AgriFI Kenya
Challenge Fund

Climate Smart Agriculture

Developing an Intervention Guide and Glossary of Terms for Smallholder Climate Smart Agriculture in Kenya

September 2019

This programme is funded by the European Union

SlovakAid
GOOD IDEA SLOVAKIA

Self Help Africa

imani DEVELOPMENT
global vision, local knowledge

Authors: Steve Taylor, Eireann Harkins & Isla Farley

Cover image: Agricultural demonstration plot, Meru county (Imani research team, 2019)

CONTENTS

EXECUTIVE SUMMARY

The concept of climate smart agriculture (CSA) is fundamental to AgriFI realising its objective of improving the capacity of smallholder farmers (SHF) to practice environmentally sustainable agriculture as a business in inclusive value chains (VC).

Climate change and climate variability are key challenges facing Kenya as it seeks to realise its Vision 2030. The business case for CSA is strong and agri-enterprises seeking to develop commercial resilience must ensure that they address issues of environmental sustainability both at the firm level and throughout their sourcing activities. CSA is a vital means of securing sustainable, productive and resilient livelihoods for SHFs.

Figure 1: Commercial land and forestry, Meru (2019)

In as much as it is designed to promote commercially resilient and environmentally sustainable agriculture, AgriFI's theory of change naturally contributes to key CSA requirements. In its evaluation of impacts, and across the portfolio, AgriFI can maximise the potential for positive impact by taking an informed approach to selection of and engagement with partner SMEs. In doing so, it will also minimise the risk of negative climate / environmental impacts.

Kenya is a country of diverse geographies and localised climate systems where a one-size-fits-all approach to CSA would prove ineffective. This paper therefore sets out key principles of CSA, a glossary of key terms, and tools for assessing concept notes (CN) and business plans in order to equip the AgriFI team to make informed judgements about the potential climate impacts of applicant SMEs and their proposed projects. Key questions for consideration in engagement with SMEs include:

i) whether they can demonstrate how their activities are contributing to CSA
ii) if / how they are contributing to commercially resilient agriculture through their sourcing models,
iii) whether they are leveraging the strategic imperatives of CSA across different initiatives (e.g. decentralisation, climate objectives, agroforestry)

Summary of Key Findings:

1. **Business Case:** There is a strong *business case* for climate smart agriculture.
2. **Building Resilience:** CSA is as much about *building resilience* and *mitigating climate risks* as it is about optimising opportunities to increase productivity.
3. **Local Context:** Kenya has a wide range of localised geographies and climates. CSA initiatives need to be *tailored to the local context* in order to be appropriate and effective.
4. **Water:** Drought, variation in / unpredictable rainfall patterns continue to be key issues of concern in Kenya. For this reason, initiatives focusing on water (e.g. conservation, harvesting, storage, irrigation) are of particular importance.
5. **Tree crops:** have an inherently strong CSA case beyond deliberate or specific interventions (with caveats of water and land conservation).

1. INTRODUCTION

This report provides assistance and background information relevant to the assessment of potential agricultural projects in Kenya. The aim is to develop projects which follow the principles and ethos of climate smart agriculture and which may be suitable candidates for AgriFI in that they indicate an understanding of, and willingness to adapt farm and business models to ensure that they are more robust to changing climate patterns, are low greenhouse gas emitting and are practical and achievable in a time of climate emergency.

The literature review here clearly identifies the effects of climate change and climate variability on agriculture as the greatest challenge for Kenya to realise its Vision 2030 and specifically of becoming a prosperous country. For this reason alone, addressing the link between climate challenges and agriculture is crucial and justified. The review further identifies agriculture as being sensitive and highly vulnerable to climate change and climate variability, and already suffering through prolonged dry spells, droughts, floods and other extreme events directly affecting food production and development. Field research in early 2019 reinforced the view that drought and worrying recent rainfall patterns are amongst the greatest concerns to the agricultural sector today.

The challenges posed by climate change can be tackled by increasing the adaptive capacity and resilience of agriculture to climate change impacts. Building the capacity of land users, especially SHFs, and influencing policy makers and relevant institutions towards the implementation of technologies and systems that can adapt to and mitigate the effects of climate change and weather variability is recommended throughout the reports, strategies and policy documents reviewed here.

A recent World Bank Report describes the CSA concept as reflecting *"an ambition to further integrate agricultural development and climate responsiveness. CSA aims to achieve food security and broader development goals under a changing climate and increasing food demand. CSA initiatives sustainably increase productivity, enhance resilience, and minimise greenhouse gas (GHGs) emissions. Increased planning is vital in order to address trade-offs and synergies between the three pillars: productivity, adaptation, and mitigation. By addressing challenges in environmental, social, and economic dimensions across productive landscapes, CSA practices coordinate the priorities of multiple countries and stakeholders in order to achieve more efficient, effective, and equitable food systems."* [1]

This report considers both agricultural and horticultural practices and delivers recommendations which fit within the cultural and political context of Kenya today. It is understood that in different regions of Kenya there may be different approaches, cultural concerns and climate issues and where possible these are taken into account.

[1] World Bank; CIAT. 2015. Climate-Smart Agriculture in Kenya. CSA Country Profiles for Africa, Asia, and Latin America and the Caribbean Series. Washington D.C.: The World Bank Group. (CIAT is the International Center for Tropical Agriculture

1.1. RELEVANCE TO AGRIFI

AgriFi seeks to support and enable at least 50 agri-enterprises to increase their turnover by at least 25%, leading to increased incomes and food security for at least 100,000 smallholders / pastoralists. Agricultural issues inevitably form a crucial component of the well-being of smallholder farmers and pastoralists. The challenges posed by changing climate conditions need to be understood and addressed if farm output and food supplies are to maintain growth. These climate-related challenges are also a key concern for agri-enterprises whose growth and development depends on the productivity and resilience of their SHF suppliers. Adapting to the principles of CSA is demonstrated here as being the most appropriate means of helping SHFs meet current and future climate associated challenges.

The purpose of developing a brief on the principles of CSA for value chain development with smallholder farmers in Kenya is to ensure that members of the AgriFi team are well informed when scoring concept notes and supporting implementation of agricultural, horticultural and agri-business programmes / elements of AgriFi. It is important to note that there are deeply embedded drivers in agri VCs supporting the development of CSA. Whilst there is strong potential for AgriFI to support ambitious targeted improvements through CSA, it is important to note that by broadly supporting sustainable agricultural development the fund will naturally bring about positive CSA impacts.

Figure 2: Growing food crops during maturation of new higher-value Hass avocado tree, Meru county (2019)

2. CLIMATE SMART AGRICULTURE

This section briefly reviews the concept of CSA as described in recent relevant literature which can help inform our understanding of how it is considered and adopted in Kenya.

2.1. WHAT IS CLIMATE SMART AGRICULTURE?

The Food and Agricultural Organization of the United Nations (FAO) defines CSA as practices which[2]:

1. Sustainably increase agricultural productivity and incomes (assets)
2. Adapt and build resilience to climate change (vulnerability, adaptation and resilience)
3. Reduce and/or remove greenhouse gases emissions, where possible (mitigation)

Unpacking and building upon these factors, we can understand CSA as an approach which ensures that agricultural practices[3]:

- Increase gender equality within households and communities
- Provide nutrition and health benefits despite anticipated changes in the climate in a defined region (nutrition-sensitive agriculture)
- Build, or prevent the decline of, soil fertility
- Do not negatively affect the local environment, biodiversity, ecosystems and hydrology
- Do not negatively affect pastoralist communities and indigenous communities who share common resources
- Do not create a monopoly for the owners of the technology
- Do not displace or exclude other technologies that would score higher on the CSA scale (alternatives analysis)
- Show a higher ratio of benefits to risks than that of existing technologies (risk benefit analysis)
- Adequately mitigate any negative consequences of the technology

Published in 2015, The World Bank CIAT Report[4] is now slightly dated but remains an important starting point for understanding CSA in Kenya. Initial research indicates that many of the issues remain the same or are broadly similar to those noted in 2015. It states that the CSA concept reflects an ambition to further integrate agricultural development and climate responsiveness, highlights that the key aim is *"to achieve food security and broader development goals under a changing climate and increasing food demand"*.

The report highlights the importance of addressing synergies between the three pillars: **productivity, adaptation,** and **mitigation** but notes that, while the concept is new and still evolving, many of the practices that make up CSA already exist worldwide and are currently used by farmers at various stages of agricultural activities**.** A useful summary chart provided in the report is reproduced below.

[2] FAO 2013 – Climate Smart Agriculture Sourcebook: http://www.fao.org/3/i3325e/i3325e.pdf

[3] SHA 2019 - Climate Smart Position Paper

[4] World Bank; CIAT. 2015. Climate-Smart Agriculture in Kenya. CSA Country Profiles for Africa, Asia, and Latin America and the Caribbean Series. Washington D.C.: The World Bank Group.

Climate-smart agriculture (CSA) considerations

(P) Kenya agriculture is characterized by both very small landholdings (0.3–3 ha) and extremely limited irrigation (less than 0.16% of arable land). This poses the greatest challenge on sustainably intensifying agricultural productivity. However, intensive agriculture using sustainable land management (SLM) practices with basic irrigation presents an opportunity for redressing this issue.

(P) (A) While continuing to rely on traditional practices, Kenyan farmers are also embracing new and improved technologies, as evident in dairy and horticulture production systems. These value chains have the potential to generate enough revenue to enable farmers to invest in promising CSA interventions, such as the use of forage (improved feeding systems) and irrigation (water management practices).

(P) (A) (M) Declining productivity of many staples (particularly wheat and maize) is alarming. However, there is also great potential to redress this through investing in CSA interventions that would increase productivity and mitigate climate change risks, such as new improved seeds, drought-resistant seeds, alley cropping, coupled with small-scale irrigation or production diversification.

(P) (A) (M) Targeted CSA interventions, such as the inclusion of agroforestry in the cultivation of fruit trees and vegetables or keeping small ruminants and poultry, have the potential to reduce the prevalence of undernourishment from the current rate (24%).

(P) (M) Investments in improved pastoral livestock-keeping practices are essential for achieving reductions in methane emissions from agriculture. Introducing improving breed and feeding regimes, the use of biodigestors for biogas production have the potential to reduce greenhouse gas (GHG) emissions, particularly in key areas such as the Arid and Semi-arid Lands (ASALs).

(Institutions) (A) (M) (P) Effective, widespread implementation of CSA policies and practices requires an integrated landscape management strategy, broader gender mainstreaming approaches when designing interventions for promoting financial or land ownership, as well as adequate institutions and financing mechanisms to address tradeoffs and/or synergies between productivity, adaptation, and mitigation goals.

(Institutions) (A) (M) (P) Kenya has several innovative platforms that offer opportunities for increased productivity, adaptation, and mitigation across production systems. In particular, the Kenya Climate-Smart Agriculture Programme (2015–2030) will be crucial for coordinating domestic and international CSA interventions.

(Institutions) Devolution of agriculture decision-making to county governments creates valuable opportunities for accelerating the implementation of policies that incentivize CSA adoption on the field, for targeted investments in rural infrastructure, but also for the delivery of timely information to farmers (early warning systems, agricultural extension services, etc.). This requires examining and building capacity of county governments to spearhead agricultural development needs.

(A) Adaptation (M) Mitigation (P) Productivity (Institutions) Institutions ($) Finance

2.2. WHY CLIMATE SMART AGRICULTURE IS IMPORTANT

> *"Climate change creates additional stresses on land, exacerbating existing risks to livelihoods, biodiversity, human and ecosystem health, infrastructure, and food systems"*
> (IPCC 2019)

The business case for adopting CSA practices is compelling and is driven to a certain extent by the concerns associated with the 'do nothing' scenario. It is clear that climate change is having an impact, globally and specifically in Kenya, and that continuing existing practice and failing to adapt is likely to reduce agricultural sector output. This is clarified in several recent reports, strategies and policies.

The Intergovernmental Panel on Climate Change (IPCC) reports that the frequency and intensity of droughts are projected to increase through the 21st Century, particularly affecting southern Africa[5]. Global warming is already resulting in increased water scarcity, soil erosion, vegetation loss and crop yield decline; these risks are projected

[5] IPCC 2019 – Climate Change and Land - https://www.ipcc.ch/srccl/

to become increasingly severe. The increasing frequency and magnitude of severe weather events is a significant threat to the stability food supplies.

To understand the climate threat in Kenya as a starting point, the relevant background is available through the Met Office Report: *Climate Observations, Projections and Impacts*[6]. Though somewhat dated (published in 2011) it still offers valuable insights into the climate factors that are driving the need for CSA and helps place agricultural practices in the context of changing climate challenges. It identifies the following key points:

Climate observations

- Widespread warming has been observed over Kenya since 1960.
- There is little precipitation data available for Kenya but there is some limited evidence for decreasing precipitation between 1960 and 2003, the period for which some data is available.

Climate change projections

- There is reasonable agreement for projections for temperature increases across Kenya of up to around 3°C (CMIP3).
- The CMIP3 model ensemble projects strong precipitation increases over East Africa, in particular Kenya, with increases of over 20% projected with strong agreement across the CMIP3 models. [7]

Climate change impact projections

Crop yields

- The majority of global- and regional-scale studies included here generally project yield declines with climate change for the country's most important staple crops; maize and beans.
- National-scale studies highlight the importance of water storage in ameliorating and managing the impact of future climate change on the country's crops.

Figure 3: Coconut processing using husks for biofuel, Kwale county (2018)

[6] Met Office 2011 - Climate: Observations, projections and impacts - Kenya

[7] Data on projected rainfall and temperature changes is also available from the more recent CMIP5. This suggests rises in temperature across East Africa of 1.7-2.8 °C and an increase in extreme rainfall events (Ongoma et al 2017). Up to date information is available from the IPCC Data Distribution Centre - https://www.ipcc-data.org/index.html

Food security

- Kenya is currently a country of moderately high levels of undernourishment. Several global-scale studies project that Kenya could face increasingly serious food security issues over the next 40 years.

Water stress and drought

- Recent analysis of Kenya's current water resources has shown it is exposed to a high water security threat across its entire area.
- Future water availability is uncertain, with potential increases in annual run-off masking overall reductions in water availability during certain periods, while studies neglect the lack of infrastructure to store water.
- Large uncertainties remain in global-, regional- and national-scale projections of future water stress and drought for the country, and as such, knowledge is little improved beyond that reported in the IPCC AR4.
- Simulations from the AVOID programme project that climate change generally has a minor impact on water stress beyond 2030 in Kenya, and that some parts of the country may experience a decrease with climate change from 2050 onward.

Pluvial flooding and rainfall (water ponding on surfaces including fields and roads)

- The IPCC AR4 noted potential increases in mean precipitation across East Africa, especially in summer.
- Some recent work has contradicted this, suggesting the potential for decreased summer rainfall over Kenya in the future.

Fluvial flooding (flooding relating to rivers)

- A number of global-scale and catchment-scale assessments are consistent in indicating that flood magnitudes in Kenya could increase with climate change.
- Simulations by the AVOID programme support this, with a large majority of the models showing a tendency for (sometimes very large) increases in flood risk, particularly later in the century and in the A1B scenario.

Tropical cyclones

- Kenya is occasionally affected by tropical cyclones moving westward from the Indian Ocean. There is considerable uncertainty in projections of overall Indian Ocean cyclone frequency and intensity.
- Uncertainty in projections means that it is not possible to robustly state whether cyclone damage in Kenya may increase or decrease with climate change.

Coastal regions

- A recent study provides new knowledge relative to the IPCC AR4, for coastal impacts in Kenya. A 10% intensification of the current 1-in-100-year storm surge combined with a 1m Sea Level Rise (SLR) could affect around 42% of coastal total land, 22% of coastal agricultural land, 32% of coastal GDP, and 39% of coastal urban areas.
- Research presented in the first national communication of Kenya to the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCC) also suggests that Kenya is highly vulnerable to SLR, and that impacts could be severe, especially in the Mombasa district.

The climate concerns are developed further and supported by the Kenya National Adaptation Plan 2015 – 2030[8] (NAP) which focuses on current and future climate trends and describes the country's vulnerability to climate change. It elaborates institutional arrangements, including monitoring and evaluation and highlights priority actions across 20 planning sectors for the short, medium and long term. This builds on the premise that all socioeconomic sectors are vulnerable to climate change impacts, but with potentially varying impacts between sectors.

2.3. WHAT CSA MEANS TO KENYA

The *National Climate Change Action Plan*[9] (NCCAP) considers the required response to climate change across a range of sectors, having analysed existing climate change institutional structures. It proposed a comprehensive institutional framework with defined roles and responsibilities for climate change response in the context of a devolved government system. This included a climate related recommendation for agriculture, stating:

> *"Agriculture, which accounts for about 20 percent of the GDP43, is very sensitive to climate change, meaning that agricultural systems will need to adapt to ensure provision of adequate food for a growing population and to improve production of export crops"*

NCCAP further notes that the agriculture sector offers great potential for synergies among the objectives of food security, poverty reduction, adaptation and mitigation. Many climate-smart agricultural practices that reduce climate vulnerability also reduce emissions and improve agricultural production potential. CSA is therefore not just about agriculture itself but helping Kenya meet the challenges associated with climate change and to acknowledge the interdependent nature of agriculture with other sectors and other priorities across Kenya.

The report's key recommendations included comprehensive institutional reforms, with the establishment of a National Climate Change Council, a Climate Change Directorate, and a Technical Advisory Committee, together with the establishment of a Kenya climate fund. A framework climate change law encapsulating legislative, policy and institutional change was recommended.

At the policy level, the concerns highlighted in climate reports have led to a Framework Program, Strategy and supporting documents to direct the agricultural response. These include the Kenya Climate-Smart Agriculture Framework Program[10], which identifies the agriculture sector as one of the key sectors contributing to the projected annual national economic growth as envisaged in the National Development Blue Print, *The Kenya Vision 2030*. About 98% of Kenya's agricultural systems are rain-fed and susceptible to climate change and variability which could jeopardise the projected sector contribution to national economic growth. The Framework Program expects changes in climate and weather patterns to expose the rain-fed farming systems, especially those in the arid and semi-arid lands (ASAL), to more climate related vulnerabilities increasing farming communities' susceptibility to food insecurity and poverty. Innovative climate responsive and transformative measures are therefore urgently required to assist stakeholders in the sector across the agricultural VC to cope with the effects of both current, and projected, change in climate patterns. CSA is identified in the Framework Programme as a viable alternative to provide solutions towards increased agriculture sector productivity while addressing effects of changing climate and weather patterns.

[8] Kenya National Adaptation Plan: 2015-2030, Government of Kenya, July 2016
[9] Government of Kenya (2012). National Climate Change Action Plan
[10] Republic of Kenya, Jointly co-ordinated by Ministry of Agriculture, Livestock and Fisheries and Ministry of Environment and Natural Resources – Kenya Climate Smart Agriculture Framework Programme: published 2015

The Vision for the CSA Program is a ***"climate resilient and low carbon growth sustainable agriculture that ensures food security and contributes to national development goals in line with Kenya Vision 2030."***

The Kenya Climate Smart Agriculture Strategy 2017 - 2026[11] (KCSAS) is the national strategy, produced on the basis that *"climate change is real and has become an impediment to sustainable development globally"*. The KCSAS is based on a need for action and warns of the consequences of not adopting CSA practices. It highlights the negative impacts associated with climate change and continuing agricultural practices, which will include declining agricultural productivity and loss of crops, livestock, fish and investments in agriculture due to changing temperatures and precipitation with increased frequency and intensity of extreme weather events. Further, fisheries and aquaculture are affected through acidification of water bodies, changes in water temperatures and circulation patterns which reduce productivity.

Agriculture itself also contributes to the problem. The dependence on rainfall leads to unsustainable land and agricultural water management such that according to the KCSAS, Kenya's GHG emissions - estimated to be 73 million tons of carbon dioxide equivalent (Mt CO^2e) in 2010 - are expected to rise to 143 Mt CO^2e in 2030 unless appropriate mitigation actions are taken.

Agriculture is the largest source of GHG emissions and was responsible for one-third of Kenya's total emissions in 2010. Agricultural emissions are likely to increase from 20 Mt CO^2e in 2010 to 27 Mt CO^2e by 2030, largely driven by livestock methane emissions and land use change, which account for 90% of agriculture emissions and 30% of overall national emissions.

Figure 4: Planting vegetables in coconut groves, Kwale county (2018)

Figure 5: Maize in coconut groves, Kilifi county (2018)

[11] Republic of Kenya, Ministry of Agriculture, Livestock and Fisheries, - Kenya Climate Smart Agriculture Strategy 2017 – 2026; produced 2017.

2.4. IMPLEMENTING CSA IN KENYA

Successful implementation of CSA practices in Kenya will require the support and participation of farmers and pastoralists, particularly SHFs and businesses that operate in the agricultural sector. The KCSAS notes weaknesses in the current systems which contribute to current unsustainable practices. These include:

- weak institutions and policies and poor stakeholder involvement;
- inadequate financing of CSA activities;
- limited capacity of Women, Youth, and Vulnerable Groups (WY&VG) to participate in CSA activities;
- unsustainable natural resource management (NRM) and utilisation;
- limited human resource capacity to undertake CSA;
- limited CSA research technology development and innovations; and
- inadequate data and information on CSA.

These issues are of concern and relate to both farmers and business, highlighting that there is a need for top down measures (Government/institution level) and bottom up activities (farm/business level) if unsustainable practices are to be reversed.

With existing agricultural and social strategies proving inadequate in addressing adaptation and GHG emission issues, the Strategy has been developed with the broad objective of adapting to climate change through building resilience of agricultural systems while minimising emissions for enhanced food and nutrition security and improved livelihoods.

The specific objectives of the KCSAS are to:

- enhance adaptive capacity and resilience of farmers, pastoralists and fisher-folk to the adverse impacts of climate change;
- develop mechanisms that minimise greenhouse gas emissions from agricultural production systems;
- create an enabling regulatory and institutional framework; and
- address cross-cutting issues that adversely impact CSA.

KCSAS identifies four broad strategic areas:

- adaptation and building resilience by addressing vulnerability due to changes in rainfall and temperature, extreme weather events and unsustainable land/water management and utilisation;
- mitigation of GHG emissions from key and minor sources in the agriculture sector;
- establishment of an enabling policy, legal and institutional framework for effective implementation of CSA; and
- minimising effects of underlying cross-cutting issues such as human resource capacity and finance which would potentially constrain realisation of CSA objectives.

The KCSAS is supported by a new Kenya Climate Smart Agriculture Implementation Framework 2018-2027[12]. This has been produced by the Government of Kenya to help implement the CSA strategy. The Ministry of Agriculture, Livestock, Fisheries and Irrigation has prepared the Implementation Framework which explores climate smart practices relating to sustainable intensification of crops, agroforestry, livestock and fisheries production; adaptation and mitigation practices in livestock production systems; efficient management of agricultural commodity value chains; opportunities to leverage climate finance for CSA; knowledge sharing and effective learning; strengthening

[12] Republic of Kenya, Ministry of Agriculture, Livestock, Fisheries and Irrigation - Kenya Climate Smart Agriculture Implementation Framework 2018-2027 – produced 2018

key institutions and systems for CSA initiatives; and mainstreaming CSA elements into national policies and development planning process.

The Framework has been developed to guide implementation of CSA at national and county government levels within the context of global obligations and local realities, noting that Kenya is a signatory to the Kyoto Protocol and the Paris Agreements. It also identifies the ability to access global opportunities and climate financing instruments by providing clear structures through which farmers can directly benefit.

The purpose of the Framework is to *"promote climate resilient and low carbon growth sustainable agriculture that ensures food security and contributes to national development goals in line with Kenya Vision 2030".* For this reason, all applications for external finance for agricultural programmes should adhere to the principles of CSA. This works in conjunction with the Kenya National Adaptation Plan 2015 – 2030[13] (NAP) which elaborates institutional arrangements and highlights priority actions across 20 planning sectors for the short, medium and long term.
It proposes a series of Adaptation Actions under the headings:

- *Devolution* – to mainstream climate change adaptation into County Integrated Development Plans and other county plans
- *Energy* – to enhance implementation of an energy generation mix plan that increases the resilience of the current and future energy systems to the impacts of future climate variability and change
- *Science, Technology and Innovation* – to support innovation and development of appropriate technologies and capacity that promote climate resilient development
- *Public Sector Reforms* – To integrate climate change adaptation into public sector reforms
- *Human Resource Development*, Labour and Employment – to enhance adaptive capacity and resilience of the informal sector
- *Infrastructure* – to enhance climate proofing of infrastructure
- *Land Reforms* – to mainstream climate change adaptation in land reforms
- *Education and Training* – to mainstream climate change adaptation in education (formal, nonformal and informal) and training
- *Health* – to strengthen integration of climate change adaptation into the health sector
- *Environment* – to mainstream climate change adaptation in the environment sector
- *Water and Sanitation* – to mainstream climate change adaptation in the water sector
- *Population, Urbanisation and Housing* – to enhance the adaptive capacity of the population, urbanisation, and housing sector
- *Gender, Vulnerable Groups and Youth* – to strengthen the adaptive capacity of vulnerable groups (women, orphans and vulnerable children, the elderly, and persons with disability)
- *Tourism* – to enhance the resilience of the tourism value chain
- *Agriculture* – to enhance the resilience of the agricultural value chain
- *Livestock Development* – to enhance the resilience of the livestock value chain
- *Fisheries* – to enhance the resilience of the fisheries value chain
- *Private Sector/ Trade; Manufacturing; Business Process Outsourcing; Financial Services* – to create an enabling environment for the resilience of private sector investment
- *Oil and Mineral Resources* – to integrate climate change adaptation into the oil and mineral resources sector

[13] Kenya National Adaptation Plan: 2015-2030, Government of Kenya, July 2016

The broad range of issues affected by climate change indicates that agriculture is only one of a number of sectors experiencing concern. It also highlights the need to think across sectors and categories to develop an integrated response to the climate emergency.

2.5. INTEGRATING CSA IN KENYA

The Climate Smart Agriculture Training Manual for Agricultural Extension Agents in Kenya[14] identifies CSA as a pathway towards development and food security built on three principles/pillars:

- Increasing productivity and income
- Enhancing resilience or adaptation of livelihood and ecosystems
- Reducing and removing greenhouse gas emissions from the atmosphere

There are many benefits and synergies to be captured when working towards these three pillars. However, in reality the use of natural resources for productive food systems may also demand some trade-offs while still seeking to ensure that ecosystem services are not compromised e.g. through dry season river flows, air and water quality, land degradation, and animal and human health.

The Agriculture in National Adaptation Plans (NAP–Ag) Programme[15] stresses the importance of following the CSA process noting that the highest level of political support is given to planning, implementing and reporting climate change measures, with the President of Kenya sitting as chair of the National Climate Change Council.

The plans realise that significant efforts have been made to implement the proposed agricultural sector–related interventions in the NAP, especially through the development of the Kenya CSA Framework Programme. It notes that implementation of the Framework Programme will require capacity building, resources, coordination and political goodwill, particularly in the agriculture, livestock and fisheries sectors. Adaptation will be through the development of climate change adaptation strategies for six basins in Kenya, and the revision of the forestry sector strategy.

Since mid–2016, the NAP–Ag programme has carried out capacity needs assessment in six ministries, and produced studies – *Assessing Institutional Barriers to National Adaptation Plan Implementation in Kenya's Agriculture Sector* (2016) and *Analysis of the Sustainable Development and Climate Change Nexus: The Case of Kenya* (2016) – and disseminated the findings at both national and county level. This helps set the policy and support context. The NAP–Ag programme in Kenya is also supporting capacity building activities for technical officers both at national and county level. The training opportunities are focused on: climate vulnerability and risk assessment; cost benefit analysis of adaptation interventions; generation and management of climate-related knowledge; methodologies to assess and incorporate climate change adaptation measures into investment projects in agriculture.

[14] FAO, Ministry of Agriculture, Livestock and Fisheries, 2018. Climate Smart Agriculture - Training Manual for Extension Agents in Kenya.

[15] *FAO & UNDP. (2017). Integrating Agriculture in National Adaptation Plans: Kenya Case Study. Rome, Italy, FAO XX pp 3-5. (also available at www.fao.org/in-action/naps)*

3. AGRIFI'S APPROACH TO CSA

3.1. SME-LEVEL AND FARM-LEVEL ISSUES

Much of the literature and advice relating to CSA focuses on the growing of crops, the land, and the livestock that uses it. But CSA can apply to agricultural businesses as well as to the farms that might be supplying them. Whether a smallholder farmer or an agri-enterprise, the issues will be similar, but will have different implementation opportunities.

The Kenya Climate Smart Agriculture Implementation Framework 2018-2027 (KCSAIF) outlines four components:

1. Institutional coordination to strengthen national inter-ministerial collaboration, enhance coordination between the national and county governments and provide an enabling policy and institutional environment for the realisation of the overall purpose of KCSAIF.
2. CSA knowledge, extension and agro-weather services to strengthen communication systems to transmit timely information on CSA and agro-weather issues among VC actors.
3. Enhance agricultural productivity and integration of VC approach to transform Kenya's agricultural sector into an innovative, commercially oriented, competitive and modern industry by supporting establishment of efficient and effective VCs. This is meant to support a shift in smallholder production strategies from subsistence to satisfying market demand through use of improved technologies and enhanced linkages.
4. Build resilience and appropriate mitigation to address issues related to soil health and land degradation; water and natural resources; insurance and other safety nets; building of synergies in adaptation and mitigation measures.

The outworking of these components will be different, though closely related, at the SME / firm level and the SHF / supplier level. For example, an SME working towards improving CSA knowledge, extension and agro-weather services (point 2) may be focused on:

- Identifying relevant sources of CSA knowledge particular to their VC / needs
- Development of training materials on relevant CSA practices for SHF suppliers
- Implementation of training (or training of trainers) amongst SHF suppliers
- Technology acquisition or development for accurate forecasting
- Identifying cost-effective and efficient communication systems to keep SHF suppliers informed

In terms of more general CSA issues, at the SME / firm level concerns might include:

- How to minimise water consumption during processing
- How to maximise climate smart production efficiencies e.g. use of coconut husks as biofuel
- How to implement workplace initiatives e.g. recycling

Whilst at the SHF / supplier level concerns relating to CSA might include:

- Addressing seasonality to ensure household food and nutrition security
- Securing effective water harvesting and storage techniques to ensure resilience in times of drought
- Access to credit to implement CSA initiatives e.g. drip irrigation systems, better inputs
- Meeting buyer volume and quality standards to ensure offtake of produce

3.2. CHECKLIST OF PRINCIPLES FOR SUSTAINABILITY

This section presents key principles of sustainability that can be used as a checklist when considering CN applications and engaging with SMEs. The checklist is not exhaustive but draws on the UN Sustainable Development Goals (SDGs) together with practitioner experience of diverse sustainability projects and has been widely and successfully applied to operational business.[16]

Climate Change

This is an overarching heading which covers the subheadings below, but which also asks questions in its own right.

Key issues to be aware of are:

- Measuring greenhouse gas emissions and carbon footprint – are efforts being made to understand the business' impact on the environment, including through measuring CO^2 emissions?
- Climate change adaptation – are measures in place to adapt to changing weather patterns or ground conditions?
- Climate education – are staff and customers educated to understand what they can do to help mitigate the business' environmental impact and to reduce harmful practices?
- Legacy – is sufficient attention being given to ensure that today's practices leave a suitable legacy for future generations?

Biodiversity

This covers flora and fauna species on site, and an understanding that practices within the business could have negative or positive impacts on habitats.

- What practices are being encouraged to increase biodiversity on land?
- What measures are being carried out to prevent habitat destruction?
- Is any form of assessment made to see whether habitats are being affected by current practices?

Water

In many areas, climate smart means adapting to changing rainfall patterns and responding to drought, flood or other water flow issue. In addition, external factors such as dam construction, river basin management or new high-volume water users could impact on a business' ability to draw water from established sources (e.g. a new factory or hydro power plant taking water from a river used by the business)

- Are water conservation measures in place?
- Are there any water storage facilities?
- Are there any drought resistance policies?
- Are pipes and water transport facilities checked for leakages and wastage?
- Are staff encouraged to reduce water wastage and to utilise water efficiently?
- Are flood prevention measures required?

[16] This checklist was developed by ideeas ltd

Energy

Power generation can be a major contributor to greenhouse gas emissions, and efforts should be made to reduce energy consumption.

- What energy conservation measures are in place relating to both staff activity and physical equipment?
- What proportion of energy is derived from renewable sources?
- How much diesel or other carbon-based fuel is used and what measures are taken to minimise this?
- Are generators efficient, serviced, maintained etc. to ensure optimum performance?

Waste

Is the waste hierarchy of reduce, reuse, recycle followed (including alternatives such as prevent, repurpose etc)?

- Is food and green waste composted on site, and compost used within the business?
- How much waste is taken to landfill?
- Is any waste disposed of onsite?
- What happens to wood and metals no longer needed on site?
- What happens to waste plastics?
- Are materials and textiles retained for reuse or recycling?
- Is any contaminated waste generated on site?
- Is inert waste prepared for reuse?

Waste Water & Sanitation

Waste water and sanitary waste will be generated by staff, animals and visitors, in addition to natural water such as rainfall. How this is treated can be significant to a business' CO^2 emissions.

- Is rainwater harvested or captured for reuse?
- Are there any attempts to use human or animal waste as compost (chicken waste etc)?
- Is use made of a septic tank and how is it disposed of?
- Are any animal waste products repurposed for building materials or other use?

Transport

There will be vehicular movements, both directly related to farm practices and for staff movements (e.g. off-site visits). There are opportunities to reduce CO^2 emissions through all forms of transport.

- How many vehicles miles are used within the site each year (estimate if not recorded)?
- Are efforts made to reduce car, tanker or other vehicle miles?
- Are electric / hybrid vehicles used?
- Are bicycles used where practical?
- Is a transport manager in place, or does a member of staff have responsibility for producing a transport plan which effectively reduces vehicle miles?

Procurement, Purchases & Additives

A farm business will make many purchases, both direct farming purchases such as seeds and fertiliser and associated items from clothing to bottled drinks.

- Is inorganic fertiliser used?
- Are there efforts to reduce plastic use on site?
- Is a conscious effort made to avoid purchasing materials which involve polluting practices (e.g. bleached cloth etc) or child labour in manufacture?
- Do procurement decisions consider full lifecycle of product (ease of disposal, source of materials etc)?
- Are products which may generate long term harm to the environment prohibited?
- Are pollution prevention items such as spill kits purchased and kept in working order?

Pollution Risk

Agricultural practices may lead to pollution of ground or watercourses if they are not well managed. Run off during rainfall can be a particularly acute contributor to polluting watercourses, particularly if the soil has used inorganic fertilisers.

- Is there a pollution risk and response management plan in place?
- Are spill kits or other products available in event of a pollution incident?
- Are any materials prohibited due to their potential to pollute the land or watercourses?
- Is water quality measured in any watercourses?
- Is soil or land monitored in any way to understand the potential for pollution?
- Are different management practices employed for different seasons?

Community & Social Benefits

An important aspect of sustainability involves how a business interacts with its local community and whether it provides long term economic and social benefits for that community.

- Is local labour employed?
- Are working age practices followed (no child labour)?
- Does local labour have negotiating rights?
- Are staff families supported (education for children etc)?
- Are local purchases and inputs encouraged?
- Are volunteering, training or educational opportunities encouraged?
- Are local charities or causes supported?

Food & Drink

Focusing on food and drink in general can highlight a number of practices that can have an impact on the sustainability of a venture.

- Are food purchases made with origins in mind (organic, local, low carbon footprint, etc)?
- Is food waste disposed of in a manner which sees it returned to ground (composting, digestion)?
- Are chemical additives in food stocks prohibited?

- Are efforts made to reduce food packaging/containers (e.g. minimise plastic packaging)?
- How much food waste is generated each year?

Monitoring & Evaluation

Any public supported project should have robust and impartial M&E in place.

- Are efforts made to measure or monitor environmental performance?
- Are targets set each year to encourage continual improvement to environmental performance?
- Are reviews carried out to highlight areas of low conformity / potential for improvement?

Management & Education

It goes without saying that good management will help the project to succeed. Strong project management should be in place before the project starts and a focus on education or dissemination would be helpful in ensuring good practice and success stories are communicated to others.

- Is a named person given any responsibility for managing sustainability or environmental practices?
- Are training / upskilling opportunities offered?
- Are timescale plans or critical path charts made freely available so that all staff can assess progress against timelines?
- Is there a communications process to help spread good news stories and warn others of potential difficulties?

The chart below gives an indication of the potential importance of each of the principles of sustainability in the Kenyan context. However, it is important to note that the diversity of Kenya's climate and landscape means that the relative importance of these pillars will vary widely depending on the local context.

Pillars	Importance to Agriculture	Importance to Kenya	Total Importance
Pollution	High	Low	Moderate
Water	High	High	High
Waste	Moderate	Low	Moderate
Community Benefits	N/A	Moderate	Moderate
Biodiversity	Moderate	Low	Moderate
Procurement	N/A	Low	Low
Sanitation	Low	High	Moderate
Energy	Moderate	Moderate	Moderate
Transport	N/A	Low	Low
Climate Change	High	High	High

Figure 6: Scale of Importance for Sustainability Pillars (Source: ideeas ltd)

3.3. CONCEPT NOTE SCORING

The Climate-Smart Agriculture Training Manual for Agricultural Extension Agents in Kenya produced a table highlighting key areas for consideration[17]. This has been adapted and developed below, to reflect issues of relevance to AgriFI, and to provide a point of reference for CN scoring and engagement with SMEs.

It is important to remember that there are significant embedded drivers for CSA in many agri-VCs. Therefore, an initiative or proposal that may not have an overtly identifiable CSA element may still indirectly address issues of sustainable development consistent with principles of CSA. The impacts of such proposals / initiatives may be just as significant as those of overt CSA initiatives and should not be discounted or under-valued.

Term	*Farm Considerations*	*Business Considerations*	*Communication & Public Policy*
1. Climate Resilience	Is the farm increasing its resilience to expected climate events including drought, flood, storms, coastal issues? Are they implementing simple or complex measures to protect against hail, extreme rain, pests and drought?	Is the business considering diversification, either of products or seasons, to help combat uncertainty? Are products and advice available in relation to protecting against extreme weather events?	Are farms able to access government information? Are national and regional bodies communicating information adequately to SHFs?
Considerations include: Choosing appropriate farm enterprises for each area e.g. growing arrow roots in a flood-prone area, growing drought-tolerant maize or other staple varieties in low-rainfall areas, and selecting drought-tolerant livestock species for dry areas. Are farms developing linkages and synergies with other factors including gender, management, diversity and education? Diversification of farm enterprises so that when the season experiences extreme weather, some enterprises will survive. Are enterprises seeing opportunities to develop community scale projects rather than just individual farm scale? To what extent are renewable energy options being taken across both farm and enterprise?			
2. Land Degradation	Is the farm protecting the soil, introducing new organic matter, reducing artificial fertilisers, preventing practices which erode soil? Are seed types appropriate to the land? Could they help enhance the nitrogen fixing capacity of the soil?	Is the business focusing on soil improvers and additives that provide long term soil benefits and introduce organic matter? Are they avoiding environmentally destructive materials? Are businesses selling seeds and products that support intercropping,	Are communication channels working, including the passing on of good success stories from elsewhere? Are farmers adequately encouraged to think about the longer-term quality of the soil? Are they familiar with terms and processes such as intercropping and rotation?

[17] FAO, Ministry of Agriculture, Livestock and Fisheries, 2018. Climate Smart Agriculture - Training Manual for Extension Agents in Kenya. The original table is reproduced in Annex 2.

		assist nitrogen fixing and otherwise enhance the soil?	
Are farms developing a relationship between waste and soil, ensuring that biodegradable matter is returned to soil as compost? Is there a focus on proper timing and application of farm operations such as timely addition of appropriate fertilisers to enable the crop to absorb nutrients easily and reduce losses through leaching or conversion to gaseous forms? Is there appropriate attention on contours, hardpan soils, tillage and mulching to help prevent erosion and soil loss? Are businesses moving away from certain chemical compounds that ultimately degrade soil? Are businesses offering demonstrations or training to support farmers who move to new products and new techniques?			
3. Agroforestry	Are farmers planting trees in association with crops? Is there adequate understanding and guidance of type of tree, suitable locations and maintenance needs?	Are businesses providing suitable trees with appropriate planting and maintenance advice? Where are tree stocks derived, and what do we know about the long-term sustainability of the tree stocks being provided?	Are regional or local public bodies providing motivation for SHFs? Are bodies helping to create an understanding of the importance and the potential of trees?
Is suitable advice available through local agricultural offices relating to the type of tree which works best in each location, benefits of planting in certain parts of a site, protecting from theft, protecting livestock etc? Are appropriate trees specified to provide shade where required, or to balance nutrient absorption from the soil?			
4. Conservation Agriculture – Adoption	Is the farm following at least 2 of the 3 linked principles of continuous minimum mechanical soil disturbance, permanent soil cover and diversification of crop species?	Are businesses encouraging the sale/purchase of suitable facilities such as water retaining structures, biogas equipment, beekeeping, suitable seasonality of seed sales to overcome drought or flood?	Are local and regional advisory groups assisting the adoption of CA practices? Is there adequate demonstration of success stories?
Are farms practising integrated farming so that by-products from one enterprise may be used to promote performance in another enterprise on the farm (perhaps energy generation from waste products)? Are there soil and water conservation measures such as water-retention structures and minimum tillage, and planting crops that increase ground cover quickly and use little water? Is there Intercropping and crop rotation involving legumes to improve soil fertility and increasing chances of some harvest even in poor seasons; and is there farmyard manure management through biogas production, and farmyard composting to improve soil fertility and reduce release of methane?			

Are businesses using suitable promotion, marketing and educational opportunities to indicate the benefits of CA?			
5. Conservation Agriculture with Trees (CAWT)	Are farms using economic benefit or social purpose trees (nuts, fruits, timber, fuel etc) to increase resilience and support farm economy?	Is suitable tree stock available with the advice for planting and maintaining?	Is there adequate education and promotion of this idea at the local level?
A relatively new idea where conservation agriculture includes trees to provide fodder, fuel, construction materials, nutrient cycling, fruits among other products and services. Structured inclusion of leguminous trees in a CA system assists the fixation of atmospheric nitrogen enriching the soil with nitrates. Appropriate selection of tree species and good management should substantially reduce the need for inorganic fertilizers.			
6. Water Harvesting	Are farms capturing rainfall runoff from roofs, buildings, paths and other receptors? Is it stored and used productively? Is this balanced with seeds and crops that are suitable for the available water in the area, especially in areas where drought or reduced rainfall is becoming more frequent?	Are businesses encouraging use of suitable scale water retention equipment for capturing and storing water run-off? Are businesses promoting seeds and crops that help store or retain water?	Are public bodies assisting, especially as part of disaster relief post extreme weather event damage?
Is rainwater harvesting linked to water efficiency practices such as drip irrigation? Are drip kits readily available with suitable maintenance regimes to clean blockages etc?			
7. Road Run Off Harvesting	Are there suitable means to capture road run off? Is it appropriate in this location?	Is there advice and opportunity to purchase suitable equipment?	Is there suitable guidance on collecting water from a public owned feature such as a road?
Is there advice to overcome the possibility of road contamination, and is equipment of the right scale and strength to cope with significant road run off in rainy seasons? This is a relatively small and unproven area which may warrant only limited time input.			
8. Household Resilience to Climate Change	Are farm households demonstrating climate resilience and food and nutrition security?	Are households able to receive appropriate advice on financial matters, borrowing, purchasing, economic strengthening?	Is guidance flowing down from National Government level to SHFs?
This heading can integrate agriculture with many other aspects of family, farm, village or town life. Is there any demonstration of linkages between farm operations and household resilience? What materials are households using that may reduce post-harvest loss of crops e.g. storage bags? What opportunities are available to use waste for energy or to increase low carbon and low cost energy, lighting and cooking?			

9. Sustainable Increase in Production	Is there an increase in production of crops, livestock, vegetation that is sustained over time?	Is productivity advice available and demonstration of long-term benefits clear? Is suitable equipment to assist productivity readily available and affordable?	Is guidance flowing down from National Government level to SHFs?
Has consideration been given to increasing productivity through new practices such as using greenhouses? Are these products available and affordable?			
10. Productivity Increase	Is there an attempt to compare production per unit area of a CSA farm to a non-CSA farm?	Are there attempts to disseminate the benefits of CSA to attract more adopters?	Is there monitoring and evaluation, formally or informally, that can highlight increases or lack of progress in productivity?
Productivity increases should result from good adoption of CSA practices and this should be made clear to other farmers, fisher folk and livestock herders. What community driven initiatives are in place to help understand why productivity increases through CSA?			

3.4. CURRENT CONCERNS

During research in early 2019, the lack of recent rainfall had focused many minds on the concerns over drought and reliable water availability. For this reason, interventions which focus at least partly on water issues are likely to be well received.

Water conservation issues and water harvesting techniques include:

- *Zai pits* – shallow, wide, circular pits that combine water harvesting and conservation of both moisture and fertility in the pit, mostly used for growing cereals or fodder in drier areas.
- *Drip Irrigation* – customised drip kits focus water use on the plant and plant roots to reduce wastage of water. Water would be stored in a drum or buckets.
- *Retention Ditches* – ditches dug along a contour to trap water and enable it to sink laterally into the soil, often used for growing bananas.
- *Catch pits* – pits dug in corners or elsewhere on a farm to catch rainwater along with the silt. This enhances moisture availability to the crops.

Figure 7: Drip irrigation in use at a demonstration plot, Meru county (2019)

However, there are also an increasing number of extreme weather incidents, which potentially lead to a refocus on overcoming destruction caused by extreme wind, storm damage, floods and salt water pollution. This requires different responses, and suitable CSA practices should attempt to provide a balance between water conservation, storm recovery, and other issues as appropriate.

4. CONCLUSION

The case for CSA is strong, both commercially and as a means of securing sustainable and resilient livelihoods. It is now clearly supported by the Kenyan Government through the many policies and plans documented here. Reviewing the CSA policy and strategy documents currently operational in Kenya has provided a strong foundation for support and implementation of AgriFI programmes in alignment with the fund's objective of supporting productive and market-integrated environmentally sustainable and climate smart agriculture. The sustainability checklist and CSA matrix presented in section 3 are designed to facilitate evaluation of CSA proposals within CNs and business plans, as well as other areas that are not currently 'labelled' as CSA, in alignment with this objective.

In evaluation of impacts and across the portfolio, the wider AgriFI theory of change naturally contributes to key CSA requirements in that it is designed to promote commercially resilient and environmentally sustainable agriculture. However, it is important to stay alert to the potential for negative climate / environmental impacts (e.g. where an SME may be encouraging run-off / monoculture) and minimise this risk where possible.

The considerable diversity of landscapes and localised climate systems in Kenya make it clear that a one-size fits all approach to CSA will not suffice. Furthermore, the specific opportunities and challenges of implementing programmes and initiatives in alignment with the principles of CSA will vary according to VC and scale. Consequently, each CN and business plan should be assessed according to its own social, geographical and economic circumstances.

There will be differences in how the challenges and benefits of a potential agricultural project present themselves and accrue to SHFs and to SMEs. If they work closely together, there is potential for significant improvements in the livelihoods of SHFs as well as the growth and development of commercially successful agri-enterprises.

As the AgriFI team selects and engages with partner SMEs, key points to consider include the following.

Are SMEs:

- able to demonstrate how their activities are contributing to CSA, especially regarding policies that encourage or discourage, for example, monocropping, diversity, land degradation?
- contributing to commercially resilient agriculture through their sourcing models?
- acknowledging / addressing climate issues at the firm level as well as through their sourcing models?
- leveraging strategic imperatives across different initiatives (decentralisation, climate objectives, agroforestry)?

Certain opportunities and challenges stand out and may help to inform AgriFI's selection process and engagement with SMEs:

- There is a strong **business case** for CSA.
- CSA is as much about **building resilience** and **mitigating climate risks** as it is about optimising opportunities to increase productivity.
- Kenya has a wide range of localised geographies and climates. CSA initiatives need to be **tailored to the local context** in order to be appropriate and effective.
- **Tree crops** have an inherently strong CSA case beyond deliberate or specific interventions (with important caveats of water and land conservation).
- Drought, variation in / unpredictable rainfall patterns continue to be key issues of concern in Kenya. For this reason, **initiatives focusing on water** (e.g. conservation, harvesting, storage, irrigation) are of particular importance.

APPENDIX 1: GLOSSARY OF KEY TERMS FOR CLIMATE SMART AGRICULTURE

Adaptation: Adjustment in agro-ecosystems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.

Agro-ecosystem: The organisms and environment of an agricultural area considered as an ecosystem.

Arid and semi-arid lands: Areas characterized by inadequate precipitation, which constrains their two major interlinked services of primary production and nutrient cycling.

Biodiversity: The total diversity of all organisms and ecosystems at various spatial scales (from genes to entire biomass).

Capacity building: In the context of climate smart agriculture, it is the process of developing relevant technical skills and institutional capability to enable effective addressing of the causes and effects of climate change for the agriculture sector.

Carbon sequestration: The process of removing carbon from the atmosphere and depositing it in a reservoir, such as the soil or trees.

Climate change: Climate change refers to a change in the state of the climate that can be identified (e.g. by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcing, or to persistent anthropogenic changes in the composition of the atmosphere or in land use.

Climate-proofing: Ensuring that climate risks are reduced to acceptable levels through long-lasting and environmentally sound, economically viable and socially acceptable changes implemented at one or more of the stages in the project cycle.

Climate smart agriculture: Agriculture that sustainably increases productivity, resilience (adaptation), reduces/removes greenhouse gases (mitigation), and enhances the achievement of national food security and development goals.

Co-benefits: Multiple benefits in different fields resulting from one policy, strategy, or action plan.

Conservation agriculture: An approach to managing agro-ecosystems for improved and sustained productivity, increased profits and food security while preserving and enhancing the resource base and the environment. It is characterized by three linked principles namely, continuous minimum mechanical soil disturbance; permanent organic soil cover; and diversification of crop species grown in sequences and/or associations.

Crop diversification: Species diversification through varied crop associations and/or rotations(involving annual and/or perennial crops including trees).

Deforestation: The conversion of forest to another land use or the long-term reduction of tree canopy cover below the 10% threshold.

Disaster: A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources.

Disaster risk management: The systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster.

Disaster risk reduction: The concept and practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment and improved preparedness for adverse events.

Drought: The phenomenon that exists when precipitation is significantly below normal recorded levels, causing serious hydrological imbalances that often adversely affect land resources and production systems.

Dry spell: Short period of water stress during critical crop growth stages and which can occur with high frequency but with minor impacts compared with droughts.

Ecosystem: The interactive system formed from all living organisms and their abiotic (physical and chemical) environment within a given area.

Ecosystem resilience: The capacity of an ecosystem to absorb external pressure or perturbations through change and re-organization, but still retain the same basic structure and ways of functioning.

Ecosystem services: Ecological processes or functions that have monetary or non-monetary value to individuals or society at large e.g. Productivity or biodiversity maintenance; provisioning services such as food, fibre, or fish; regulating services such as climate regulation or carbon sequestration; and cultural services such as tourism or spiritual and aesthetic appreciation.

Enteric fermentation: Enteric fermentation is a natural part of the digestive process for many ruminant animals where anaerobic microbes, called methanogens, decompose and ferment food present in the digestive tract producing compounds that are then absorbed by the host animal. A resulting by-product of this process is methane.

Enteric methane: Methane gas emitted as a natural by-product of microbial fermentation of carbohydrates and, to a lesser extent, amino acids in the rumen and the hindgut of farm animals.

Erosion: The process of removal and transport of soil and rock by weathering, mass wasting, and the action of streams, glaciers, waves, winds and underground water.

Exposure: The nature and degree to which a system is exposed to significant climatic variations.

Fluvial flooding: flood waters related to or caused by high river levels.

Food and nutrition security: This exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

Greenhouse gases: The atmospheric gases responsible for causing global warming and climate change. The major GHGs are carbon dioxide (CO^2), methane (CH^4) and nitrous oxide (N^2O). Less prevalent but very powerful greenhouse gases are hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and Sulphur hexafluoride (SF6).

Hardpan soils: a distinct soil layer, usually found below the uppermost topsoil layer which is largely impervious.

Integrated landscape management: An umbrella term for natural resource management (NRM) systems that recognize the value of various ecosystem services to multiple stakeholders, and how this leads them to pursue different land use objectives or livelihood strategies.

Integrated pest management: An ecosystem approach to crop production and protection that combines different management strategies and practices to grow healthy crops and minimize the use of pesticides.

Intercropping: A multiple cropping practice involving growing two or more crops in proximity to produce greater yields from the land through making use of resources or ecological processes that would otherwise not be utilised by a single crop.

Intergovernmental Panel on Climate Change: Established in 1988 by the World Meteorological Organization and the UN Environment Programme, the IPCC surveys world-wide scientific and technical literature and publishes assessment reports that are widely recognized as the most credible existing sources of information on climate change. The IPCC also works on methodologies and responds to specific requests from the UNFCCC's subsidiary bodies.

Legumes: plants which are grown agriculturally, for human consumption, for livestock forage and silage, and / or as soil-enhancing green manure.

Mitigation: In the context of climate change, human intervention to reduce the sources or enhance the sinks of greenhouse gases e.g. using fossil fuels more efficiently or electricity generation, switching to solar energy or wind power from fossil fuels for industrial processes and expanding forests and other "sinks" to remove greater amounts of carbon dioxide from the atmosphere.

Mulching: provision of a layer of material, usually organic, which is applied to the surface between crops or on vacant land to help retain moisture, reduce weed growth and enhance fertility of the soil.

Nationally appropriate mitigation actions: A set of government prioritized actions aimed at reducing or limiting greenhouse gas emissions.

Payment for ecosystem services: An economic instrument designed to provide positive incentives to users of agricultural land and those involved in coastal or marine management. These incentives are expected to result in continued or improved provision of ecosystem services, which in turn, will benefit society as a whole.

Pluvial flooding: surface water accumulating as a result of intense rainfall which is not absorbed by drainage.

Reducing emissions from deforestation and forest degradation: Reducing Emissions from Deforestation and Forest Degradation plus the role of conservation, sustainable management of forests and enhancement of forest carbon stocks.

Reforestation: The re-establishment of forest formations after a temporary condition with less than 10% of canopy cover due to human-induced or natural perturbations.

Resilience: The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner.

Sensitivity (to climate variability or change): Sensitivity is the degree to which a system is affected, either adversely or beneficially, by climate variability or change. The effect may be direct (e.g. a change in crop yield in response to a change in the mean, range or variability of temperature) or indirect (e.g. damages caused by an increase in the frequency of coastal flooding due to sea-level rise).

Sustainable development: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Technology transfer: A broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change among different stakeholders.

Tillage: the agricultural preparation of soil by mechanical agitation of various types, such as digging, stirring, and overturning.

Vulnerability: The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity.

*Note: this glossary of terms has been largely taken from the Kenya Climate Smart Agriculture Strategy-2017-2026

APPENDIX 2: KEY CSA TERMS & INDICATORS

	Term	Definition	Key Indicators
1.	Climate Resilience	Capacity of a socio-ecological system or land user is able to cope with a hazardous event or disturbance, responding or reorganising in ways that maintain its essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation	Socio-ecological system or lifestyle that demonstrates ability to recover after climatic shock or disturbance
2.	Land Degradation	Reduction in the capacity of the land to provide ecosystem goods and services, over a period of time, for its beneficiaries	Vegetation cover; soil organic matter and related soil factors decreasing/ decreased compared with stable conditions
3.	Agroforestry	Land-use systems and technologies where woody perennials are deliberately used on the same land-management units as agricultural crops and/or animals, in some form of spatial arrangement or temporal sequence	Significant number of multipurpose trees deliberately grown in association with crops or pastures
4.	Conservation Agriculture - adoption	CA is characterized by three linked principles, namely: (1) Continuous minimum mechanical soil disturbance.; (2) Permanent soil cover and (3) Diversification of crop species grown in sequences and/ or associations	A farmer can be considered to be an 'adopter' if s/he reports to practice consistently 2-3 principles
5.	Conservation Agriculture with Trees (CAWT)	The combination of CA principles within same land with a form of deliberately arranged multipurpose trees and shrubs. CA enterprises could be food crops while Agroforestry enterprises could be fruit/nuts, timber, fodder and fertilizer trees and shrubs.	System that offers mutual benefit to both the food crops and economical/social purpose trees/shrubs while minimizing impact of food production on the environment and increasing resilience on other farm enterprises

6.	Water Harvesting	The collection and concentration of rainfall runoff, or floodwaters for plant, fisheries and livestock production, and domestic purposes.	System designed to capture and use rainfall runoff from roofs, path, rocks or other catchments – and use productively
7.	Road Runoff Harvesting	The collection and concentration of road drainage waters for crop and fisheries production or other purposes.	System designed to capture and use rainfall runoff from roads – and use productively
8.	Household resilient to climate change	Household with socio-economic system that demonstrates climate resilience [see climate resilience above]	Household fulfils the above definition of being food secure and has increased both its absolute income and the variety of sources of income, improved its access to markets and has adopted integrated agricultural practices that are aligned to CSA approach
9.	Sustainable increase in production	An increase in production of crops or other vegetation/ livestock per unit area that is stable and sustained over time	Increase in production is achieved regularly and in the long term through the use of CSA technologies in watershed management around the productive sites
10.	Productivity increase	An increase in production of crops or other vegetation/ livestock per unit area	Productivity increase is measured by comparing the various crop yields of the treatment group with that of a non-treatment group for the same season.

Reproduced from: FAO, Ministry of Agriculture, Livestock and Fisheries (2018)

This publication was produced with the financial support of the European Union. Its contents are the sole responsibility of Self Help Africa and Imani Development Limited and do not necessarily reflect the views of the European Union.

AgriFI Kenya
Challenge Fund