

The development of the themes for the 2nd biennial conference took a clue to the outcomes of the 2020 conference as well and other emerging issues on the continent. The themes included: (i). The role of digitalization in advancing CSA in the smallholders' systems, (ii) The nexus of CSA and the mechanization of the smallholder system in Africa., (iii). Bottom-up and system-wide capacity development approaches to enhance CSA practices, (iv). Strengthening the support of extension and advisory services to ensure CSA compliance among smallholder farmers in Africa, (v) Advances in CSA technology generation and use in the crop, livestock, fisheries, and aquaculture, and (vi) Compatibility assessment of agroecology and CSA practices.

Recommendations:

The conference discussions teased out the following.

1. There is considerable progress in research activities on CSA within and outside the continent; but the research outputs are on knowledge generation and policy issues compared to hard-line technology generation in terms of CSA production systems, breed, and variety development; water management techniques, processing technologies, and weather management systems.
2. The emerging digitalization drive has a huge potential to shape the development of agriculture through a reduction on transaction costs, facilitation of information including technologies, prices of commodities, and networking. The digitalization drive needs to step into robotics and mechanization for the smallholder system, including remote sensing and provision of climate, soil, and agronomic information to inform decision on cultivation practice that are climate smart.
3. The compatibility of the agroecology practices with CSA is growing in importance and awareness among stakeholders in African agriculture is growing. However, knowledge, policy and institutional actions are required to further strengthen the awareness and development of new farming practices. The need for Africa to define the pathway for transition of its agriculture and food systems to align with CSA and agroecology is still outstanding.
4. The development of CSA compliant mechanization system for smallholders in Africa is a key outstanding issue, while the design and development of small machineries for processing is accomplished, the compatible machines for clearing and tillage remain a challenge alongside with other economic and institutional constraints.
5. The need for Africa to strengthen its common position at the COP is very vital to the development of its agriculture and the adaptation and mitigation drive. Africa needs to push for a dedicated UNFCCC Subsidiary Body (SB) on Developing Countries and Agriculture and Food Security. It should strengthen planning towards ensuring financial gaps related to tackling climate change are delivered as earlier promised by developed countries. Promote meaningful representation of specific CSA transition needs for Africa that integrates context as a key consideration. Thus, to create enabling environment for investment in research and interventions related to CSA opportunities in the region while strengthening capacity to empower and include women, men, and youth, as well as address restrictive socio-cultural barriers.

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